RECOGNITION OF MALOCCLUSION: AN EDUCATION OUTCOMES ASSESSMENT

by

BRENDA B. BRIGHTMAN

Submitted in partial fulfillment of the requirements

for the Degree of Master of Science in Dentistry

Department of Orthodontics

School of Dentistry

CASE WESTERN RESERVE UNIVERSITY

January 18, 1996

CASE WESTERN RESERVE UNIVERSITY

SCHOOL OF DENTISTRY

GRADUATE STUDIES

We hereby approve the thesis of

Brenda Bonnie Brightman

candidate for the degree Master of Science

in Dentistry.

Signed: _____ (Chairman)

_____

_____

_____

_____

Date: August 3, 1995

RECOGNITION OF MALOCCLUSION: AN EDUCATION OUTCOMES ASSESSMENT

Abstract

by

BRENDA B. BRIGHTMAN

The purpose of the present study was to design a test instrument to assess the outcome of predoctoral orthodontic dental education at the School of Dentistry, Case Western Reserve University (CWRU) in Cleveland, Ohio. This test measured the clinical abilities of dental students in the diagnosis of malocclusions in children, as well as their didactic abilities in answering selected questions from recent national board examination in orthodontics. Seven cases were selected from the practice of a board certified orthodontist which demonstrated different types of malocclusion. These cases were presented to dental students at CWRU who were asked to make diagnoses and recommendations for treatment. The administration of national board examination questions was used to measure the objective classroom education in the subject. Together these tests were used to assess outcomes of the predoctoral dental curriculum in imparting orthodontic knowledge to future general dentists.

The dental students at CWRU answered ten questions regarding malocclusion. The results show that their didactic knowledge increased over the four years of their education. First year students answered 30% of the questions correctly, while the fourth year students answered 59% correctly. However, the students overall did not

demonstrate the ability to apply this knowledge consistently in clinical diagnoses. While the first year students scored 64.9% correct overall on all questions for all cases, the fourth year students improved only slightly, scoring 70.3%. This showed that their clinical skills in orthodontic diagnosis did not improve significantly over the four years. The discussion and analysis of scores on the clinical test identified specific clinical problems which were not recognized by the majority of the students. The study identified shortcomings in the abilities of the fourth year students, soon to begin general dentistry practice, in applying didactic knowledge to clinical situations.

DEDICATION

I dedicate this thesis to the three generations of members of my family who preceded me in the practice of dentistry.

ACKNOWLEDGEMENTS

The author wishes to express her sincere appreciation and gratitude to all those who have contributed to this study and have made this project possible.

My thanks to all of the doctors and students who participated in this study to further the progress of orthodontic education.

It is a pleasure to acknowledge:

Dr. Mark G. Hans, Chairman of the Department of Orthodontics for his creativity and completeness in research design, for his support, guidance, encouragement and confidence in my abilities, and for making my dream of becoming an orthodontist come true.

Dr. Gary R. Wolf, Associate Professor, Department of Orthodontics, for his enthusiasm and great expertise in this project, and for helping me in every aspect of orthodontics so that I could become an able specialist. Thank you for being my mentor and inspiring me to always do my best and for being such a wonderful friend.

Dr. Hinsdale Bernard, Professor, Department of Education, Cleveland State University, for his extensive knowledge in statistics, his orderly step-by-step analysis of the enormous amount of data and for his patience.

Dr. B. Holly Broadbent, Jr., Director of the Bolton-Brush Growth Study Center for his friendship, and whose instruction initiated my interest in orthodontics.

Dr. Donald H. Enlow, Thomas J. Hill Professor Emeritus, Department of Orthodontics, for his scholarly excellence and challenging dialogue in stimulating my

interest in facial growth and development.

Heidi Raynor for her professional assistance and vast computer knowledge.

Mrs. LaVerne Vogel for her professional skill and wizardry on the word processor, and her patience in preparing this extensive manuscript.

All of my classmates for the unique experience of the last two years.

The entire faculty of the Orthodontic Department for teaching me so much and so well, and for making me proud to be a member of this specialty, and a graduate of Case Western Reserve University.

I wish to thank my grandparents, Dr. Joseph H. Goodman and Henrietta Mandel Goodman for all the love they showed and for being like parents to me. It was my grandfather who gave me my start in dentistry at age five by appointing me his assistant.

Dr. William J. Goodman, my great uncle, for constantly encouraging me in my pursuit of higher education, and for showing me how great dentistry had been for him and could be for me.

Harold A. Salzer, my favorite cousin, for his friendship and support throughout the years, and for sharing all of his world-wide travelling adventures.

Most of all, I wish to express my deep appreciation to my mother, Gloria G. Brightman, who has supported and encouraged me beyond that which might be expected every day of my life. Her sacrifices, unselfish commitment to rearing me and unconditional love helped guide me, and ultimately she was the only person I could trust and depend on to help me all through the years. It was because of her that I was able to become the last dentist in my generation, and the only orthodontist in our family.

TABLE OF CONTENTS

PAGE

ABSTRACT ii

DEDICATION. iv

ACKNOWLEDGEMENTS v

TABLE OF CONTENTS. vii

LIST OF FIGURES. ix

LIST OF TABLES. x

INTRODUCTION 1

REVIEW OF THE LITERATURE 3

STATEMENT OF THESIS 26

MATERIALS AND METHODS. 27

RESULTS 34

DISCUSSION. 221

SUMMARY AND CONCLUSIONS. 267

APPENDICES

A. Consent Form 270

B. The Gold Standard - List of Orthodontists and Number of Years in Practice. 271

C. Outcome Test, Orthodontics 272

D. Questionnaire 275

E. Criteria of Malocclusion. 281

TABLE OF CONTENTS (Cont.)

PAGE

F. Orthodontists' Criteria for Recognition of Malocclusion. 282

G. Case Descriptions of The Seven Cases of Malocclusion. 284

H. Correlation Coefficients for Pairs of Questions. 286

I. Frequencies of Responses to Individual Questions by Orthodontists and Undergraduate Dental Students. 305

J. Base Questions for Cases 1 - 7. 347

REFERENCES 354

LIST OF FIGURES

FIGURE		PAGE
1.	Case Western Reserve University Didactic Knowledge Base-1994.	35
2.	Case One	56
3.	Case Two	81
4.	Case Three	103
5.	Case Four	126
6.	Case Five	149
7.	Case Six	173
8.	Case Seven	197
9.	University of Tennessee Didactic Knowledge Base - 1992.	222
10.	University of Tennessee Didactic Knowledge Base - 1993.	223
11.	Examples of an Upward and Downward Trend from the Mean Case Scores for Dental Groups by Question.	231
12.	Comparison of Means For Cases 1 - 7 By Group.	253

LIST OF TABLES

TABLE		PAGE
1.	One Way ANOVA Table of Dental Groups by Score for Case One.	36
2.	Student - Newman-Keuls Comparison of Means for Case One	37
3.	Means, Standard Deviations, And Ranges of Test Scores for Dental Groups - Case One.	37
4.	One Way ANOVA Table of Dental Groups by Score for Case Two.	38
5	Student - Newman-Keuls Comparison of Means for Case Two.	39
6.	Means, Standard Deviations, and Ranges of Test Scores for Dental Groups - Case Two.	39
7.	One Way ANOVA Table of Dental Groups by Score for Case Three.	40
8.	Student - Newman-Keuls Comparison of Means for Case Three.	41
9.	Means, Standard Deviations, and Ranges of Test Scores for Dental Groups - Case Three.	42
10.	One Way ANOVA Table of Dental Groups by Score for Case Four.	42
11.	Student - Newman-Keuls Comparison of Means for Case Four	43
12.	Means, Standard Deviations, and Ranges of Test Scores for Dental Groups - Case Four.	43
13.	One Way ANOVA Table of Dental Groups by Score for Case Five.	44
14.	Student - Newman-Keuls Comparison of Means for Case Five.	45
15.	Means, Standard Deviations, and Ranges of Test Scores for Dental Groups - Case Five.	45
16.	One Way ANOVA Table of Dental Groups by Score for Case Six.	46

TABLE PAGE

17. Student - Newman-Keuls Comparison of Means for Case Six 47

18. Means, Standard Deviations, and Ranges of Test Scores for Dental Groups - Case Six..... 47

19. One Way ANOVA Table of Dental Groups by Score for Case Seven 48

20. Student - Newman-Keuls Comparison of Means for Case Seven..... 49

21. Means, Standard Deviations, and Ranges of Test Scores for Dental Groups - Case Seven..... 49

22. One Way ANOVA Table Of Dental Groups by Score for Case Totals 50

23. Student - Newman-Keuls Comparison of Means for Case Totals..... 51

24. Means, Standard Deviations, and Ranges of Test Scores for Dental Groups - Case Totals..... 51

25. Correlation Coefficients for Pairs of Questions - Case One 286

26. Correlation Coefficients for Pairs of Questions - Case Two..... 288

27. Correlation Coefficients for Pairs of Questions - Case Three 291

28. Correlation Coefficients for Pairs of Questions - Case Four..... 294

29. Correlation Coefficients for Pairs of Questions - Case Five 297

30. Correlation Coefficients for Pairs of Questions - Case Six..... 299

31. Correlation Coefficients for Pairs of Questions - Case Seven..... 301

32. Correlation Coefficients for Specific Question Pairs..... 303

33a. Frequencies of Responses to Individual Questions by Orthodontists in Percent - Case One..... 305

33b. Frequencies of Responses to Individual Questions by Freshmen In Percent - Case One 306

33c. Frequencies of Responses to Individual Questions by Sophomores in Percent - Case One..... 307

TABLE PAGE

33d. Frequencies of Responses to Individual Questions by Juniors in Percent - Case One. 308

33e. Frequencies of Responses to Individual Questions by Seniors in Percent - Case One. 309

33f. Multiple Responses from Groups by Question Number - Case One 310

34a. Frequencies of Responses to Individual Questions by Orthodontists in Percent - Case Two 311

34b. Frequencies of Responses to Individual Questions by Freshmen in Percent - Case Two. 312

34c. Frequencies of Responses to Individual Questions by Sophomores in Percent - Case Two. 313

34d. Frequencies of Responses to Individual Questions by Juniors in Percent - Case Two. 314

34e. Frequencies of Responses to Individual Questions by Seniors in Percent - Case Two. 315

34f. Multiple Responses from Groups by Question Number - Case Two. 316

35a. Frequencies of Responses to Individual Questions by Orthodontists in Percent - Case Three. 317

35b. Frequencies of Responses to Individual Questions by Freshmen in Percent - Case Three. 318

35c. Frequencies of Responses to Individual Questions by Sophomores in Percent - Case Three. 319

35d. Frequencies of Responses to Individual Questions by Juniors in Percent - Case Three. 320

35e. Frequencies of Responses to Individual Questions by Seniors in Percent - Case Three. 321

35f. Multiple Responses from Groups by Question Number - Case Three . . . 322

36a. Frequencies of Responses to Individual Questions by Orthodontists in Percent - Case Four. 323

TABLE PAGE

36b. Frequencies of Responses to Individual Questions by Freshmen in Percent - Case Four. 324

36c. Frequencies of Responses to Individual Questions by Sophomores in Percent - Case Four. 325

36d. Frequencies of Responses to Individual Questions by Juniors in Percent - Case Four. 326

36e. Frequencies of Responses to Individual Questions by Seniors in Percent - Case Four. 327

36f. Multiple Responses from Groups by Question Number - Case Four. 328

37a. Frequencies of Responses to Individual Questions by Orthodontists in Percent - Case Five. 329

37b. Frequencies of Responses to Individual Questions by Freshmen in Percent - Case Five. 330

37c. Frequencies of Responses to Individual Questions by Sophomores in Percent - Case Five. 331

37d. Frequencies of Responses to Individual Questions by Juniors in Percent - Case Five. 332

37e. Frequencies of Responses to Individual Questions by Seniors in Percent - Case Five. 333

37f. Multiple Responses from Groups by Question Number - Case Five. 334

38a. Frequencies of Responses to Individual Questions by Orthodontists in Percent - Case Six. 335

38b. Frequencies of Responses to Individual Questions by Freshmen in Percent - Case Six. 336

38c. Frequencies of Responses to Individual Questions by Sophomores in Percent - Case Six. 337

38d. Frequencies of Responses to Individual Questions by Juniors in Percent - Case Six. 338

38e. Frequencies of Responses to Individual Questions by Seniors in Percent - Case Six 339

TABLE		PAGE
38f.	Multiple Responses from Groups by Question Number - Case Six.	340
39a.	Frequencies of Responses to Individual Questions by Orthodontists in Percent - Case Seven.	341
39b.	Frequencies of Responses to Individual Questions by Freshmen in Percent - Case Seven.	342
39c.	Frequencies of Responses to Individual Questions by Sophomores in Percent - Case Seven.	343
39d.	Frequencies of Responses to Individual Questions by Juniors in Percent - Case Seven.	344
39e.	Frequencies of Responses to Individual Questions by Seniors in Percent - Case Seven.	345
39f.	Multiple Responses from Groups by Question Number - Case Seven. . . .	346
40.	Chi-Square Results for Case One Undergraduate Dental Students.	58
41.	Chi-Square Results for Case Two Undergraduate Dental Students	83
42.	Chi-Square Results for Case Three Undergraduate Dental Students	105
43.	Chi-Square Results for Case Four Undergraduate Dental Students.	128
44.	Chi-Square Results for Case Five Undergraduate Dental Students.	151
45.	Chi-Square Results for Case Six Undergraduate Dental Students.	175
46.	Chi-Square Results for Case Seven Undergraduate Dental Students. . . .	199
47.	Number of Significant Responses by Complete Group for Case Seven. .	220
48.	Number of Complete Groups for Seven Cases With Correct Responses	229
49.	Dental Group Means on all 39 Questions for the Seven Cases.	230
50.	Mean Case Scores for Dental Groups by Question.	232
51.	Number of Correct Questions by Group and Placement.	233

TABLE PAGE

52. Correct Questions and Base Questions by Complete Group for Case One. 347

53. Correct Questions and Base Questions by Complete Group for Case Two. 348

54. Correct Questions and Base Questions by Complete Group for Case Three. 349

55. Correct Questions and Base Questions by Complete Group for Case Four. 350

56. Correct Questions and Base Questions by Complete Group for Case Five. 351

57. Correct Questions and Base Questions by Complete Group for Case Six. 352

58. Correct Questions and Base Questions by Complete Group for Case Seven. 353

INTRODUCTION

The ability of undergraduate dental students to identify malocclusion varies with their educational level and increases as their education advances. It is possible to devise a test instrument to measure and compare undergraduate dental students for both their didactic knowledge of malocclusion and their clinical ability to recognize malocclusion and to compare the results for each year in the dental school. This comparison can be used to test the desired outcome of the dental school curriculum as it relates to the teaching of the ability to identify malocclusion. The present study examined didactic abilities of first through fourth year dental students by means of a test comprised of objective questions about malocclusion, and compared the results of each year to examine how educational level discriminated between these groups.

The clinical ability of undergraduates to identify malocclusion in actual cases was measured by administering a test comprised of thirty-nine questions about seven cases of malocclusion, using photographs and intraoral views. These cases were chosen from the practice of an orthodontist for their presentation of a number of characteristics of malocclusion. The responses of a group of ten orthodontists to these seven cases established the Gold Standard against which the accuracy of student responses were measured and compared. The results of the didactic and clinical test results were analyzed by means of statistical methods including ANOVA, Newman-Keuls analysis, and chi square analysis to test frequencies, correlations, and reliabilities.

This study concentrated on comparing the four years of education received by undergraduate dental students, looking at the changes in their abilities as they progressed through the curriculum. This study sought to answer the question of what the student knows at the end of the fourth year that was not known in the first year, second year, and third year, by comparing performance on these tests.

LITERATURE REVIEW

Education

Education of the General Dentist

When aspects of recognition, diagnosis and treatment of malocclusion by the general dentist are discussed in the literature, the analysis invariably includes attention to the controversy over what type of treatment is appropriate by the generalist, and the overwhelming conclusion is that all but the most simple cases must be referred to the orthodontist for treatment. These discussions bring out collateral issues, namely proper undergraduate education and continuing education on recognition of malocclusion and basics of orthodontic treatment, etiology, facial growth and morphology, and related courses; the need for general dentists to make timely referrals to orthodontic specialists and the optimal timing of treatment in relation to maturity, cooperation, facial growth and related factors; and measuring or rating the skill of generalists in making diagnoses. Therefore, these issues have been addressed in the present study.

Education of General Dentists: Recommendations, Guidelines, Curriculum, and Evaluation

Hannett (1963) called for the profession to provide a better orthodontic undergraduate curriculum. He summarized four previous major reports on orthodontic education: the 1935 American Association of Dental Schools (AADS) curriculum survey, the 1949 AADS evaluation of undergraduate training, which both recommended closer correlation of the curriculum with the demands of dental practice;

the orthodontic workshop in Ann Arbor, Michigan of 1958, wherein clinical and didactic leaders of the profession made further recommendations; and the American Association of Orthodontists (AAO) report of its president D.C. Anderson in 1960 which warned that the profession was not providing enough teaching for undergraduate education.

The AAO Education Committee in 1952 recommended undergraduate course content in anticipation and detection of malocclusion; prevention or interception of malocclusion; treatment of simple cases and recognition of complex cases; use of this knowledge as adjunct to dental practice; and acquisition of skill in determining which cases to refer to orthodontic specialists for treatment. The Michigan Workshop of 1958 recommended teaching priorities in the orthodontic department as 1) undergraduate teaching, 2) interdepartmental consultation, 3) graduate and postgraduate teaching, 4) continuing education for orthodontists, and 5) continuing education in interceptive orthodontics for general practitioners. Hannett's 1963 summary of the status of pedodontists specializing in orthodontics, and the fact that the majority of orthodontic treatment was still being provided by general practitioners. Moyers, who also reported on dental education in 1963, pointed out that orthodontists are uniquely qualified to teach undergraduates the fundamentals of facial growth, principles of occlusal development, diagnosis of malocclusion, and possibilities for interceptive orthodontics.

T. M. Graber made recommendations on dental education in a 1967 report, calling for the expansion of teaching programs in orthodontics to qualify general practitioners to provide orthodontic treatment and counsel. This survey showed that the majority of specialty dental students were studying orthodontics, and recommended inclusion of orthodontics in the pedodontic curriculum. Educational objectives for

undergraduate education included definition of terms, growth and development, physiology of the stomatognathic system, incidence and recognition of malocclusion, etiology, diagnostic records and interpretation, unfavorable sequelae of malocclusion, biochemical principles of tooth movement, tissue response to orthodontics, general principles of orthodontic therapy, preventive orthodontics, interceptive orthodontics, limited corrective orthodontics, and appraisal of long term clinical results.

Andreasan in 1968 made education recommendations based on the ability of dental students to recognize malocclusion and predict results from treatment. The curriculum goals stated were to enable students to recognize normal development in dentition, recognize deviations and the appropriate treatment and timing, to design and construct simple appliances for selected cases suitable for treatment by minimal tooth movement, appropriate laboratory techniques, recognition of orthodontic problems encountered in general practice, interaction with orthodontists and referrals. Lerian called for continuing education in orthodontics for general dentists in a 1968 article, but warned that quality of undergraduate education was critical in providing general dentists with appropriate skills and imparting the appreciation of the dentist's responsibilities to patients.

Further studies in dental education evaluated programs at selected dental schools, surveyed the status of undergraduate education in general, and reported on ADA and AAO recommendations regarding training in orthodontics. In 1971 Morton reported on the curriculum of the University of Kentucky dental school, where the orthodontic curriculum was based on a multi-disciplinary approach to facial growth and development in the first year, combined pedodontic and orthodontic curriculum in the second and third years, with separation of the specialties in clinical experience in the

third and fourth years. In the fourth year orthodontics is presented as an integral part of the patient's total dental needs. Clinical experience stressed comprehensive diagnosis and treatment planning involving the student, pedodontist, orthodontist, patient, and parents, in teaching settings which provided the opportunity to evaluate the student's skills and abilities.

Another evaluation of dental schools was reported by Miller in 1973, who found that education and practice of orthodontics has traditionally been handled by practitioners with post-doctoral training engaged in exclusive practice. Because of this training and exclusivity, treatment methods have evolved of which most general dentists have no knowledge. Miller found that by 1973 most university dental schools were offering complete orthodontic curriculums, and that there was a trend to combine the departments of pedodontics and orthodontics and merging their curriculums. This was found to be appropriate since orthodontics is part of children's dentistry, and orthodontic guidance, limited treatment, and intelligent referral should be part of the general practice. Miller's recommendations emphasized the importance of training for early recognition and treatment, and placed that responsibility on the general dentist.

The Council on Dental Education instructional "Guidelines for Teaching Orthodontics in Dental Education" published in 1976 were reported by Richard Jacobs in 1977, and advocated upgrading undergraduate orthodontic education to the level of comprehensive dental care delivered by the general dentist who should be capable of recognizing and identifying all aspects of malocclusion, treating specific simple cases of oral and dental disease and orofacial disorders. He made recommendations based on a ten-year study of strategies for teaching in pre-doctoral orthodontic education based on a three-phase approach, effective instructional strategy for complex skills via discovery

learning and the hypothetical deductive method of teaching, promoting student self-reliance in application of facts to clinical cases. Phase II involves teaching the skills necessary to evaluate the severity of malocclusions, and phase III teaches skills for assessing the degree of treatment difficulty. These teaching methods were successful in imparting skills to students.

American Association of Dental Schools (AADS) curricular guidelines for orthodontics published in 1980 called for educating general dentists to recognize and identify all aspects of oral and dental disease and orofacial disorders. The guidelines place orthodontics as an integral and basic component of pre-doctoral education. Didactic instruction and laboratory technique should precede clinical experience, and training should include growth and development, pre-clinical orthodontics, including applied growth and development. diagnostic methods, biomechanics and techniques; and clinical experience including uncomplicated orthodontic treatment as well as referral and interaction with specialists.

Later reports and recommendations demonstrated that the problems of adequate undergraduate teaching of orthodontics continued to be a concern. Dugoni, Chambers and Roberts in 1981 found that orthodontic education in dental schools was failing to provide necessary theoretical foundation and depth of experience for general practitioners to adequately provide orthodontic care. They found that graduate orthodontic programs were strengthened at the expense of expending resources on undergraduate education in orthodontics, and that this presented a threat to the specialty of orthodontics. Because the undergraduate is the future general practitioner, whom orthodontists are dependent upon for referrals. The undergraduate curriculum should insure that dentists: 1) are trained to refer patients properly and at the appropriate time,

2) are aware of the sophistication of orthodontic skill and treatment planning, and 3) understand the function and possibilities of orthodontics and its benefit to patients. Their 1981 study examined curricular objectives and quality of faculty, and called for a rigorous didactic program and meaningful clinical experience. The quality of the faculty was found to strongly influence students' attitudes about specialties such as orthodontics, and competent, committed teachers are vital in the students' perceptions of what it means to be a dentist or specialist.

R. J. Smith in 1987 defined the issue of who should diagnose and treat malocclusion, with its inherent conflict between general dentists and orthodontists, as a problem rooted in education. In summarizing the 1979 guidelines for pre-doctoral dental education in orthodontics, Smith stated that "the general dentist should be able to recognize and treat uncomplicated orthodontic problems" and that the student should not deliver comprehensive orthodontic treatment. The recommendations in effect at the time of his study, Smith reported, specify the level of treatment of simple cases which the graduate dentist should be able to carry out, and the average of 110 hours of instruction in pre-doctoral orthodontics are insufficient to train dentists to provide comprehensive orthodontic treatment. He further concluded that continuing education for generalists would not resolve the problems, since most general practitioners, in his estimation, are simply unaware of how insufficient their diagnostic and technical skills are.

Lowe provided a broad overview of undergraduate and continuing education in orthodontics in 1987, and reported the trend for more orthodontic treatment to be initiated by general practitioners. He reported on the undergraduate curriculum at the University of British Columbia, and described course offerings in detail, where pre-

clinical instruction is provided on the Dental Performance Simulation System (DPSS), and methods of evaluating students. The strong pre-clinical preparation provided by the DPSS teaching aid, which is a simulator for conditions found in actual dental practice, was found to provide better preparation for clinical study and to provide the student with better diagnostic skills, and the ability to recognize malocclusion and make appropriate referral decisions.

Richard Jacobs, who has reported on educational guidelines for teaching orthodontics to undergraduates with extensive analysis and recommendations for several years, again reported on the 1988 Council on Dental Education guidelines on dealing with malocclusion in general practice, which called for teaching the ability to evaluate the severity of malocclusion and assessment of treatment difficulty, and found that conventional methods of pre-doctoral instruction were unsuitable for transmitting these complex skills to dental students. He recommended instruction and evaluation focused on mastery of these areas, and to prepare dental students "to deal with the continuum of malocclusions observed in the general practice...and to select and treat appropriate orthodontic problems.

Outcomes Assessment of Dental Education

The discussion of content of undergraduate dental curriculum for orthodontics naturally leads to consideration of methods to assess the outcome of dental education. That is, to evaluate the effectiveness of course content and teaching methods objectively. The topic of outcomes assessment has become critical for dental schools as the Commission on Dental Accreditation of the American Dental Association has mandated dental schools, graduate, and post-doctoral programs must "regularly evaluate the degree to which goals are being met through a formal assessment of

outcomes" (Adair, 1990). Six aspects of professional competence to be demonstrated by graduates are conceptual, contextual, technical, interpersonal communications, integrative, and adaptive competence. Casamassimo (1990) described the accreditation standards as patient oriented, with a "service first" philosophy. In order to construct an outcomes assessment program, goals must be defined carefully, measures must be selected to assess outcome, the process must be developed, and the assessment must show change or validation of the status quo.

Adair's 1990 review of the guidelines gave recommendations for implementation of an outcomes assessment program. The steps included planning, systematic data collection, analysis of data, action to identify and implement corrective measures, and periodic review of the assessment plan.

Outcomes assessment was described by Romberg in 1990 as the process of collecting information about the attainment or outcome of an academic endeavor, analyzing that information by comparing and contrasting it with previously established statements of missions, goals and objectives, then using the information to validate the existing effort or to make recommendations for improvements. Romberg defined an effective outcomes assessment process to include a) involvement of a broad base of faculty and administrators, b) establishment of clearly defined purpose or mission appropriate to the department, program, or school, c) development of procedures for evaluation of the achievement of goals, and e) utilization of results to improve the program's effectiveness.

Morganstein placed the outcomes assessment of dental education in the context of a wider movement building in the country in response to criticism of higher education in recent years. In a 1990 report on the Statement of Principles on Student

Outcomes Assessment of the National Association of State Universities and Land Grant Colleges, Morganstein iterated several key factors for a successful outcomes assessment plan. Some of these include outcome measures directly related to program objectives; multiple methods of assessment; development of new methods rather than relying on existing instruments for convenience; utilizing a wide range of individuals in determining outcome measures; and guarding against contamination of graduate profiles by numerous variables that may have wider impact.

Various authors have studied and reported on outcomes assessment programs at several dental schools. Bader and Kaplan in 1983 studied treatment distributions, a method of evaluating curricula by using information from dental practice. The distribution of treatment they found consisted of a narrow range of procedures, the focus of the dentists' treatment efforts was primarily restorative, and practitioners may not have achieved the broad curriculum evaluators have suggested. Based on the results, the authors recommended that dental educators evaluate curricula in light of information from actual practice of graduates, and assume responsibility for attempting to improve the performance of the "product," i.e., the general dentist. Some shortcomings in dental education pointed out by the survey were the lack of recognition of the need for treatment and provision of unnecessary treatment due to lack of current information. The attitude and behavior of graduates toward continuing education as professionals was also based on undergraduate education received.

McDuffie surveyed dental schools in 1985 and found that orthodontic instruction comprised less than 4% of total instruction time in the institutions surveyed. He evaluated the curriculum of the University of Florida to determine the amount of orthodontic treatment actually performed by recent graduates in private practice,

compared to graduates of other dental schools practicing in Florida. It was found that, despite differences in curricula, the practices of recent Florida and non-Florida graduates appeared similar. The Florida graduates reported greater recognition of malocclusions in their patient populations. Recent graduates in general were found to be performing a limited amount of minor orthodontic treatment and the number of malocclusions recognized and referrals made was smaller than would have been expected from epidemiological studies.

In 1988 Nieberg studied delivery of dental care through prepayment programs by general dentists and the implications for pre-doctoral dental education. Defining critical components of undergraduate education in orthodontics to include recognition, classification and differentiation of occlusal problems in children and adults, the study developed a survey questionnaire to collect data about orthodontic faculty, didactic course content in orthodontic courses, orthodontic laboratory techniques, and breadth of orthodontic clinical experience offered in various dental school undergraduate programs. The results of the study showed that the amount of didactic and clinical instruction varied widely, and that this variation was due to lack of specific criteria for the degree of emphasis to be placed on these topics.

With regard to undergraduate education in pediatric dentistry, Hanes (1990) recommended assessment of knowledge and skill outcomes in relation to AADS curriculum guidelines for pre-doctoral pediatric dentistry as applied to the curriculum of the Georgia School of Dentistry. The goals stated by the program were to prepare dentists to provide, by treatment or referral, comprehensive dental care for the patient; to create an attitude toward pediatric dentistry in dental students that encourages graduates to treat children; and to develop an attitude toward learning which will

encourage graduates to seek further opportunities to upgrade knowledge and skill throughout their careers.

The University of Tennessee implemented an outcomes assessment program testing didactic knowledge, which was described by Behrents (1993). Questions selected from recent National Board examinations were compiled in a test administered to all graduate and undergraduate classes on the same day. The results were used to establish a test instrument for a longitudinal study to follow the learning of students through their academic careers, and to measure how well they absorbed course content. This strategy was used to compile the didactic test for the present study.

The General Dentist Practice and Recognition of Malocclusion and Issues of Treatment and/or Referral

Moorrees (1962) suggested that the pediatrician, family dentist, orthodontist, and child psychiatrist could collaborate to provide comprehensive treatment for patients with malocclusion. Salzmann has reported extensively over a number of years on aspects of general practice related to identification, diagnosis, treatment and referral of orthodontic problems. His 1969 report reminded the family dentist that referral to a specialist does not end the responsibility for overall care and follow-up of the patient, and urged intra-professional cooperation with emphasis on preventive orthodontics, and timely correction of problems. Other authors have stated that generalists can and should treat simple cases. Gecker in 1969 stated that incipient malocclusions in children should be intercepted and corrected by the family dentist. Selected orthodontic procedures were defined as well within the scope of general dental practice.

Salzmann, speaking of the general dentist in a 1970 study, found that early dental care and timely recognition and referral of orthodontic problems to the specialist were critical to comprehensive delivery of dental health care. The general dentist must

have current knowledge of the changes that occur in the practice of orthodontics, be prepared to discuss and express clinical judgements on treatment planning, and to recognize normal occlusion and malocclusion. He urged basic educational requirements covering prevention, interception, and treatment of malocclusion be incorporated in the undergraduate curriculum.

Miranda in 1980 reported on a survey of the Southwestern Society of Pedodontists and showed that most were actively involved in orthodontic treatment more complex than space maintenance and a minority were involved in comprehensive orthodontic treatment. The majority were working in the preventive/interceptive area of orthodontics. A need for better undergraduate and continuing education was identified as well.

The Association of Pedodontic Diplomates conducted a 1981 survey which found that 33% of diplomates provided some comprehensive orthodontic services as well as oral surgery, endodontic, and periodontic treatment. Almost all provided a wide range of orthodontic preventive and interceptive services (APD, 1983).

Early treatment and the importance of early diagnosis by the family dentist are stressed by several authors. Vego and Murphy in 1982 stated that many malocclusions are not treated early enough to achieve optimal results. Problems suitable for early treatment include Class I dentition, mild crowding, cross-bites, ectopic teeth, open bite, skeletal Class II, skeletal and dental Class II facial asymmetries. Malocclusions best treated in the permanent dentition were defined as dental Class II and Class I malocclusions with excessive crowding, overbite and overjet, bimaxillary protrusion and Class III malocclusion with predicted severe mandibular growth.

Cautions are iterated in several studies for the general practitioner and

implications for undergraduate education. Linge in 1987 stated that the long-term processes of dentofacial growth, function and development were not given high priority by dentists in general practice, who should be concerned with prevention rather than repair. The study found generalists extending their clinical practice to areas of specialists. Orthodontic treatment is characterized by long-term treatment objectives, he stressed, and should preferably be carried out by a specialist, even if a case appears to be simple. He stated that all dentists should obtain continuing education and communicate with other members of the dental care delivery team.

Koruluk in 1988 discussed as a current issue in dental care the provision of orthodontic services by pediatric dentists and general practitioners, and found this trend, as reported in past surveys, was continuing. Practitioners surveyed in the State of Indiana were found to be providing significantly greater amounts of treatment of a more complex nature than was found in previous surveys. The Indiana study found significant differences between pedodontists and general practitioners, and related them to differences in education, since pedodontists receive more training in their doctoral program.

Several more recent studies have examined the amount and type of orthodontic services provided by general dentists. Jacobs, Bishara and Jakobsen in 1991 surveyed general practitioners to determine if a high volume of orthodontic treatment was linked to an expanded scope of treatment and fewer referrals. Questionnaires pertaining to volume, scope and other correlates of orthodontic services were mailed and 728 responses were tabulated. When compared to providers of a low volume of orthodontic treatment, it was found that providers of a high volume of orthodontic treatment performed about the same amount of limited orthodontic treatment, performed

significantly more major orthodontic treatment, used more fixed appliances, functional appliances and headgears (but not removable appliances), took more hours of continuing education in orthodontics, and referred significantly fewer patients to specialists.

Another aspect of referrals by general dentists to orthodontic specialists is the business aspect of orthodontic practice. Gottlieb studied the effects of advertising and alternate forms of dental care in 1984 and concluded that a division has arisen with two approaches to health care involving orthodontists as principals: business orthodontists -- businessmen who are using the profession to advance business -- versus professional orthodontists -- professionals who recognize a business aspect to a professional practice and who use certain business methods to advance the practice. Adequately trained, referral source, private fee for service orthodontists are a factor in the profession, and the author stresses that orthodontic practice is and has always been dependent on referrals for new patients. Without such referrals, patients and parents would more likely make choices based on advertising, price, convenience or other factors unrelated to competence and reputation of the orthodontist.

Manasse and Dooley in 1980 reported on a study to determine the extent of orthodontic referrals and treatment performed by general dentists. The relevance of this study to dental education was the attempt to relate the extent and type of pre-doctoral training of general dentists to the number of referrals and the type and extent of orthodontic treatment performed by the general practitioner. Their results indicated that recent graduates tended to make many more referrals than earlier graduates, and the general practitioners who had treated patients in their pre-doctoral training continued to do so in their practice.

Successful Diagnosis by the General Dentist and Timely Referral for Orthodontic Treatment: Timing of Treatment

Trapani stated in a 1977 study that the most important key to successful orthodontic treatment is proper diagnosis and evaluation of the problem. He concluded that the general practitioner should limit case selection to the following: Angle Class I malocclusion with good facial balance, problems of space maintenance, mild muscle problems, and simple cross-bites anterior and posterior. He warned the general practitioner to avoid treating skeletal malocclusion Class II or III, severe arch length discrepancy, congenitally missing teeth, obvious extraction cases, impacted teeth, advanced periodontal disease, poor facial esthetics, and multiple problem cases, all of which should be referred to the appropriate specialist.

Kilmon found in 1983 that early detection and treatment of dental problems in children may avoid later problems and stated that the practitioner must recognize malocclusions of all kinds: lingual eruptions, crowding, anterior and posterior cross-bites, supernumerary and missing teeth, and midline diastema.

Wasson stated in 1983 that the misconception that a patient must wait until the permanent teeth have erupted before beginning orthodontic treatment is harmful to good dentistry. He places the responsibility for observing situations requiring treatment and taking appropriate action on the family dentist, who must be trained to know what to look for and what to do. The dentist's education should include orthodontic diagnosis and knowledge of various treatment options. Since the seven to ten year range is the most effective for use of functional appliances, the family dentist must be able to recognize candidates for such therapy. Early referral and treatment can eliminate bad oral habits, facial growth problems and improve functional occlusion while reducing

treatment time and minimizing the need for headgear and extractions. Wasson finds these goals appropriate for the general dentist and orthodontist to approach cooperatively.

Continuing discussion centers on the question of who diagnoses malocclusion. Moores and Gron stressed in 1966 that diagnosis is an analytical process that constitutes the essential link between clinical examination and all aspects of medical treatment. In orthodontics successful diagnosis demands evaluation of the functional aspects of dentition in terms of esthetics, physiologic activity, and health of teeth and supporting tissues. Because seemingly similar types of malocclusion may require quite different treatments, and the difficulties of diagnosis in the growing child with accurate prediction of facial growth and dental development, analytic description and classification are, they conclude, only part of diagnosis. Descriptive diagnosis and individual treatment planning are stressed as essential.

Atchison in 1989 found that the pediatric dentist provides the initial diagnosis for most orthodontic service provided to children and adolescents, basing the initial diagnosis on clinical and radiographic examinations.

Battagel in 1985 suggested routine orthodontic examination of all 8 to 10 year olds regardless of the presence of an obvious anomaly. This examination would include radiographs and be performed as part of the child's regular dental checkup by the family dentist, with referral where appropriate for orthodontic treatment. He differed from other authors in stating that most children are not considered eligible for orthodontic treatment until the primary teeth have been shed and being replaced by permanent successors. He concluded that a definitive treatment plan and tooth movement cannot be accomplished until permanent dentition is established. However,

he stresses it is still important for the general practitioner to recognize potential problems, and make timely referrals.

The reliability of diagnosis for children in the 7 to 15 year old age groups was tested by Heikinheimo, Salmi and Myllarneimi in 1987, who compared diagnosis made at age 7 with the child's condition at age 15 for a group of school children. They found that repeated orthodontic check-ups between those ages are required to evaluate real requirements for treatment, and that it is appropriate to initiate treatment in many cases in the deciduous and mixed dentition stages.

Recent thinking on the topic is summarized in a 1994 panel discussion reported in Orthodontic Dialog related to the debate on general dentists and referrals to orthodontists. The teamwork between generalist and specialist was stressed with emphasis placed on optimal patient care. The conclusions of the panel were that the general dentist's examination should record orthodontic evaluation of the patient, and early referrals may occur during deciduous or mixed dentition and include cross-bites, severe crowding, ectopic eruption, congenital problems, and abnormal oral habits. Mixed dentition referrals should include cases amenable to growth guidance and interceptive treatment. Later mixed or adolescent dentition problems include those undetected earlier and those requiring extraction because of late treatment.

Methodology

Written Examinations to Test Didactic Learning

The specific aspects of written examinations to test didactic learning have been discussed by several researchers. Murphee in 1961 stated the goals in giving examinations are to spur study, evaluate the amount and quality of learning by the student and what areas have been missed. Teaching and testing can be evaluated

quantitatively using psychometrics to raise standards for testing and achievement. Examinations should be evaluated for reliability, that is, the degree to which examinations are consistent within themselves or within a series of similar tests. Validity, the degree to which a test actually measures what it is intended to measure, should also be assured.

Presenting Cases to Examiners

A method of presenting cases to examiners was described by Shaw, Lewis and Robertson in 1975. A film showing children with different occlusions was assessed by lay and professional groups, and found that the orthodontists tested applied a scale of aesthetic values that differed from the community at large, which had implications for assessment of treatment need as well as amount of orthodontic correction to be attempted.

Han, Vig, Weintraub and Kowalski in 1991 evaluated how incremental information obtained from different types of diagnostic records contributed to orthodontic treatment decisions. They sampled patients with Class II malocclusions at three developmental stages, using study models, facial photographs, panoramic radiograph, lateral cephalogram, and its tracing. In 55% of the cases the study models alone provided adequate information for treatment planning, and when compared with other diagnostic aids, recommendations did not vary significantly.

Gottlieb, Nelson and Vogels surveyed practitioners and reported in 1991 the results of a questionnaire mailed to all practicing orthodontists identified in the United States (8,901) and received 1,253 usable responses. They compared the results of their 1990 survey to an earlier survey reported by the JCO Study of Orthodontic Diagnosis and Treatment Procedures in 1986. The five cephalometric analyses used most

routinely in 1986 remained the same in 1990. Fewer respondents reported routinely taking full series of x-rays and bite-wings, and more reported taking panoramic x-rays in 1990 than in 1986. The study also surveyed treatment methods. Based on the consensus of the literature, for the present study, cases were presented by means of photographs of the patient intra and extra oral, photographs of the models and the panoramic radiograph.

Comparisons of Examiner Reliability

The literature discusses methods of testing examiner reliability in comparative diagnosis. Brook and Shaw in 1989 reported on the development of a valid and reproducible index of orthodontic treatment priority using dental photographs of 12 year olds, and the index was tested in use on sample populations of 11 or 12 year olds. The index and method of case presentation provided good levels of intra- and inter-examiner reliability.

Comparison of examiner results has been a useful study method. Using this strategy, Lewis, Albino, Cunat and Tedesco in 1980 tested the reliability and validity of selected clinical judgements of malocclusion. The completed ratings on six dimensions: need for treatment, degree of malocclusion, potential for tissue loss, negative effect on occlusal stability, negative effect on facial attractiveness, and negative effect on masticatory function. Clinical evaluations were found to be stable over time and were comparable to objective measures in terms of inter-examiner reliability. In evaluating clinical assessments, the degree of agreement among raters making clinical evaluations of malocclusion should be determined. In this study the clinical evaluations of severity of malocclusion compared favorably with the Treatment Priority Index (TPI) in terms of inter-examiner reliabilities and intra-class correlations.

Use of Questionnaires

Questionnaires have been demonstrated as reliable survey instruments when properly constructed and evaluated. Cummings described the proper construction and use of questionnaires in a 1986 study and stressed their value in clinical research. He described two basic methods for gathering data on behavior and knowledge: questionnaires answered by the respondents themselves, and interviews conducted by an examiner. Questionnaires have the advantage of being more efficient and uniform. Both methods of collecting information are susceptible to errors and the study described ways to insure accurate data collection, collation, and computation, as well as good design of the test instrument.

Criteria for Assessing and Diagnosing Malocclusions

In order to compare the clinical abilities of dental students and practitioners in diagnosing malocclusions in children, an objective means of classifying indicators of malocclusion had to be devised for the present study. Various authors have described indices of malocclusion to establish objective criteria for diagnosis.

Edward Angle stressed the influence of normal occlusion or the muscles, lips and cheeks. He also recognized the effects of the inclinations of the occlusal planes of the teeth in establishing and maintaining harmony in the relationship of the teeth. He also took into account the relative size of the arches in his classification system (Angle, 1899). Angle defined normal occlusion in terms of the mesiobuccal cusp of the maxillary first molar, which should rest in the buccal groove of the mandibular first molar. He stated that, if the rest of the teeth in the arch are aligned, then ideal occlusion will result. Angle described three basic types of malocclusion, all of which represented deviations in the anteroposterior dimension. His system was readily accepted by the

dental profession since it brought order out of previous confusion regarding dental relationships, and his classes of malocclusion remain the basis for judgement against which other systems and indices of malocclusion are measured (Ackerman and Proffit, 1969).

Several critics have pointed out deficiencies in the Angle system, for example, disregard of the relationship of the teeth to the face, lack of differentiation of dentoalveolar and skeletal discrepancies, and disregard for arch length problems. These criticisms are summarized by Ackerman and Proffit in their 1969 study, which proposed systematic enhancement of the Angle system based on a standard of ideal alignment into arch form and ideal interdigitation.

In 1973 Proffit and Ackerman further described their systematic description of five characteristics of malocclusion. This system was designed to extend the Angle system and overcome its weaknesses. Specifically they provided a format for considering the effect of arch length problems, with or without an influence on the profile; took into account the effect of tooth position on facial esthetics; covered the transverse (cross-bite) and vertical (bite depth) planes of space as well as the anterior-posterior plane; and differentiated the skeletal and dental problems at the level of individual planes of space. They recommended a thorough patient history and oral examination, including functional analysis of mastication, swallowing, and speech. Systematic description of the malocclusion using their group classification with quantitative rating scales, produces an individualized problem list for each patient. This problem list can then be used to direct treatment planning.

Freer (1973) pointed out that the distinction between normal and abnormal occlusion is unclear from morphological and physiological viewpoints. This lead in

differences in objective assessments among practitioners. In describing a method for reaching consistent assessments of the severity of a given malocclusion, he suggested studying the complete diagnostic records including casts, facial photographs and radiographs, including cephalometric head films. Freer recommended beginning with the assumption that, in ideal occlusion, the maximum intercuspal contact (centric occlusion) and the unstrained retruded position of the mandible (centric relation) should approximately coincide. Step one in this procedure was analysis of the alignment and symmetry of the teeth in the dental arches (interproximal contact relationships). Step two viewed the patient's profile. In step three the dental arches were viewed with regard to lateral dimensions (transverse plane) and the buccolingual relationships of the posterior teeth are noted. In step four the patient and dental arches were viewed in the anteroposterior dimension (sagittal plane). In step five the patient and dentition were viewed with regard to the vertical dimension.

Kimmel in 1987 defined orthodontic diagnosis and recommended critical study of casts, radiographic examination, intraoral and facial photographs, and evaluation of facial properties and esthetics, stressing the value of analysis of models.

Gravely and Johnson in 1989 examined the reliability of the Angle system of classifying malocclusion for both clinical and epidemiological applications. Their findings showed that classification of malocclusions, according to this system, cannot be carried out with a high degree of reliability, and questioned its clinical usefulness. In community studies this system was reliable when observations were made by the same examiner.

Ghafari, Lock, and Bentley in 1989 developed the Treatment Priority Index (TPI) as an epidemiological tool used to rank malocclusions and assess the need for

orthodontic treatment, and it has been extensively tested and found to be a valid indicator, however, the TPI does not predict the severity. Gravely and Johnson in 1989 examined the reliability of Angle's system of the classification of individual malocclusions in the permanent dentition.

Richmond in 1992 described the PAR index developed to provide a single summary score for all the occlusal anomalies which may be present in a malocclusion. The score provides an estimate of how far a case deviates from normal, and has proven to be reliable with different examiners, offering uniformity and standardization of assessing the outcome of orthodontic treatment.

The criteria for diagnosis of malocclusions suggested by these authors validate the method of selecting a list of criteria used by subjects in the present study and the method of case presentation. The discussion of classification of malocclusion points out the need for specialized training beyond the basic undergraduate dental curriculum for general dentists to be adequately trained in the complexity of recognizing malocclusions in children and making referrals for timely initiation of treatment. The present study used intraoral and extraoral photographs as well as photographs of casts and the panoramic radiograph to present cases to subjects for examinations, a method which was chosen to provide complete, consistent information to each examiner.

STATEMENT OF THESIS

The general dentist should bring to practice, upon completing four years of education, not only demonstrated didactic knowledge, but also clinical abilities to recognize malocclusions in children and make appropriate referral decisions for orthodontic treatment. The purpose of the present study was to design a test instrument to assess the outcomes of dental education over a cross-section of students in all four years to measure their improvement, from first year to fourth year students, as they progress through the curriculum. While the didactic and clinical abilities should be expected to increase over four years, the outcomes assessment test identifies specific strengths and weaknesses in students' didactic knowledge and clinical skills in the diagnosis of malocclusion.

The specific objectives of the study were to compare the education level of the student with the ability to identify malocclusion in children and make timely referrals for orthodontic treatment. The long-term objective was to develop a test instrument that can be used longitudinally to assess outcomes of didactic and clinical predoctoral dental education related to diagnosis of malocclusion.

MATERIALS AND METHODS

Over a period of several weeks at the beginning of the spring semester, data were collected from a study sample of dental students in the School of Dentistry at the Case Western Reserve University (CWRU) School of Dentistry in Cleveland, Ohio. The didactic test was administered to one-hundred-ninety-five students: Fifty-seven first year students or Freshmen, fifty-four second year students or Sophomores, forty-two third year students or Juniors, and forty-two fourth year students or Seniors. The clinical test was completed by one-hundred seventy-one students: Fifty-five Freshmen, fifty-four Sophomores, thirty-one Juniors, and thirty-one Seniors.

Ten orthodontists were tested and their results used as the Gold Standard by which to measure the performance of the dental students. The dental students were tested during class time at the beginning of the Spring Semester. All subjects of this study signed a consent form (Appendix A).

The Gold Standard for this study, that is the reference group of ten orthodontists, was obtained at the Department of Orthodontics at CWRU and then through the telephone directory. When subjects were obtained through the yellow pages, the test instrument was delivered to their offices and then after a one or two week time period, the completed study was collected.

The American Association of Orthodontists outlines the standards for certification and practice for the specialty, including the educational requirements, and accredits dental school programs (Bylaws, 1990). The Ohio State Dental Board

determines qualifications for practicing in the specialty within the state (Dental Law and Rules, revised 1978). The reference group for this study were the orthodontists who, by training and experience, are qualified to diagnose and treat malocclusion and to be designated orthodontic specialists by the American Association of Orthodontists (AAO). Thus, they are the "Gold Standard," by whose judgements on the cases presented, the results of the subjects were measured (Appendix B). AAO Bylaws specify that a condition for membership and for the specialty is a post-graduate degree from an accredited orthodontics program. The graduate curriculum in orthodontics at CWRU is accredited and the orthodontics specialty curriculum provides a model. The course requirements include facial growth and development; anatomy of the head and neck; orthodontic diagnostics, seminars in diagnostics, interdisciplinary relationships, and clinical specialty seminar; biomechanics of tooth movement; advanced specialty principles of orthodontics; clinical cephalometrics; advanced facial growth and dentofacial anomalies; concepts of occlusion; statistical methods; cephalometrics; biological aspects of stomatological systems; advanced oral pathology; orthodontics/oral surgery conference; limited tooth movement; orthodontic practice management; literature review and thesis. This is a two year accredited program (CWRU Catalog, 1994).

Specific Methodology - Test Instrument

The subjects tested included undergraduate students in the dental program at the Case Western Reserve University School of Dentistry, first through fourth year. The testing of subjects was carried out in two components. The Outcomes Assessment Test consisted of ten questions selected from recent national board examinations, in multiple choice format, relating to the diagnosis of malocclusion in children (Appendix C). These were selected to test didactic knowledge gained in dental education, and the test

was completed by 195 students.

The second component was designed to test clinical abilities. Each subject was presented with seven cases selected from the practice of a Board Certified Orthodontist, Dr. Gary R. Wolf of Norwalk, Ohio. Photographs (5" x 7") were taken of the models from five views, which included frontal, right lateral, left lateral, maxillary occlusal and mandibular occlusal. Three intraoral views were utilized: frontal, right and left laterals. Extraoral facial views used were frontal at rest, frontal smiling, and lateral (profile) at rest. A photograph was also taken of the panoramic radiograph as part of the presentation of each case.

Approximately three-hundred-fifty cases were initially viewed and eventually were narrowed down to around forty. Of these, eighteen cases were then brought to CWRU, where the final selection of seven cases was made by Dr. B. Douglas Amberman and the author. The cases were selected to demonstrate different types of malocclusion. Orthodontists were asked to evaluate the cases, and their answers were used as the Gold Standard, or reference group.

All answers by the participants to the questionnaires accompanying the seven cases, as well as the answers to the Outcomes Assessment Test, were placed on scan sheets, (Scantron Form 2050C, Scan-Tron Corporation, Tustin, California). The Outcome Assessment Test was scored at the CWRU School of Dentistry. The answers from the scan sheets from the seven cases were transferred to another type (#0970 Cleveland State University, Compusentials, Canfield, Ohio) of scan sheet). A number was assigned to each group of seven cases completed by one subject from 001 to 171. Also, Freshmen were assigned the code 01, Sophomores 02, Juniors 03, and Seniors 04. These were then run through a scantron and placed on a computer disk and analyzed statistically at Cleveland State University.

To facilitate uniform testing of individuals viewing the seven cases, a questionnaire was designed (Appendix D). A list of seventy-four criteria used to recognize malocclusion was given to ten orthodontists who were asked to select the twenty criteria they considered to be most important in the recognition of malocclusion (Appendix E). These twenty most commonly mentioned criteria were used to select the seven cases presented to the subjects of this study and to formulate the questionnaire which accompanied the cases (Appendix F).

The media (photographs) for the seven cases were shown to one-hundred-seventy-one dental students, first through fourth year, and to ten orthodontists. The subjects were asked to make a diagnosis and recommendation regarding referral for orthodontic treatment for each case. The diagnosis and prognosis of each was recorded and subjected to statistical analysis. The determinations of the subjects were then compared to the diagnoses of the reference group of ten orthodontists. Both analysis of variance, and chi square analysis were performed to identify how the diagnoses of the sample varied from the reference group of orthodontists (Appendix G).

The study sought to determine which types of malocclusion are most commonly misdiagnosed as well as the degree to which the recommendations of the sample regarding referral for orthodontic treatment differ from the recommendations of the reference group. Informed consent forms were obtained from each member of the sample, assuring maintenance of confidentiality. The results have been used for statistical analysis only, not as an evaluation of individual participants.

In addition to the case study presentations, all undergraduate dental students in the sample were asked to answer ten questions selected from recent national board examinations in order to test their didactic abilities and to assess the outcome of objective classroom lecture courses relating to malocclusion. The test was completed

by one-hundred-ninety-five students.

The analysis and results of the written test scores were compared to the results of an ongoing study being conducted by Dr. Rolf G. Behrents at the School of Dentistry of the University of Tennessee, and has been modelled on the test instrument he described.[1]

This test and comparison have been designed to measure didactic ability and, when compared with the results of the clinical diagnosis trial, can be used as an outcomes assessment tool. One may then test the success of education in the transfer of didactic abilities to clinical skills in diagnosis and recognize the importance of educating general dentists in the identification of malocclusions in children in order to assure that every patient receives timely referral and treatment.

The current study proposes a test instrument which can be applied to measure the effectiveness of undergraduate dental education in imparting didactic knowledge and clinical skills in diagnosing malocclusions in children in a cross-sectional study. This test instrument can be adapted as a part of an educational outcomes assessment program for longitudinal study to follow a class of students through the curriculum. The assessment of the recognition and diagnosis of malocclusion is the most important part of the study.

Methods Of Statistical Analysis

In order to make a statistical analysis of the results, the undergraduate students' answers to the thirty-nine questions in the clinical test were studied. The chi square analysis was used to determine if there are any differences in the responses to each of

---

1 Behrents, Rolf G., The significance of outcomes assessment to orthodontics. Proceedings of the Orthodontic Educational Development Symposium, American Association of Orthodontists, 1994.

the thirty-nine questions for each case. Chi square is a statistical test of significance used to determine whether or not frequency differences have occurred other than by chance. Chi square requires that the data be in nominal form, or the actual number of cases (frequency of occurrence) fall into two or more discrete categories. It is considered to be a non-parametric test (no population assumptions are required for its use). The dental students were compared to the ten orthodontists (the Gold Standard). The analysis was repeated for each of the seven cases yielding a total number of chi square analyses of two-hundred-seventy-three. One way analysis of variance (ANOVA) was used to compare the means of the total scores for the five groups on each of the seven cases and on their grand total of the seven cases combined. The one-way ANOVA uses a statistical test of significance, called the F ratio. The test is designed to establish whether or not a significant (nonchance) variance exists among several sample means. Statistically, it is the ratio of variance occurring between the sample means to the variance occurring within the sample groups. A large F ratio, that is when the variance between is larger than the variance within, usually indicates a nonchance significant difference. If a significant difference is noted between any of the groups, a Newman-Keuls or similar test is usually done to determine exactly which groups are different from each other.

The Newman-Keuls Test is a multiple comparison procedure. When one declares that a significant difference exists between three or more groups, the ratio will not tell exactly where that difference lies. After one declares that a significant difference was found between three or more groups, a test must be performed to see where the difference is located and a Newman-Keuls Test does this.

Frequency Distribution is the arrangement of measured scores in order of

magnitude. Listing scores in distribution form allows the researcher to notice general trends more readily than with an unordered set of raw scores. A frequency distribution is a listing of each score achieved, together with the number of individuals receiving that score.

RESULTS

The results from the didactic assessment test were as follows: the Freshmen achieved a score of 30% as did the Sophomores S.D. 14.93 and 12.32 respectively, while the Juniors had 42% correct S.D. 15.26, and the Seniors presented with 59% correct S.D. 19.22 (Figure 1).

The next section of this study dealt with clinical ability, and a total of 171 dental students from Case Western Reserve University were tested.

The frequency and percentages of the participants are as follows:

55 Freshmen or 32.2%

54 Sophomores or 31.6%

31 Juniors or 18.1%

31 Seniors or 18.1%

The range of scores for the one-hundred-seventy-one participants for each individual case is listed as follows:

Case One	15 to 32
Case Two	14 to 36
Case Three	13 to 35
Case Four	10 to 36
Case Five	13 to 34
Case Six	11 to 37
Case Seven	9 to 32

Individual score totals from the seven cases ranged from a low of 100 to a high of 227 out of a possible total score of 273.

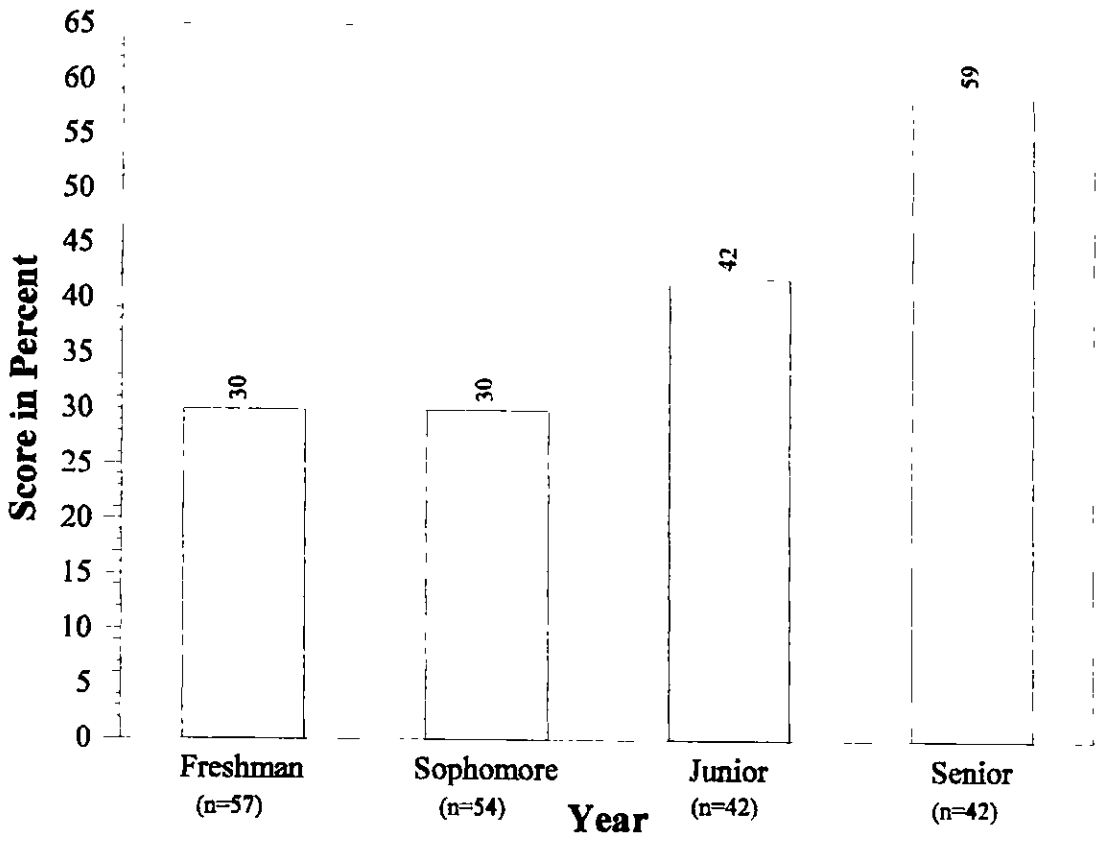


Figure 1 Case Western Reserve University
Didactic Knowledge Base - 1994

The One Way ANOVA tables were used to compare only the four dental groups: Group 1 - First year students or Freshmen, Groups 2 - Second year students or Sophomores, Group 3 - Third year students or Juniors, Group 4 - Fourth year students or Seniors. However, the Newman-Keuls comparison of means, and the Means, Standard Deviations, and Ranges of Test Scores tables also included Groups 5 - Orthodontists. This was done to make certain that the reference group was different from the other four groups when making the comparisons listed above. Overall, one may note the Student-Newman-Keuls test demonstrated that the results for Groups 1 - 4 were identical to those when Group 5 was also included.

Research Question I

There was a significant difference among the undergraduate dental students on the knowledge of the dental and skeletal problems for Case One ($F_{3,167} = 5.56$, $p = 0.001$) (Table 1). This test also confirmed that the orthodontist group or the "Gold Standard" scored significantly higher than any of the other student groups (Table 3). The Newman - Keuls Procedure indicated that the Senior students did better than the Freshmen and the Sophomores, and were found to be significantly different at the 0.050 level, but there were no differences among any other groups as shown in Table 2.

Table 1.--One Way ANOVA Table of Dental Group By Score for Case One

Source	df	Sum of Squares	Mean Square	F Ratio	p
Dental Groups	3	200.4091	66.8030	5.5578	0.0012*
Error	167	2007.2751	12.0196		

* Significant at the $p < 0.01$ level

Table 2.--Student-Newman-Keuls
Comparison of Means for Case One

Dental Group	Mean	Group Number 2 1 3 4 5
Group 2	22.6667	
Group 1	23.3455	
Group 3	24.4839	
Group 4	25.6452	* *
Group 5	35.1000	* * * *

* Significant at the p < 0.05 level

Table 3.--Means, Standard Deviations, and Ranges
of Test Scores for Dental Groups - Case One

Group	Count	Mean	Standard Deviation	Minimum	Maximum
Grp 1	55	23.3455	3.5393	15.0000	30.0000
Grp 3	31	24.4839	3.4046	19.0000	31.0000
Grp 2	54	22.6667	3.3251	15.0000	29.0000
Grp 4	31	25.6452	3.6382	20.0000	32.0000
Grp 5	10	35.1000	1.9692	31.0000	37.0000

Research Question II

There was no difference among the undergraduate dental students on the knowledge of the dental and skeletal problems for Case Two as shown in Table 4. This test also confirmed that the orthodontist group or the "Gold Standard" scored significantly higher than any of the other students groups (Table 6). The Newman-Keuls procedure indicated that the Senior students did better than the Freshmen, and were found to be significantly different at the .050 level, but there were no differences in any other groups as shown in Table 5.

Table 4.--One Way ANOVA Table of Dental Group By Score for Case Two

Source	df	Sum of Squares	Mean Square	F Ratio	p
Dental Groups	3	132.7367	44.2456	2.3528	0.0740*
Error	167	3140.5733	18.8058		

* Significant at the p < 0.001 level

Table 5.--Student-Newman-Keuls Comparison of Means for Case Two

Dental Group	Mean	Group Number 1 2 3 4 5
Group 1	25.8364	
Group 2	27.0185	
Group 3	27.0968	
Group 4	28.3871	*
Group 5	37.0000	* * * *

* Significant at the $p < 0.05$ level

Table 6.--Means, Standard Deviations, and Ranges of Test Scores for Dental Groups - Case Two

Group	Count	Mean	Standard Deviation	Minimum	Maximum
Grp 1	55	25.8364	4.1265	15.0000	36.0000
Grp 2	54	27.0185	4.4531	14.0000	35.0000
Grp 3	31	27.0968	5.1013	16.0000	36.0000
Grp 4	31	28.3871	3.6026	20.0000	35.0000
Grp 5	10	37.0000	1.4907	34.0000	39.0000

Research Question III

There was a significant difference among the undergraduate dental students on the knowledge of the dental and skeletal problems for Case Three ($F_{3,167} = 6.99$, $p = 0.0002$) Table 7. This test also confirmed that the orthodontist group or the "Gold Standard" scored significantly higher than any of the other student groups Table 9. The Newman - Keuls Procedure indicated that the Sophomore students did better than the Freshmen and Seniors, and the Junior students did better than the Freshmen, and were found to be significantly different at the 0.050 level, but there were no differences among any other groups as shown in Table 8.

Table 7.--One Way ANOVA Table of Dental Group By Score for Case Three

Source	df	Sum of Squares	Mean Square	F Ratio	p
Dental Groups	3	333.4223	111.1408	6.9931	0.0002*
Error	167	2654.1333	15.8930		

* Significant at the $p < 0.001$ level

Table 8.--Student-Newman-Keuls
Comparison of Means for Case Three

Dental Group	Mean	Group Number 1 4 3 2 5
Group 1	25.0545	
Group 4	26.3226	
Group 3	27.3548	*
Group 2	28.4630	* *
Group 5	36.5000	* * * *

* Significant at the $p < 0.05$ level

Table 9.--Means, Standard Deviations, and Ranges
of Test Scores for Dental Groups - Case Three

Group	Count	Mean	Standard Deviation	Minimum	Maximum
Grp 1	55	25.0545	4.3522	13.0000	34.0000
Grp 2	54	28.4630	3.2778	13.0000	33.0000
Grp 3	31	27.3548	4.6011	19.0000	35.0000
Grp 4	31	26.3226	3.7717	18.0000	32.0000
Grp 5	10	36.5000	1.7795	13.0000	39.0000

Research Question IV

There was a significant difference among the undergraduate dental students on the knowledge of the dental and skeletal problems for Case Four ($F_{3,167} = 3.87$, $p = 0.0105$) Table 10. This test also confirmed that the orthodontist group or the "Gold Standard" scored significantly higher than any of the other student groups Table 12. The Newman - Keuls Procedure indicated that the Senior, Junior and Sophomore students all did better than the Freshmen, and were found to be significantly different at the 0.050 level, but there were no differences among any other groups as shown in Table 11.

Table 10.--One Way ANOVA Table of
Dental Group By Score for Case Four

Source	df	Sum of Squares	Mean Square	F Ratio	p
Dental Groups	3	182.3050	60.7683	3.8672	0.0105*
Error	167	2624.2213	15.7139		

* Significant at the $p < 0.05$ level

Table 11.--Student-Newman-Keuls Comparison of Means for Case Four

Dental Group	Mean	Group Number 1 2 3 4 5
Group 1	26.3455	
Group 2	27.8889	*
Group 3	28.4839	*
Group 4	29.0968	*
Group 5	35.6000	* * * *

* Significant at the $p < 0.05$ level

Table 12.--Means, Standard Deviations, and Ranges of Test Scores for Dental Groups - Case Four

Group	Count	Mean	Standard Deviation	Minimum	Maximum
Grp 1	55	26.3455	5.2466	10.0000	36.0000
Grp 2	54	27.8889	3.2311	20.0000	35.0000
Grp 3	31	28.4839	3.0207	20.0000	33.0000
Grp 4	31	29.0968	3.2182	18.0000	34.0000
Grp 5	10	35.6000	1.7127	32.0000	38.0000

Research Question V

There was a significant difference among the undergraduate dental students on the knowledge of the dental and skeletal problems for Case Five ($F_{3,167} = 5.23$, $p = .0018$) Table 13. This test also confirmed that the orthodontist group or the "Gold Standard" scored significantly higher than any of the other student groups Table 15. The Newman - Keuls Procedure indicated that the Sophomore and Junior Students did better than the Seniors and Freshmen and were found to be significantly different at the 0.050 level, but there were no differences among any other groups as shown in Table 14.

Table 13.--One Way ANOVA Table of
Dental Group By Score for Case Five

Source	df	Sum of Squares	Mean Square	F Ratio	p
Dental Groups	3	237.6801	79.2267	5.2331	0.0018*
Error	167	2528.2965	15.1395		

* Significant at the p < 0.01 level

Table 14.--Student-Newman-Keuls
Comparison of Means for Case Five

Dental Group	Mean	Group Number 1 4 3 2 5
Group 1	25.7091	
Group 4	26.0968	
Group 3	28.0645	* *
Group 2	28.2593	* *
Group 5	36.0000	* * * *

* Significant at the p < 0.05 level

Table 15.--Means, Standard Deviations, and Ranges
of Test Scores for Dental Groups - Case Five

Group	Count	Mean	Standard Deviation	Minimum	Maximum
Grp 1	55	25.7091	4.3234	13.0000	34.0000
Grp 2	54	28.2593	3.6816	14.0000	34.0000
Grp 3	31	28.0645	3.5018	18.0000	33.0000
Grp 4	31	26.0968	3.7978	20.0000	33.0000
Grp 5	10	36.0000	1.1547	34.0000	38.0000

Research Question VI

There was a significant difference among the undergraduate dental students on the knowledge of the dental and skeletal problems for Case Six ($F_{3,167}$ =4.03, p = 0.0084) Table 16. This test also confirmed that the orthodontist group or the "Gold Standard" scored significantly higher than any of the other student groups Table 18. The Newman - Keuls Procedure indicated that the Senior, Sophomore and Junior students all did better than the Freshmen, and were found to be significant at the 0.050 level, but there were no differences among any other groups as shown in Table 17.

Table 16.--One Way ANOVA Table of
Dental Group By Score for Case Six

Source	df	Sum of Squares	Mean Square	F Ratio	p
Dental Groups	3	181.3390	60.4463	4.0337	0.0084*
Error	167	2502.5674	14.9854		

* Significant at the p < 0.01 level

Table 17.--Student-Newman-Keuls
Comparison of Means for Case Six

Dental Group	Mean	Group Number 1 3 2 4 5
Group 1	25.6909	
Group 3	27.4516	*
Group 2	27.7407	*
Group 4	28.3226	*
Group 5	37.0000	* * * *

* Significant at the p < 0.05 level

Table 18.--Means, Standard Deviations, and Ranges
of Test Scores for Dental Groups - Case Six

Group	Count	Mean	Standard Deviation	Minimum	Maximum
Grp 1	55	25.6909	3.5636	17.0000	34.0000
Grp 2	54	27.7407	4.3834	11.0000	36.0000
Grp 3	31	27.4516	4.3653	18.0000	37.0000
Grp 4	31	28.3226	2.7494	19.0000	34.0000
Grp 5	10	37.0000	1.2472	35.0000	39.0000

Research Question VII

There was a significant difference among the undergraduate dental students on the knowledge of the dental and skeletal problems for Case Seven ($F_{3,167} = 5.88$, $p = 0.0008$) Table 19. This test also confirmed that the orthodontist group or the "Gold Standard" scored significantly higher than any of the other student groups Table 21.

The Newman - Keuls Procedure indicated that the Senior, Sophomore, and Junior students all did better than the Freshmen and were found to be significant at the 0.050 level, but there were no differences among any other groups as shown in Table 20.

Table 19.--One Way ANOVA Table of
Dental Group By Score for Case Seven

Source	df	Sum of Squares	Mean Square	F Ratio	p
Dental Groups	3	228.0474	76.0158	5.8830	0.0008*
Error	167	2157.8590	12.9213		

* Significant at the p < 0.001 level

Table 20.--Student-Newman-Keuls Comparisonof Means for Case Seven

Dental Group	Mean	Group Number 1 3 2 4 5
Group 3	26.6774	*
Group 2	26.9074	*
Group 4	27.1935	*
Group 5	37.2000	* * * *

* Significant at the p < 0.05 level

Table 21.--Means, Standard Deviations, and Ranges of Test Scores for Dental Groups - Case Seven

Group	Count	Mean	Standard Deviation	Minimum	Maximum
Grp 1	55	24.4727	4.6542	9.0000	32.0000
Grp 2	54	26.9074	3.0731	18.0000	32.0000
Grp 3	31	26.6774	3.0593	19.0000	32.0000
Grp 4	31	27.1935	2.6258	20.0000	30.0000
Grp 5	10	37.2000	1.4757	35.0000	39.0000

Research Question VIII

There was a significant difference among the undergraduate dental students on the knowledge of the dental and skeletal problems for a total of the scores for the seven cases ($F_{3,167} = 7.45$, $p = 0.0001$) Table 22. This test also confirmed that the orthodontist group or the "Gold Standard" scored significantly higher than any of the other student groups Table 24. The Newman - Keuls Procedure indicated that the Senior, Junior and Sophomore students all did better than the Freshmen, and were found to be significant at the 0.050 level, but there were no differences among any other groups as shown in Table 23.

Table 22.--One Way ANOVA Table of
Dental Group By Score for Case Totals

Source	df	Sum of Squares	Mean Square	F Ratio	p
Dental Groups	3	6624.2811	2208.0937	7.4505	0.0001*
Error	167	493.6955	296.3694		

* Significant at the p < 0.001 level

Table 23.--Student-Newman-Keuls
Comparison of Means for Case Totals

Dental Group	Mean	Group Number 1 2 3 4 5
Group 1	176.4545	
Group 2	188.9444	*
Group 3	189.6129	*
Group 4	191.0645	*
Group 5	254.4000	* * * *

* Significant at the p < 0.05 level

Table 24.--Means, Standard Deviations, and Ranges
of Test Scores for Dental Groups - Case Totals

Group	Count	Mean	Standard Deviation	Minimum	Maximum
Grp 1	55	176.4545	19.9191	100.0000	224.0000
Grp 2	54	188.9444	16.8113	114.0000	220.0000
Grp 3	31	189.6129	17.1069	137.0000	227.0000
Grp 4	31	191.0645	11.9859	161.0000	211.0000
Grp 5	10	254.4000	15.6214	243.0000	260.0000

Correlations

Correlations were used to study internal consistencies by looking at associations between test questions. Correlations addressed how well each item fit with all the other items on the test. The higher the number, the better that item relates with the entire test. A low number indicates the item did not relate well to the other items while a negative number indicates an inverse relationship existed. For example, in Case One, question pair 1 - 2 had a correlation co-efficient of 0.28 which turned out to be highly significant even though the correlation co-efficient was low. Generally, the magnitude of the coefficient indicates how strong the relationship was between these two questions (Appendix H, Tables 25-31).

In this study, in the relationship between the following question pairs was of interest: 1-4, 2-3, 5-6, 7-8, 9-11, 10-11, 12-14, 13-14, 15-17, 16,17, 15-18, 19-21, 20-21, 22-23, 26-27, 26-28, 26-29, 27-29, 28-29. Of the nineteen question pairs, twelve were found to have significance on Case One, thirteen for Case Two, twelve for Case Three, eleven for Case Four, thirteen for Case Five, twelve for Case Six, and twelve for Case Seven (Appendix H, Table 32).

The correlation coefficients for Cases One to Seven show the degree of consistency present between cases from the scores of all the students tested. The higher this number, the more consistently the questions were answered. When comparing the correlation coefficients between cases, two tailed significance at the 0.01 level was identified for the following case pairs: 1-4, 1-6, 2-4, and 2-5, while two tailed significance at the 0.001 level was identified for the following case pairs: 1-2, 2-3, 2-6, 2-7, 3-4, 3-5, 3-6, 3-7, 4-5, 4-6, 4-7, 5-6, 5-7, 6-7.

The case pairs where no significance was found were 1-3, 1-5, and 1-7. This

appears to be correct as the orthodontist group could not agree uniformly when diagnosing Case One.

Item Analysis

The item analysis provided estimates of the reliability of the test. A high standardized item coefficient alpha indicates a good test instrument, and the higher the item alpha number, the better the test. It gives an idea of how reliable the total scale is and gives a sense of the internal consistency regarding how all the items are working together. The means of each question were studied as answered by all one-hundred-seventy-one students. This provided a quick way to view which questions were consistently answered either correctly or incorrectly overall.

The standardized item alpha for Case One (0.4212) was the lowest value among the seven cases, and indicated that this test was not as good as the others. The values for the six other cases were rather close and are: Case Two (0.6730), Case Three (0.6459), Case Four (0.6871), Case Five (0.6177), Case Six (0.6378), and Case Seven (0.6176). Based on the reliabilities, Cases Two and Four seem to be stronger than the other five cases, when considering the nature of the test.

For example, Case Four is a good test and will do well 47% of the time that it is administered [$(0.6871)^2 \times 100 = 47.2\%$]. This is an acceptable figure, considering the nature of the test.

Chi Square Analysis

A Chi square analysis was performed on every question for each of the seven cases. The frequencies of the answers from the one-hundred-seventy-one participants in this study. The answers recorded by the dental students were analyzed as to correctness, when compared to the experts (orthodontist group), and the four groups of

students were also compared with each other (Appendix I. Tables 33a and 39f). The larger the Chi square, the more likely it will be significant. The Pearson statistic is significant if it is less than 0.05 and shows significance among the groups in the patterns of their responses. This indicates that the correct answer stands out, in other words, it is confirming the responses that were given by the orthodontists (Tables 40 - 46).

When there is no significance, one explanation is that the question is not a good discriminator between those who possess knowledge and those who don't possess it. Another explanation could be that the particular question is confusing to the participants. Also, the students may not be able to distinguish between the various choices available and, therefore, are weak in their knowledge in this particular area. Another way to explain the lack of significance is that all the groups behaved in a similar manner proportionately, so as to say the answers were rather consistent and no overall difference was detected because no group really stood out.

Case One

Caucasian Female

8 years, 9 months

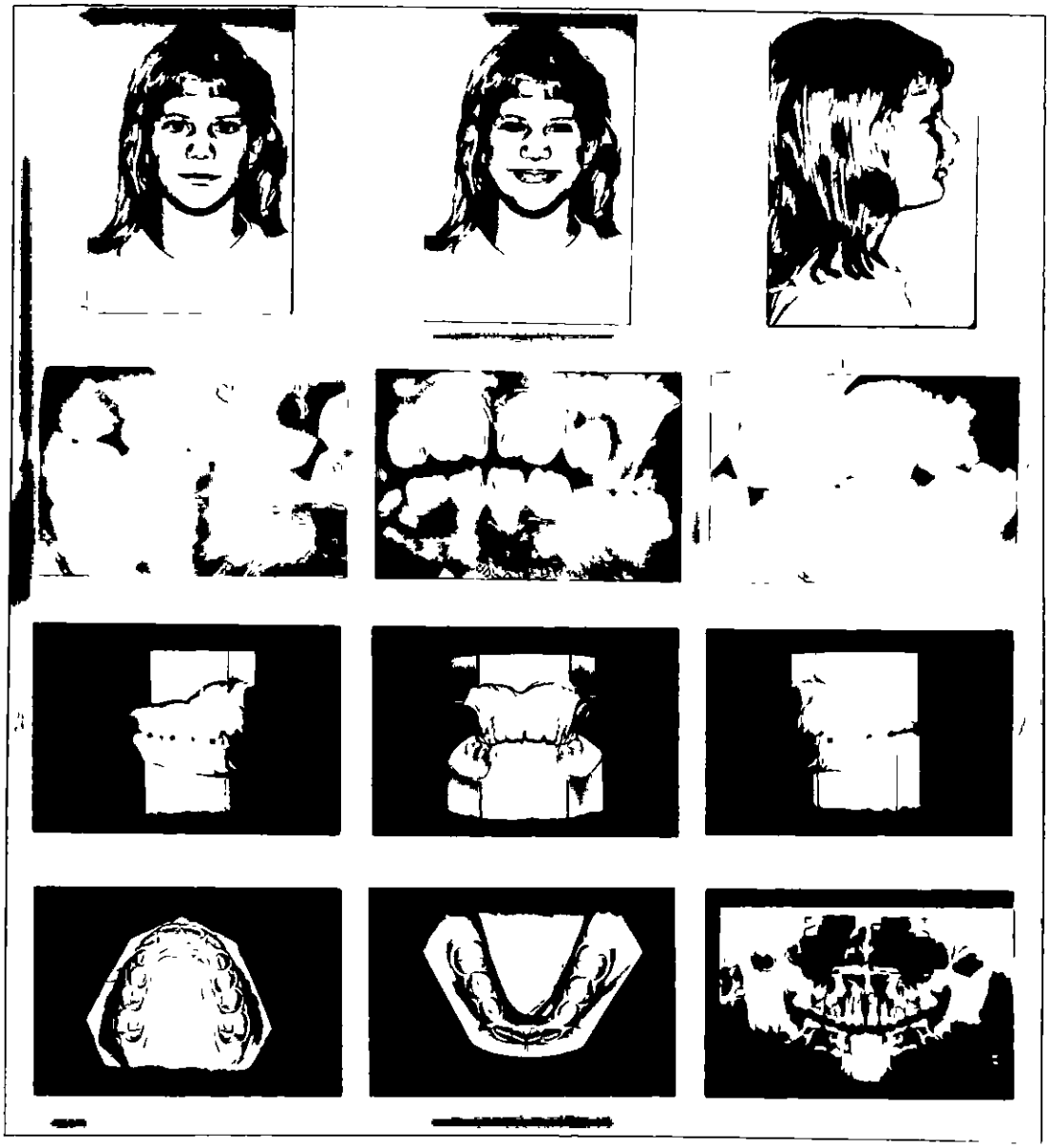
Medical History: Non-contributory

Dental History: Habits: Sucked her thumb until age 7

Anterior tongue thrusting

Breathes through her mouth

Class II skeletal with a retruded mandible in the mixed dentition and an anterior open bite. Additionally, a posterior cross-bite with a maxillary transverse deficiency, end-to-end molar relationship with moderate mandibular crowding and excessive overjet are present. Dental midlines are not co-incident and the lips appear tense when closed. Figure 2



Case One

Seven cases were used in testing all of the participants in this study, and each case consisted of thirty-nine questions. In this section of the results, each question for every case was analyzed individually, and any significant differences in the patterns of responses were reported by class standing, and where appropriate, an overall comparison was made. In this study, the Freshmen group consisted of fifty-five students or 32.2%, the Sophomore group consisted of fifty-four students, or 31.6%, the Junior group consisted of thirty-one students or 18.1%, and the Senior group also consisted of thirty-one students or 18.1%, for a total of one-hundred-seventy-one.

+Q 1 - Appearance of the Facial Profile. All the orthodontists agreed that the patient's profile was convex or Class II.

Overall, 103 or 60.2% determined that the facial profile in this case was convex or Class II, which included 27 or 49.1% of the Freshmen, 27 or 50% of the Sophomores, 23 or 74.2% of the Juniors, and 26 or 83.9% of the Seniors. This indicated a trend, for as the level of education increased, so did the number of correct responses. A total of 47 or 27.5% believed this subject had a straight or Class I facial profile, specifically 13 or 23.6% Freshmen, 23 or 42.6% Sophomores, 7 or 22.6% Juniors, and 4 or 12.9% Seniors. Overall, 14 or 8.2% found the profile to be concave or Class III, including 11 or 20% Freshmen and 3 or 5.6% Sophomores, while a total of 6 or 3.5% decided this patient exhibited bimaxillary protrusion. This included 4 or 7.3% Freshmen, 1 or 3.2% Juniors, and 1 or 3.2% Seniors.

Only about half of the Freshmen and Sophomore students answered correctly, whereas 42.6% Sophomores responded Class I. Of the Freshmen, 23.6% found the profile to be Class I, while 20% thought it was Class III. The Pearson statistic was significant, as the correct answer stood out, while a trend was evident as the students

Table 40.--Chi-Square Results for Case One Undergraduate Dental Students

Question Number	Pearson Chi-Square	Degrees of Freedom	Significance
1	34.60456	12	0.00054*
2	14.15818	6	0.02792*
3	5.19454	3	0.15809
4	14.40835	30	0.00240*
5	22.11113	6	0.00116*
6	23.99195	6	0.00052*
7	9.16053	6	0.16475
8	5.96994	6	0.42657
9	39.72750	12	0.00008*
10	32.16460	12	0.00131*
11	29.61256	9	0.00051*
12	23.44162	9	0.00528*
13	13.73800	9	0.13196
14	12.34074	3	0.00630*
15	24.59210	9	0.00346*
16	26.17980	12	0.01012*
17	14.44860	9	0.10724
18	16.69416	6	0.01048*
19	8.79889	6	0.18521
20	5.93334	9	0.74657
21	19.40238	9	0.02198*
22	6.50332	3	0.08953
23	12.46215	6	0.05242
24	5.12150	3	0.16311
25	9.46730	6	0.14895
26	10.01064	6	0.12420
27	14.43768	12	0.27364
28	23.87562	12	0.02115*
29	11.83002	9	0.22306
30	9.92096	6	0.12802
31	14.06109	15	0.52090
32	5.31948	6	0.50354
33	27.82665	15	0.02268*
34	7.30438	9	0.60546
35	25.01989	18	0.12437
36	16.68700	9	0.05385
37	9.76159	9	0.37013
38	17.42832	12	0.13418
39	14.08534	12	0.29529

*p<.05

answered in an increasingly correct manner from the Freshmen through the Senior years. The majority of participants overall, as well as in the Junior and Senior groups, answered this question correctly, just about half of the students in the Freshmen and Sophomore groups gave the correct response.

+Q 2 - Position of the Mandible. All the orthodontists agreed that the mandibular position was retruded.

Overall 97 or 56.7% indicated that the position of the mandible was retruded. This included 36 or 65.4% Freshmen, 21 or 38.9% Sophomores, 22 or 71% Juniors, and 18 or 58.1% Seniors. A total of 66 or 38.6% decided the mandible was in a straight position, specifically 15 or 27.3% Freshmen, 31 or 57.4% Sophomores, 8 or 25.8% Juniors, and 12 or 38.7% Seniors. Only 8 or 4.7% overall found the mandible to be prominent, including 4 or 7.3% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors and 1 or 3.2% Seniors.

Therefore, the Junior group had 71% correct, while the Senior group only had 58% correct, with 25.8% Juniors who thought the mandible was straight, as did 38.7% Seniors and 57.4% Sophomores. The Pearson statistic was significant as the correct answer stood out. The majority of participants overall, as well as in the Freshmen, Junior and Senior groups, answered correctly, while the majority of students in the Sophomore group responded incorrectly.

+Q 3 - Treatment for the Mandibular Position. The orthodontists all agreed that treatment of the position of the mandible was required.

Of the 171 participants, 78 or 45.6% determined that treatment was necessary for this patient, which included 31 or 56.4% Freshmen, 19 or 35.2% Sophomores, 13 or 41.9% Juniors and 15 or 48.4% Seniors. The majority of the respondents, 93 or 54.4% decided against treatment for the mandibular position, which consisted of 24 or

43.6% Freshmen, 35 or 64.8% Sophomores, 18 or 58.1% Juniors and 16 or 51.6% Seniors.

Even though more participants recognized the retruded position of the mandible, 97 or 56.7%, only 78 or 45.6% would treat this problem. Therefore, overall not only did 43% not recognize this skeletal problem, but 54% chose not to treat it. This question indicated a reversal, as the majority of individuals overall responded incorrectly to this question. Only the majority in the Freshmen group answered correctly.

+Q 4 - Treatment for the Facial Profile. All the orthodontists concurred that treatment of the facial profile was required.

A total of 112 or 65.5% determined that the facial profile needed to be treated, which included 44 or 80% Freshmen, 25 or 46.3% Sophomores, 21 or 67.7% Juniors and 22 or 71% Seniors. Overall, 59 or 34.5% thought no treatment was necessary, specifically, 11 or 20% Freshmen, 29 or 53.7% Sophomores, 10 or 32.3% Juniors and 9 or 29% Seniors.

Of interest was that 12.9% Seniors thought the profile was straight, yet over twice this, 29% felt no treatment was indicated. Again, as with mandibular position, 47 or 27.5% overall answered that the profile was straight or ideal, whereas 59 or 34.5% chose not to treat it. The Pearson statistic was significant, as the correct answer stood out. The majority overall, as well as in the Freshmen, Junior, and Senior groups, answered correctly. However, only the majority in the Sophomore group responded with the incorrect answer.

+Q 5 - Appearance of the Lips. Fifty percent of the orthodontists indicated that the patient's lips were tense, while 30% felt the patient's lips were flaccid, and 20% thought they were normal.

Overall, 90 or 52.6% of the respondents decided the appearance of the patient's lips was tense, which included 29 or 52.7% Freshmen, 24 or 44.4% Sophomores, 17 or 54.8% Juniors, and 20 or 64.5% Seniors. A total of 54 or 31.6% thought the appearance of the lips was normal, which was the next most popular answer, and was given by 21 or 38.2% Freshmen, 25 or 46.3% Sophomores 6 or 19.3% Juniors, and 2 or 6.4% Seniors. The total number who answered flaccid was 27 or 15.8%, specifically, 5 or 9.1% Freshmen, 5 or 9.3% Sophomores, 8 or 25.8% Juniors and 9 or 29% Seniors.

Since the experts were divided on the answer to this question, it was not a good indicator by which to measure the participants' ability. The Pearson statistic was significant as the correct answer stood out. Overall, the majority answered correctly, except the majority in the Sophomore group responded incorrectly.

+Q 6 - Treatment for the Labial Appearance. Ninety percent of the orthodontists determined that the appearance of the patient's lips required treatment, while the other 10% decided treatment was not necessary.

Overall 86 or 50.3% of the participants thought that treatment was needed, specifically 24 or 43.6% Freshmen. 19 or 35.2% Sophomores, 18 or 58.1% Juniors, and 25 or 80.6% Seniors. A total of 84 or 49.1% decided against treatment, which included 31 or 56.4% Freshmen, 35 or 64.8% Sophomores, 13 or 41.9% Juniors, and 5 or 16.1% Seniors.

Therefore, the students were rather evenly divided on whether this patient required treatment, even though more than 68% overall identified a less than ideal appearance. The Pearson statistic was significant as the majority overall, as well as in the Junior and Senior groups, answered correctly except the majority in the Freshmen and Sophomore groups responded incorrectly.

+Q 7 - Stage of Dentition. All the orthodontists concurred that this patient was in the mixed stage of dentition.

Overall, 161 of the 171 participants, or 94.2% determined that the patient exhibited the mixed stage of dentition, including 48 or 87.3% Freshmen, all 54 or 100% Sophomores, 29 or 93.5% Juniors, and 30 or 96.8% Seniors. Only a total of 7 or 4.1% thought this was the primary dentition, while just 3 or 1.8% answered permanent dentition. This included 5 or 9.1% Freshmen, 1 or 3.2% Juniors, and 1 or 3.2% Seniors for the former, and 2 or 3.6% Freshmen and 1 or 3.2% Juniors for the latter. Since this question was answered correctly so consistently, it was not a good determinator of ability, as it was very easy.

+Q 8 - Appropriate Dentition. For this female subject's age of 8 years, 9 months, 90% of the orthodontists decided that the dentition was appropriate, while 10% felt it was not appropriate.

Overall, 149 or 87.1% of the respondents determined that the dentition was appropriate for this subject, including 46 or 83.6% Freshmen, 45 or 83.3% Sophomores, 30 or 96.8% Juniors and 28 or 90.3% Seniors, while 21 or 12.3% felt it was not appropriate. This consisted of 9 or 16.4% Freshmen, 8 or 14.8% Sophomores, 1 or 3.2% Juniors, and 3 or 9.7% Seniors. Only 1 or 1.8% Sophomores gave no answer for this question. Therefore, it appears that only about 15% of the Freshmen and Sophomore students did not correctly answer this question. Since this question was correctly answered so consistently, it was not a good determinator of ability, as it was very easy.

+Q 9 - Cuspid Relationship - Right Side. The orthodontists had varied opinions on this question: 40% thought it was Class I, 20% end-to-end, 20% Class II, and 20% thought it did not apply to this patient, as these teeth were still erupting and,

therefore, it was difficult to make this determination. In this instance, the question of cuspid classification cannot be definitely determined at this stage of development. It was, therefore, not a good subject to study on this patient.

The students answered in a variety of ways as well. Overall 55 or 32.2% decided on Class I, specifically 17 or 30.9% Freshmen, 20 or 37% Sophomores, 14 or 45.2% Juniors, and 4 or 12.9% Seniors. A total of 16 or 9.4% answered end-to-end, in detail 8 or 14.5% Freshmen, 3 or 5.6% Sophomores, 1 or 3.2% Juniors and 4 or 12.9% Seniors. Overall 61 or 35.7% decided it was Class II. This included 20 or 36.4% Freshmen, 14 or 25.9% Sophomores, 10 or 32.3% Juniors, and 17 or 54.8% Seniors. Only 13 or 7.6% overall answered Class III, including 9 or 16.4% Freshmen, 1 or 1.8% Sophomores, and 3 or 9.7% Juniors. Those who thought this classification was not applicable included 1 or 1.8% Freshmen, 16 or 29.6% Sophomores, 3 or 9.7% Juniors, and 6 or 19.3% Seniors, which equalled 26 or 15.2% overall.

The Pearson statistic was significant, however, this question demonstrated a reversal as the majority of participants did not answer correctly. The highest percentages answering this question correctly were found in the Sophomore and Junior groups.

+Q 10 - Cuspid Relationship - Left Side. As with the previous question, the orthodontists had varied opinions on this relationship: 30% thought it was Class I, 20% end-to-end, 30% Class II, and 20% said it did not apply to this patient. Therefore, it was really too difficult to make a definite determination as to the correct answer as stated in the previous question.

Of the 171 subjects, a total of 58 or 33.9% decided on Class I, 16 or 9.4% end-to-end, 57 or 33.3% Class II, 14 or 8.2% Class III, and 26 or 15.2% said it was not

applicable in this case. A similar number answered this question as they did the previous question. Eighteen or 32.7% Freshmen answered Class I, as did 20 or 37% Sophomores, 14 or 45.2% Juniors and 6 or 19.3% Seniors. End-to-end was given by 8 or 14.5% Freshmen, 3 or 5.6% Sophomores, 2 or 6.4% Juniors, and 3 or 9.7% Seniors. Those who thought it was Class II included 19 or 35.5% Freshmen, 14 or 25.9% Sophomores, 9 or 29% Juniors, and 15 or 48.4% Seniors. Class III was chosen by 9 or 16.4% Freshmen, 1 or 1.8% Sophomores, 3 or 9.7% Juniors, and 1 or 3.2% Seniors, and not applicable was stated by 1 or 1.8% Freshmen, 16 or 29.6% Sophomores, 3 or 9.7% Juniors and 6 or 19.3% Seniors. As stated previously, this too, was not a good question to study.

Since the experts were divided on the answer to this question and to the previous one, these were not good indicators by which to measure the participants' abilities. The Pearson statistic was significant as the majority of students overall as well as in each of the four groups answered this question correctly.

+Q 11 - Treatment for the Cuspid Relationship. Thirty percent of the orthodontists stated they would treat the cuspid relationship, and another 30% decided they would not treat it, while 40% thought that the relationship did not apply to this patient, as eruption was not completed, and could not be determined.

Overall, 83 or 48.5% of the participants indicated this patient required treatment for this relationship, while 66 or 38.6% thought no treatment was necessary, and 21 or 12.3% decided that treatment for the relationship did not apply to this patient. Specifically, 32 or 58.2% Freshmen, 17 or 31.5% Sophomores, 13 or 41.9% Juniors, and 21 or 67.7% Seniors would treat, and those who would not treat included 22 or 40% Freshmen, 22 or 40.7% Sophomores, 15 or 48.4% Juniors, and 7 or 22.6% Seniors. In detail, 15 or 27.8% Sophomores, 3 or 9.7% Juniors, and 3 or 9.7%

Seniors thought this was not applicable to this patient.

Since the orthodontists did not concur on the answer to this question, as well as on the previous two questions, these were not good indicators, and should not be evaluated regarding the participants' abilities. The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall selected the correct choice, as did the majority in the Freshman and Senior groups. However, the majority of individuals in the Sophomore and Junior groups responded incorrectly.

+Q 12 - Molar Relationship - Right Side. Ninety percent of the orthodontists determined that the molar relationship was end-to-end, while 10% decided it was Class I.

The individuals who answered end-to-end included 16 or 29.1% Freshmen, 14 or 25.9% Sophomores, 12 or 38.7% Juniors, and 5 or 16.1% Seniors which totalled 47 or 27.5%. Overall 42 or 24.6% chose Class I, including 14 or 25.4% Freshmen, 13 or 24.1% Sophomores, 8 or 25.8% Juniors and 7 or 22.6% Seniors. Those who thought the relationship was Class II, consisted of 14 or 25.4% Freshmen, 26 or 48.1% Sophomores, 11 or 35.5% Juniors, and 17 or 54.8% Seniors which equalled 68 or 39.8%, and was the answer chosen by the greatest percentage of individuals. Overall, only 14 or 8.2% decided on Class III, specifically, 11 or 20% Freshmen, 1 or 1.8% Sophomores, and 2 or 6.4% Seniors.

Interestingly, the lowest percentage to answer correctly were the Senior dental students, with 16% and the highest percentage were the Junior students with 38.7%. The biggest distractor was Class II, which was answered by nearly 40%, including 54.8% of the Senior students, the highest percentage incorrect among the four groups surveyed. The Pearson statistic was significant, however, there was a reversal as the majority of individuals overall, as well as in each of the four groups, answered

incorrectly.

+Q 13 - Molar Relationship - Left Side. Again, 90% of the orthodontists diagnosed this relationship as being end-to-end, while 10% found it to be Class I.

Those who chose end-to-end included 16 or 29.1% Freshmen, 11 or 20.4% Sophomores 5 or 16.1% Juniors, and only 2 or 6.4% Seniors, which again, accounted for the lowest percentage of all four groups of students to answer correctly. Overall, just 19.9% or 34 participants answered with an end-to-end response. Those who selected a Class I relationship included 23 or 41.8% Freshmen, 26 or 48.1% Sophomores, 16 or 51.6% Juniors, and 19 or 61.3% Seniors. This added up to 84 or 49.1% overall, and was the most frequently chosen answer by all four groups. Overall 41 or 24% decided on a Class II response, including 9 or 16.4% Freshmen, 16 or 29.6% Sophomores, 8 or 25.8% Juniors and 8 or 25.8% Seniors. A total of only 12 or 7% of the participants were among those who selected Class III, specifically, 7 or 12.7% Freshmen, 1 or 1.8% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors. This question indicated a reversal as the majority of individuals overall, as well as in each of the four groups, answered this question incorrectly.

+Q 14 - Treatment for the Molar Relationship. All of the orthodontists indicated that the molar relationship required treatment.

Most participants, 107 or 62.6% overall stated that the molar relationship should be treated, which included 39 or 70.9% Freshmen, 32 or 59.3% Sophomores, 12 or 38.7% Juniors and 24 or 77.4% Seniors. Of interest was that 64 or 37.4% of those tested thought no treatment was necessary for this problem. This included 16 or 29.1% Freshmen, 22 or 40.7% Sophomores, 19 or 61.3% Juniors, and 7 or 22.6% Seniors.

A very large percentage of the Junior students, 61.3%, felt no treatment was

needed even though a greater percentage identified problems, while 40.7% Sophomores and 22.6% Seniors felt this way. The Pearson statistic was significant as the correct answer stood out and the majority of participants overall answered correctly, except the majority of the Juniors answered this question incorrectly.

+Q 15 - Presence of an Overbite. All the orthodontists determined that no over-bite existed in this case.

One-hundred-nine of the 171 participants or 63.7% answered that no over-bite was present, which included 29 or 52.7% Freshmen, 30 or 55.6% Sophomores, 23 or 74.2% Juniors and 27 or 87.1% Seniors. The percentages correct increased with the amount of education, therefore, this indicated a trend. Overall, 60 or 35.1% decided that an over-bite was present, specifically, 26 or 47.3% Freshmen, 24 or 44.4% Sophomores, 7 or 22.6% Juniors and 3 or 9.7% Seniors. Only 1 or 3.2% Juniors gave no answer to this question.

It was rather surprising to see so many saying an over-bite was present in this case, when the bite was open 2-3 mm, especially the Freshmen and Sophomores at over 44% each. The Pearson statistic was significant as the correct answer stood out and the majority of participants overall answered correctly, as did the majority in each of the four groups. Also, a trend was evident as an increasingly higher percentage of students answered correctly from the Freshmen through the Senior years.

+Q 16 - Amount of Overbite. All of the orthodontists concurred that this was not applicable in this case.

The participants who thought the amount of overbite was not applicable included 19 or 34.5% Freshmen, 24 or 44.4% Sophomores, 13 or 41.9% Juniors, and 17 or 54.8% Seniors, which totalled 73 or 42.7% overall. Those answering that it was within an acceptable range included 13 or 23.6% Freshmen, 23 or 42.6% Sophomores,

13 or 41.9% Juniors and 9 or 29% Seniors, which equalled 58 or 33.9%. Only 1 or 1.8% Freshmen and 1 or 3.2% Seniors gave no answer to this question. Again, it was rather surprising to see that so many thought that this was an acceptable condition. Those answering that a moderate or excessive overbite was present were comprised of 15 or 8.8% and 23 or 13.5% overall, specifically, 8 or 14.5% Freshmen, 4 or 12.9% Juniors, 3 or 9.7% Seniors, and 14 or 25.4% Freshmen, 7 or 13% Sophomores, 1 or 3.2% Juniors and 1 or 3.2% Seniors respectively.

The Pearson statistic was significant, however, the majority of participants overall selected the incorrect answer, as did the majority in the Freshman, Sophomore, and Junior groups, while the majority of students in the Senior group responded correctly. Therefore, this question indicated a reversal as the majority of students overall answered incorrectly.

+Q 17 - Treatment for the Overbite. All the orthodontists agreed that the lack of vertical overlapping should be treated.

Of the 171 participants, 24 or 43.6% Freshmen, 24 or 44.4% Sophomores., 14 or 45.2% Juniors, and 11 or 35.5% Seniors which totalled 73 or 42.7% overall, decided to treat the vertical problem. Among those who chose not to treat it included 23 or 41.8% Freshmen, 20 or 37% Sophomores, 12 or 38.7% Juniors, and 8 or 25.8% Seniors, which equalled 63 or 36.8% overall. This was a large number of individuals that did not think treatment for the open bite was necessary, and was similar to the number of participants who thought the over-bite was within an acceptable range.

Those giving no answer to this question included 8 or 14.5% Freshmen, 10 or 18.5% Sophomores, 5 or 16.1% Juniors, and 10 or 32.3% Seniors, which totalled 33 or 19.3% overall. These participants probably thought that, since a positive over-bite was not present, they need not answer this question, yet they would most likely treat it.

Therefore, this question indicated a reversal as the majority of students overall, as well as in each of the four groups, answered incorrectly.

+Q 18 - Presence of an Open Bite. All of the orthodontists recognized an open bite in this subject.

Overall, 138 or 80.7% stated an open bite was present, specifically 41 or 74.5% Freshmen, 39 or 72.2% Sophomores, 29 or 93.5% Juniors, and 29 or 93.5% Seniors. Those who thought no open bite was present included 14 or 25.4% Freshmen, 15 or 27.8% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors, which gave 32 or 18.7% overall. Since a greater number of Freshmen and Sophomores thought this, it seems they either didn't know the terminology, or the open bite was subtle, and they failed to diagnose it, as opposed to the 93.5% each of Juniors and Seniors who did recognize it. The Pearson statistic was significant as the correct answer really stood out, and the majority of participants overall, as well as in each of the four groups, answered correctly.

+Q 19 - Presence of Overjet. All the orthodontists indicated that there was overjet present in this case.

One-hundred-fifty-four or 90.1% overall thought that overjet was present, specifically, 45 or 81.8% Freshmen, 52 or 96.3% Sophomores, 28 or 90.3% Juniors, and 29 or 93.5% Seniors, therefore, this demonstrated a very good understanding of this concept. Those who found no overjet present included 8 or 14.5% Freshmen, 2 or 3.7% Sophomores, 3 or 9.7% Juniors, and 2 or 6.4% Seniors, which equalled only 15 or 8.8% overall. This question was very easy to answer correctly and, therefore, it was not a good determinator of ability.

+Q 20 - Amount of Overjet. All of the orthodontists agreed that an excessive amount of overjet was present in this case.

Among the participants who thought that the overjet was excessive included 38 or 69.1% Freshmen, 45 or 83.3% Sophomores, 24 or 77.4% Juniors, and 27 or 87.1% Seniors which totalled 134 or 78.4% overall. Therefore, a large number recognized the excessive overjet that was present. Those who thought that the amount of overjet was acceptable or moderate overall were 10 or 5.8% and 15 or 8.8% respectively. Specifically, this included 4 or 7.3% Freshmen, 3 or 5.6% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors for the former, and 7 or 12.7% Freshmen, 4 or 7.4% Sophomores, 3 or 9.7% Juniors and 1 or 3.2% Seniors for the latter. Overall 12 or 7% gave no answer to this question, and was comprised of 6 or 10.9% Freshmen, 2 or 3.7% Sophomores, 2 or 6.4% Juniors and 2 or 6.4% Seniors.

+Q 21 - Treatment for the Overjet. All of the orthodontists agreed that treatment of the overjet was necessary.

Overall, 152 or 88.9% of the participants agreed with the orthodontists' assessment of this problem, specifically, 42 or 76.4% Freshmen, 53 or 98.1% Sophomores, 30 or 96.8% Juniors, and 27 or 87.1% Seniors. Only 14 or 8.2% thought no treatment was needed. This included 8 or 14.5% Freshmen, 1 or 1.8% Sophomores, 1 or 3.2% Juniors, and 4 or 12.9% Seniors. Only 4 or 7.3% Freshmen gave no answer to this question. The Pearson statistic was significant as the correct answer really stood out, and the majority of individuals overall, as well as in each group, answered correctly.

+Q 22 - Presence of a Cross-Bite. All of the orthodontists recognized the presence of a cross-bite.

Of the 171 participants in this study, 112 or 65.5% overall recognized a cross-bite. This included 31 or 56.4% Freshmen, 38 or 70.4% Sophomores, 18 or 58.1% Juniors, and 25 or 80.6% Seniors. Fifty-nine or 34.5% did not identify a cross-bite

and consisted of 24 or 43.6% Freshmen, 16 or 29.6% Sophomores, 13 or 41.9% Juniors, and 6 or 19.3% Seniors.

+Q 23 - Location of Cross-Bite. All of the orthodontists recognized that the cross-bite was located in the posterior region of the dentition.

One-hundred-fourteen or 66.7% overall detected a posterior cross-bite, specifically, 33 or 60% of the Freshmen, 40 or 74.1% Sophomores, 17 or 54.8% Juniors and 24 or 77.4% Seniors. Fifty or 29.2% overall thought that no cross-bite was present, specifically, 20 or 36.4% Freshmen, 14 or 25.9% Sophomores, 10 or 32.3% Juniors and 6 or 19.3% Seniors, and this corresponded rather well with the answer from the previous question. Overall, only 7 or 4.1% incorrectly thought that an anterior cross-bite was present. Therefore, a high total number of students, 57 or 33.3%, failed to recognize the location of the existing cross-bite.

+Q 24 - Presence of a Maxillary Transverse Deficiency. Seventy percent of the orthodontists thought a maxillary transverse deficiency was present, while 30% felt none existed in this case.

Only 54 or 31.6% of the students overall agreed that a maxillary transverse deficiency existed. Specifically, this included 19 or 34.5% Freshmen, 11 or 20.4% Sophomores, 13 or 41.9% Juniors, and 11 or 35.5% Seniors. A total of 117 or 68.4% determined that no problem existed, and included 36 or 65.4% Freshmen, 43 or 79.6% Sophomores, 18 or 58.1% Juniors, and 20 or 64.5% Seniors. This can also be correlated with the low score on the presence of a posterior cross-bite. This question indicated a reversal, as the majority of participants overall, as well as in each of the four groups, answered incorrectly.

+Q 25 - Presence of Spacing. Ninety percent of the orthodontists determined that spacing existed in this case while the other 10% observed no spacing.

Spacing in the arches was identified by 147 or 86% overall, specifically, 49 or 89.1% Freshmen, 48 or 88.9% Sophomores, 23 or 74.2% Juniors, and 27 or 87.1% Seniors. Only 23 or 13.5% overall answered that no spacing existed, which included 6 or 10.9% Freshmen, 6 or 11.1% Sophomores, 8 or 25.8% Juniors, and 3 or 9.7% Seniors. Only 1 or 3.2% Seniors gave no answer to this question.

+Q 26 - Presence of Crowding. All of the orthodontists agreed that crowding was present in this case.

Of the participants, 65 or 38% overall thought crowding was present, which included 23 or 41.8% Freshmen, 14 or 25.9% Sophomores, 13 or 41.9% Juniors, and 15 or 48.4% Seniors. One-hundred-and-five of the 171 participants or 61.4% thought that no crowding was present, specifically, 32 or 58.2% Freshmen, 40 or 74.1% Sophomores, 17 or 54.8% Juniors, and 16 or 51.6% Seniors. Only 1 or 3.2% Juniors gave no answer to this question. As the results show, 61.4% is a very high percentage of students that cannot recognize this problem in the mixed dentition and in a patient of this age. This question indicated a reversal as the majority of individuals overall, as well as in each of the four groups, answered incorrectly.

+Q 27 - Amount of Crowding - Maxilla. All of the orthodontists determined that there was no crowding present in the maxillary arch.

Overall, 139 or 81.3% of the participants said that no crowding in the maxillary arch was present. This included 41 or 74.5% Freshmen, 44 or 81.5% Sophomores, 26 or 83.9% Juniors, and 28 or 90.3% Seniors, which indicated a trend, for as the level of education increased, so did the percentage of students who answered correctly. Those who answered slight, moderate, and severe included 15 or 8.8%, 10 or 5.8%, and 2 or 1.2% respectively. Specifically, 6 or 10.9% Freshmen, 7 or 13% Sophomores, 1 or 3.2% Juniors and 1 or 3.2% Seniors decided on a slight amount. A

moderate amount of crowding, was decided on specifically by 5 or 9.1% Freshmen, 3 or 5.6% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors. Excessive was answered by only 1 or 3.2% Juniors and 1 or 3.2% Seniors, and just 3 or 5.4% Freshmen and 2 or 6.4% Juniors gave no answer to this question. This factor was readily identifiable in this arch, and was correctly identified in a rather consistent manner.

+Q 28 - Amount of Crowding - Mandible. All of the orthodontists agreed that there was a moderate amount of crowding in the mandibular arch.

A total of only 17 or 9.9% of the 171 participants recognized that a moderate problem existed. This included 9 or 16.4% Freshmen, 3 or 5.6% Sophomores, 3 or 9.7% Juniors, and 2 or 6.4% Seniors. Overall, 42 or 24.6% answered that a slight amount of mandibular crowding was present, including 14 or 25.4% Freshmen, 12 or 22.2% Sophomores, 11 or 35.5% Juniors, and 5 or 16.1% Seniors. Overall, only 11 or 6.4% thought a severe amount was present, specifically, 2 or 3.6% Freshmen, 3 or 5.6% Sophomores, and 6 or 19.3% Seniors. However, 98 or 57.3% thought that no crowding was present, and was comprised of 29 or 52.7% Freshmen, 36 or 66.7% Sophomores, 15 or 48.4% Juniors and 18 or 58.1% Seniors. Also, only 1 or 1.8% Freshmen, and 2 or 6.4% Juniors gave no answer to this question. The Pearson statistic was significant, however, there was a reversal as the great majority of students overall, as well as in each group, incorrectly answered this question.

+Q 29 - Treatment for the Crowding. All of the orthodontists decided that the crowding should be treated.

Overall, 44 or 25.7% of the participants thought that the crowding required treatment. This included 16 or 29.1% Freshmen, 12 or 22.2% Sophomores, 6 or 19.3% Juniors, and 10 or 32.3% Seniors. Seventy-one or 41.5% overall believed that

treatment was not necessary, and those who decided this question did not apply as no crowding was present totalled 55 or 32.2%. This was comprised of 19 or 34.5% Freshmen, 21 or 38.9% Sophomores, 18 or 58.1% Juniors, and 13 or 41.9% Seniors for the former, and 20 or 36.4% Freshmen, 21 or 38.9% Sophomores, 6 or 19.3% Juniors and 8 or 25.8% Seniors for the latter. Therefore, 126 of 171 participants or 73.7% overall would not treat the crowding as most of them felt none was present. This question indicated a reversal, as the majority of individuals overall, as well as in each of the four groups, answered incorrectly.

+Q 30 - Co-incidence of Midlines. All the orthodontists decided that the mid-lines were not co-incident with each other.

Overall 114 or 66.7% agreed with their assessment, specifically 33 or 60% Freshmen, 44 or 81.5% Sophomores, 18 or 58.1% Juniors and 19 or 61.3% Seniors. Overall, 54 or 31.6%, which included 20 or 36.4% Freshmen, 10 or 18.5% Sophomores, 12 or 38.7% Juniors, and 12 or 38.7% Seniors thought the mid-lines were indeed co-incident. Only 2 or 3.6% Freshmen and 1 or 3.2% Juniors gave no answer to this question.

+Q 31 - Presence of Dental Conditions: A) congenitally missing teeth, B) supernumerary teeth, C) impacted teeth, D) malformed teeth or E) none of the above. All of the orthodontists agreed that there were no unusual dental conditions present.

Overall 74 or 43.3% of the participants agreed with their response, specifically 22 or 40% Freshmen, 22 or 40.7% Sophomores, 13 or 41.9% Juniors, and 17 or 54.8% Seniors, which indicated a slight trend, for as the level of education increased, so did the number of individuals who answered correctly. A large number of students, 54 or 31.6% overall, thought that some teeth were missing, specifically, 15 or 27.3% Freshmen, 15 or 27.8% Sophomores, 13 or 41.9% Juniors and 11 or 35.5% Seniors.

Perhaps they thought this, since there were some teeth that were as of yet unerupted, or that the crypts of the 3rd molars were not totally apparent. In either case all of the teeth were present, even if unerupted, and it was still too early to see if all of the 3rd molars would be developing in this subject.

There were 24 or 14% overall, who thought that some of the teeth were impacted, specifically, 8 or 14.5% Freshmen, 10 or 18.5% Sophomores, 4 or 12.9% Juniors and 2 or 6.4% Seniors. Only a total of 5 or 2.9% thought supernumerary teeth were evident, specifically, 2 or 3.6% Freshmen, 1 or 1.8% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors. Overall, just 6 or 3.5% felt teeth were malformed, including 3 or 5.4% Freshmen, and 3 or 5.6% Sophomores. Multiple answers were given by 8 or 4.7% overall, specifically, 5 or 9.1% Freshmen - 3 AC, 1 ACD, 1 ABCD and 3 or 5.6% Sophomores - 2 AC and 1 AD. Therefore, this question indicated a reversal as the majority of the students overall, as well as in the Freshman, Sophomore and Junior groups, incorrectly responded to this question.

+Q 32 - Gingival Health. All of the orthodontists indicated that the gingiva appeared healthy.

Overall, 136 or 79.5% agreed with the orthodontists' assessment. This was comprised by 45 or 81.8% Freshmen, 42 or 77.8% Sophomores, 23 or 74.2% Juniors and 26 or 83.9% Seniors. Thirty-four or 19.9% of those surveyed decided that they thought the gingiva was not healthy, which included 10 or 18.2% Freshmen, 12 or 22.2% Sophomores, 7 or 22.6% Juniors, and 5 or 16.1% Seniors.

+Q 33 - Presence of Periodontal Conditions: A) recession of the gum tissue, B) defects in the gingiva, C) loss of bone, or D) none of the above. All of the orthodontists agreed that none of these aforementioned periodontal conditions were present.

In this study, 137 of the 171 participants, or 80.1% overall agreed with the orthodontists' findings. This included 46 or 83.6% Freshmen, 43 or 79.6% Sophomores, 27 or 87.1% Juniors, and 21 or 67.7% Seniors. A total of 12 or 7% thought there was gingival recession, and 15 or 8.8% felt gingival defects existed. Specifically, this included 3 or 5.4% Freshmen, 5. or 9.3% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors, for the former, and 5 or 9.1% Freshmen, 6 or 11.1% Sophomores, 1 or 3.2% Juniors, and 3 or 9.7% Seniors for the latter. Also, 2 or 1.2% overall decided bone loss was apparent, including 1 or 1.8% Freshmen and 1 or 3.2% Juniors. Only 1 or 3.2% Seniors gave no answer to this question. This question was rather consistently answered by all four of the groups surveyed. The Pearson statistic is significant as the correct answer stood out and the majority of students overall, as well as in each group, responded correctly to this question.

+Q 34 - Need for Orthodontic Treatment. All of the orthodontists agreed that this subject required orthodontic treatment.

Overall, 160 or 93.6% decided that orthodontic treatment was necessary in this case, and included 50 or 90.9% Freshmen, 49 or 90.7% Sophomores, 30 or 96.8% Juniors, and all 31 or 100% Seniors. Only 9 or 5.3% thought no orthodontic treatment was necessary, specifically 4 or 7.3% Freshmen, 4 or 7.4% Sophomores, and 1 or 3.2% Juniors. This was a very easy question for the students to answer correctly, especially since this test was administered as an exercise for the Department of Orthodontics, and, therefore, it was not a good determinator of ability.

+Q 35 - Provider for Orthodontic Treatment: Several choices were provided to the participants in this study. They included: A) a general dentist who treats limited aspects of orthodontics, B) a general dentist who treats all aspects of orthodontics, C) a general dentist who only practices orthodontics, D) a pedodontist, and E) an

orthodontist. All the experts decided that only an orthodontist should provide treatment in this case.

Overall 116 or 67.8% overall answered that the orthodontist should provide treatment for this patient. This included 35 or 63.6% Freshmen, 33 or 61.1% Sophomores, 23 or 74.2% Juniors and 25 or 80.6% Seniors. Overall, 11 or 6.4% chose A, as did 11 or 6.4% who chose B. This included 5 or 9.1% Freshmen, 4 or 7.4% Sophomores, and 2 or 6.4% Juniors for the former, and 3 or 5.4% Freshmen, 5 or 9.3% Sophomores, and 3 or 9.7% Juniors for the latter. Only 3 or 1.8% overall chose C, specifically, 2 or 3.7% Sophomores, and 1 or 3.2% Seniors, while 13 or 7.6% chose D, including 8 or 14.5% Freshmen, 1 or 1.8% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors. A total of 13 or 7.6% chose multiple answers, which in detail were 2 or 3.6% Freshmen - 1 ABCE, 1 BCDE; 8 or 14.8% Sophomores - 2 CE, 2 BCE, 2 DE, 1 BE, 1 AE; and 3 or 9.7% Seniors - 1 CE, and 2 BCE. Only 4 or 2.3% gave no answer to this question, specifically 2 or 3.6% Freshmen, 1 or 1.8% Sophomores, and 1 or 3.2% Juniors.

+Q 36 - Necessity for Extractions. The orthodontists were divided evenly on this question: 50% for extractions and 50% against extractions.

Of the 171 participants, 56 or 32.7% thought extractions were needed. This included 18 or 32.7% Freshmen, 18 or 33.3% Sophomores, 4 or 12.9% Juniors, and 16 or 51.6% Seniors. However, 113 or 66.1% thought that no extractions were necessary, specifically, 36 or 65.4% Freshmen, 36 or 66.7% Sophomores, 26 or 83.9% Juniors, and 15 or 48.4% Seniors. Only 1 or 1.8% Freshmen gave no answer to this question. Since the experts were divided on the answer to this question, it was not a good indicator by which to measure the participants' abilities.

+Q 37 - Diagnostic Records: Models. Eighty percent of the orthodontists

responded they relied on the models in a large part and 20% answered in a small part.

Overall, 137 or 80.1% of the students thought they relied on them in a large part, specifically, 40 or 72.7% Freshmen, 48 or 88.9% Sophomores, 24 or 77.4% Juniors, and 25 or 80.6% Seniors. Only 25 or 14.6% decided in a small part. This included 11 or 20% Freshmen, 5 or 9.3% Sophomores, 4 or 12.9% Juniors and 5 or 16.1% Seniors. Just 8 or 4.7% said they totally relied on the models to make their diagnosis of this case, including 4 or 7.3% Freshmen, 1 or 1.8% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors. One Junior or 3.2% gave the answer not at all.

+Q 38 - Diagnostic Records: Photographs. Eighty percent of the orthodontists decided that they relied upon them in a large part and 20% in a small part.

Of the participants, 101 or 59.1% answered in a large part. This included 33 or 60% Freshmen, 25 or 46.3% Sophomores, 22 or 71% Juniors, and 21 or 67.7% Seniors. Overall, 64 or 37.4% answered in a small part. This encompassed 19 or 34.5% Freshmen, 29 or 53.7% Sophomores, 8 or 25.8% Juniors and 8 or 25.8% Seniors. Overall, only 3 or 1.8% said they totally required the photographs, and 2 or 1.2% said they did not rely on the photographs at all to make their diagnosis, including 2 or 3.6% Freshmen, and 1 or 3.2% Seniors for the former, and 1 or 3.2% Juniors, and 1 or 3.2% Seniors for the latter. Only 1 or 1.8% Freshmen did not give an answer to this question.

+Q 39 - Diagnostic Records: X-Rays. Sixty percent of the orthodontists answered that they relied on the radiograph in a large part, and 40% answered in a small part.

Overall, 76 or 44.4% of the participants answered in a large part, specifically 25 or 45.5% Freshmen, 25 or 46.3% Sophomores, 17 or 54.8% Juniors, and 9 or 29% Seniors. Overall, a total of 80 or 46.8% of the students answered in a small part,

specifically 22 or 40% Freshmen, 27 or 50% Sophomores, 12 or 38.7% Juniors, and 19 or 61.3% Seniors. Only 6 or 3.5% overall answered totally, and 8 or 4.7% thought that the radiograph did not help them at all. In detail, this comprised 2 or 3.6% Freshmen, 2 or 3.7% Sophomores, and 2 or 6.4% Seniors for the former, and 5 or 9.1% Freshmen, 2 or 6.4% Juniors, and 1 or 3.2% Seniors, for the latter, while 1 or 1.8% Freshmen gave no answer to this question. This question indicated that there was a reversal, as the majority of participants overall, as well as in the Freshman, Sophomore and Senior groups, answered incorrectly. However, a majority of the Junior students responded with the correct answer.

Case Two

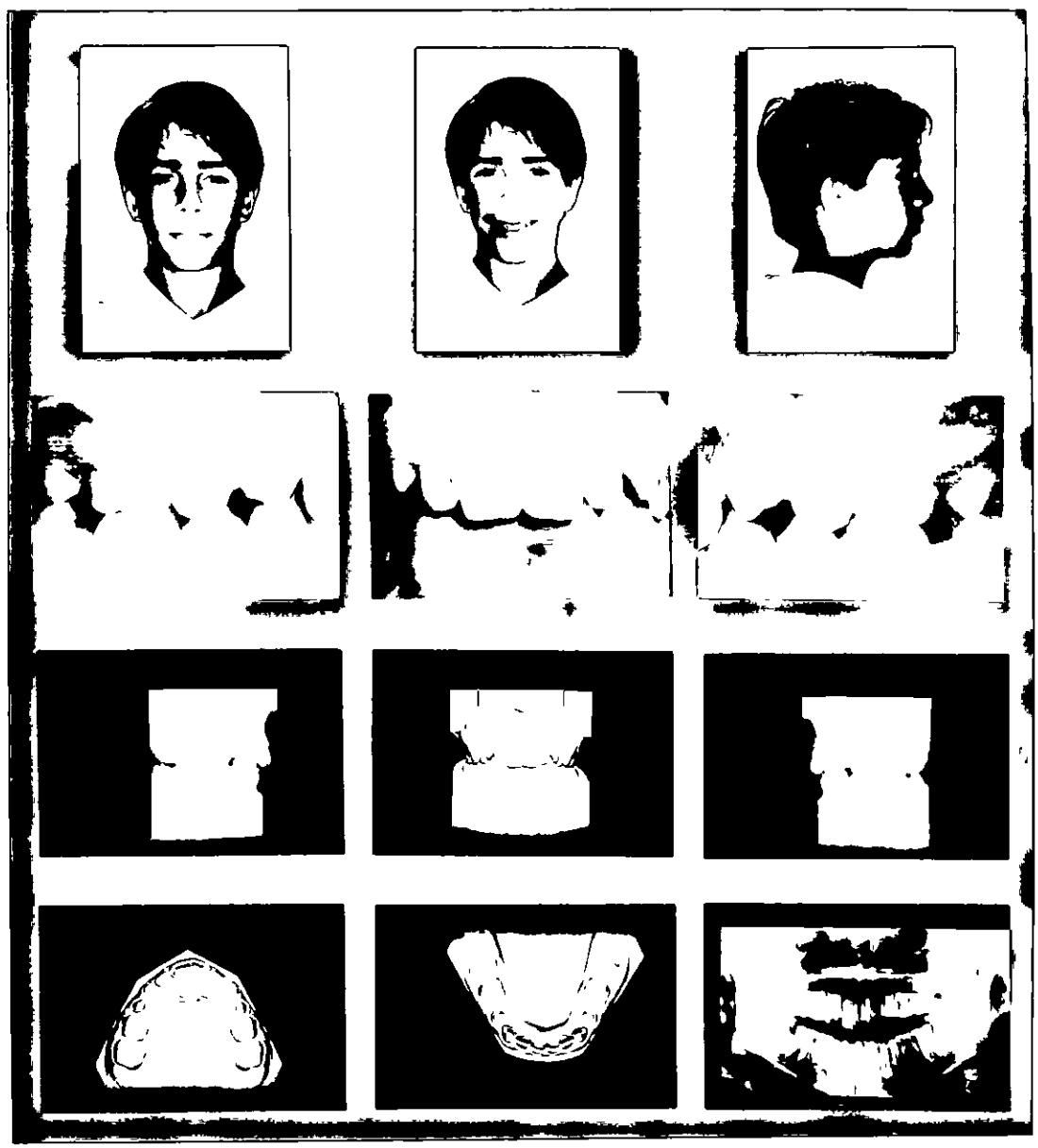
Caucasian Male

11 Years, 8 months

Medical History: Allergic to Penicillin

Dental History: Non-Contributory

Class II skeletal with a retruded mandible in the mixed dentition with end-to-end cuspid and molar relationships. There is slight mandibular crowding with excessive overbite and moderate overjet and a congenitally missing mandibular left second premolar. The lips appear normal and relaxed when closed. Figure 3



Case Two

+Q 1 - Appearance of the Facial Profile. All of the orthodontists concurred that the facial profile was convex or a skeletal Class II.

Overall, 122 of the 171 participants or 71.3% diagnosed that the profile was Class II or convex. Of these, 37 or 67.3% Freshmen, 38 or 70.4% Sophomores, 22 or 71% Juniors, and 25 or 80.6% Seniors. This indicated a trend, for the percentage correct increased with each additional year of dental education. A total of 41 or 24% responded that the profile appeared straight or Class I, specifically 14 or 25.4% Freshmen, 14 or 25.9% Sophomores, 7 or 22.6% Juniors, and 6 or 19.3% Seniors. Only 6 or 3.5% overall answered Class III or concave, which included 3 or 5.4% Freshmen, 1 or 1.8% Sophomores, and 2 or 6.4% Juniors, while only 1 or 1.8% Seniors, said bimaxillary protrusive. Just 1 or 1.8% Freshmen gave no answer to this question.

+Q 2 - Position of the Mandible. All of the orthodontists agreed that the position of this patient's mandible was retruded.

Overall, 128 or 74.9% stated that they found the mandible to be retruded. This included 39 or 70.9% Freshmen, 40 or 74.1% Sophomores, 23 or 74.2% Juniors, and 26 or 83.9% Seniors, which demonstrated a trend in that with each subsequent year of education, the score increased. Of interest was that 41 or 24% overall answered that the mandibular position was straight. Specifically, this included 14 or 25.4% Freshmen, 14 or 25.9% Sophomores, 8 or 25.8% Juniors, and 5 or 16.1% Seniors. This is approximately the same number of participants who thought that the profile was straight (Question 1). Even though the majority answered correctly, this still should be noted as nearly one-quarter of the students did not recognize this skeletal problem. Only 1 or 1.8% Freshmen chose prominent for their answer, and just 1 or 1.8%

Table 41.--Chi-Square Results for Case Two Undergraduate Dental Students

Question Number	Pearson Chi-Square	Degrees of Freedom	Significance
1	8.09312	12	0.77781
2	5.65066	9	0.77431
3	2.27415	3	0.51749
4	3.80768	3	0.28299
5	12.01082	9	0.21270
6	3.34097	6	0.76499
7	7.93265	6	0.24308
8	11.37344	3	0.00987*
9	18.57478	12	0.09932
10	12.67976	12	0.39274
11	20.93897	9	0.01292*
12	31.21646	12	0.00183*
13	32.71686	15	0.00514*
14	28.31662	6	0.00008*
15	17.40138	6	0.00792*
16	15.49548	9	0.07819
17	8.76732	6	0.18709
18	6.60166	6	0.35926
19	1.87644	3	0.59844
20	10.64040	9	0.30116
21	10.29759	6	0.11267
22	4.70982	9	0.85884
23	10.21341	9	0.33349
24	7.24574	12	0.84096
25	0.69242	3	0.87498
26	13.93280	9	0.12474
27	13.86466	12	0.30943
28	22.05995	12	0.03685*
29	27.64609	9	0.00109*
30	3.63553	6	0.72586
31	33.58763	15	0.00389*
32	10.62037	9	0.30263
33	11.12779	15	0.74348
34	27.13856	9	0.00133*
35	38.81263	18	0.00302*
36	8.68621	9	0.46673
37	7.00150	9	0.63696
38	13.77338	9	0.13062
39	14.13040	9	0.11776

***p<.05**

Freshmen gave no answer to this question.

+Q 3 - Treatment for the Mandibular Position. All of the orthodontists determined that the position of the mandible required treatment.

Only 76 of the 171 respondents or 44.4% overall decided on treatment, specifically, 26 or 47.3% Freshmen, 27 or 50% Sophomores, 11 or 35.5% Juniors and 12 or 38.7% Seniors. The majority or 95 or 55.6% overall decided against treatment, which included 29 or 52.7% Freshmen, 27 or 50% Sophomores, 20 or 64.5% Juniors, and 19 or 61.3% Seniors. It is interesting to note that even though 128 or 74.9% overall determined that the mandible was retruded, only 76 or 44.4% thought treatment of the position was necessary. This question indicated a reversal, as the majority of individuals overall, as well as in each group, answered incorrectly, except the Sophomore group had an equal number of correct and incorrect responses.

+Q 4 - Treatment for the Facial Profile. All of the orthodontists concurred that treatment of the profile was necessary.

Overall, only 90 or 52.6% indicated this subject required treatment. This included 32 or 58.2% Freshmen, 31 or 57.4% Sophomores, 14 or 48.4% Juniors, and 12 or 38.7% Seniors. Those who decided no treatment was necessary included 23 or 41.8% Freshmen, 23 or 42.6% Sophomores, 16 or 51.6% Juniors, and 19 or 61.3% Seniors, which equalled 81 or 47.4% overall. Even though 129 or 75.4% overall recognized that there was a problem with the profile, a smaller percentage chose to treat it. It is especially interesting to note that 25 or 80.6% of the Senior dental students identified the convex profile correctly, but that 19 or 61.3% of the Seniors chose not to treat it. These are the two highest figures of all the groups that were studied.

+Q 5 - Appearance of the Lips. All of the orthodontists agreed that this patient's lips appeared normal.

One-hundred-forty-six of the 171 participants or 85.4% thought that the appearance of the lips was normal. This included 46 or 83.6% Freshmen, 50 or 92.6% Sophomores, 27 or 87.1% Juniors, and 23 or 74.2% Seniors. Only 14 or 8.2% answered tense, and 10 or 5.8% answered flaccid. Specifically, this was comprised of 5 or 9.1% Freshmen, 4 or 7.4% Sophomores, 2 or 6.4% Juniors, and 3 or 9.7% Seniors, for the former and 3 or 5.4% Freshmen, or 2 or 6.4% Juniors, and 5 or 16.1% Seniors for the latter. Only 1 or 1.8% Freshmen gave no answer to this question.

+Q 6 - Treatment for the Labial Appearance. Eighty percent of the orthodontists decided treatment was necessary, while 20% decided against it.

Out of 171 participants, 153 or 89.5% thought that no treatment was necessary. Specifically, 48 or 87.3% Freshmen, 49 or 90.7% Sophomores, 27 or 87.1% Juniors, and 29 or 93.5% Seniors. Those who would treat this patient included 5 or 9.1% Freshmen, 5 or 9.3% Sophomores, 3 or 9.7% Juniors, and 2 or 6.4% Seniors, to give 15 or 8.8% overall. Therefore, the great majority or 89.5% would not treat this patient and this is similar to the 85.4% in the previous question, who said the appearance of the lips was normal. Therefore, this question was not a good determinator of ability as it was very easy to answer correctly.

+Q 7 - Stage of Dentition. All of the orthodontists determined that this patient was in the mixed dentition stage.

One-hundred-forty-six or 85.4.% overall agreed with their diagnosis, which included 46 or 83.6% Freshmen, 50 or 92.6% Sophomores, 27 or 87.1% Juniors, and 23 or 74.2% Seniors. Those who thought that this subject was in the permanent dentition stage included 9 or 16.4% Freshmen, 3 or 5.6% Sophomores, 4 or 12.9% Juniors, and 7 or 22.6% Seniors, which equalled 23 or 13.5% overall. Only 1 or

1.8% Sophomores and 1 or 3.2% Seniors which totalled 2 or 1.2% overall, answered primary dentition.

+Q 8 - Appropriate Dentition. All of the orthodontists diagnosed that the dentition was appropriate for this male subject's age of 11 years and 8 months.

Overall, 132 or 77.2% agreed with the orthodontists, specifically, 49 or 89.1% Freshmen, 40 or 74.1% Sophomores, 25 or 80.6% Juniors, and only 18 or 58.1% Seniors. Those who thought the dentition was not appropriate for this subject's age and gender included 6 or 10.9% Freshmen, 14 or 25.9% Sophomores, 6 or 19.3% Juniors, and 13 or 41.9% Seniors. Thirteen or 41.9% Senior dental students answered it was not appropriate, perhaps because some 22% answered permanent dentition in the previous question, and a number of Sophomore students who answered it was not appropriate, probably thought that the primary teeth were late in being exfoliated. The Pearson statistic was significant, as the correct answer stood out, and the majority of individuals overall, as well as in each group, answered correctly.

+Q 9 - Cuspid Relationship - Right Side. All of the orthodontists agreed that the cuspid relationship on the right side was Class II.

A total of 52 or 30.4% answered Class II, which included 13 or 23.6% Freshmen, 18 or 33.3% Sophomores, 10 or 32.2% Juniors, and 11 or 35.5% Seniors. Class I was chosen by 26 or 47.3% Freshmen, 12 or 22.2% Sophomores, 11 or 35.6% Juniors, and 6 or 19.3% Seniors, which equalled 55 or 32.2% overall. The most popular choice was end-to-end given by 57 or 33.3% overall, specifically, 12 or 21.8% Freshmen, 21 or 38.9% Sophomores, 10 or 32.2% Juniors, and 14 or 45.2% Seniors, which the greatest number of Seniors chose. Only 4 or 2.3% overall chose a Class III relationship, specifically, 3 or 5.4% Freshmen, and 1 or 1.8% Sophomores. A total of just 3 or 1.8% gave no answer to this question. On the whole, the four

groups were evenly split over a Class I, end-to-end, and Class II cuspid relationship, and it was found that this question indicated a reversal, as the majority of individuals overall, as well as in each particular group, answered incorrectly.

+Q 10 - Cuspid Relationship - Left Side. All of the orthodontists agreed that the cuspid relationship on the left side was Class II.

Overall, 64 or 37.4% of the respondents decided on Class II, which included 17 or 30.9% Freshmen, 24 or 44.4% Sophomores, 12 or 38.7% Juniors, and 11 or 35.5% Seniors. A Class I relationship was chosen by a total of 59 or 34.5%, specifically 23 or 41.8% Freshmen, 14 or 25.9% Sophomores, 12 or 38.7% Juniors and 10 or 32.3% Seniors. End-to-end was the choice of 42 or 24.6% overall. This included 12 or 21.8% Freshmen, 13 or 24.1% Sophomores, 7 or 22.6% Juniors, and 10 or 32.3% Seniors. Only 4 or 2.3% on the whole chose a Class III relationship, in detail 3 or 5.4% Freshmen and 1 or 1.8% Sophomores. Just 2 or 3.7% Sophomores, gave no answer to this question. Although a slightly higher percentage chose the correct answer for the left side, this can mainly be attributed to the Freshmen and Sophomore groups. The same number of Seniors chose Class II for each side with only 11 or 35.5%. Therefore, this question indicated a reversal as the majority of students overall, as well as in each group, responded incorrectly.

+Q 11 Treatment for the Cuspid Relationship. All of the orthodontists concurred that treatment of the cuspid relationship was necessary.

One-hundred-thirteen or 66.1% of the students decided that treatment was needed, including 30 or 54.5% Freshmen, 43 or 79.6% Sophomores, 16 or 51.6% Juniors, and 24 or 77.4% Seniors. Those who would not treat consisted of 25 or 45.5% Freshmen, 10 or 18.5% Sophomores, 15 or 48.4% Juniors, and 6 or 19.4% Seniors, which equalled 56 or 32.7% overall. Of interest is that 48.4% of the Junior

students, did not consider this problem to be severe enough to treat. The Pearson statistic was significant, as the correct answer stood out, and the majority of participants overall, as well as in each group, answered correctly.

+Q 12 - Molar Relationship - Right Side. Eighty percent of the orthodontists determined the molar relationship to be Class II, and 20% end-to-end.

Eighty-one of the 171 participants or 47.4% decided on a Class II molar relationship on the right side. This included 18 or 32.7% Freshmen, 33 or 61.1% Sophomores, 16 or 51.6% Juniors and 14 or 45.2% Seniors. Those who chose Class I included 22 or 40% Freshmen, 10 or 18.5% Sophomores, 6 or 19.4% Juniors, and 2 or 6.4% Seniors, which yielded a total of 40 or 23.4%. End-to-end was chosen by 45 or 26.3% of the participants, specifically, 11 or 20% Freshmen, 10 or 18.5% Sophomores, 9 or 29% Juniors, and 15 or 48.4% Seniors. Only 3 or 5.4% of the Freshmen students decided it was a Class III relationship, and just 1 or 1.8% Freshmen and 1 or 1.8% Sophomores gave no answer to this question. The Pearson statistic was significant as the correct answer stood out, however, the majority of individuals overall, as well as the majorities in the Freshmen and Senior groups, selected the incorrect answer which indicated a reversal. Only the majority of individuals in the Sophomore and Junior groups responded correctly to this question.

+Q 13 - Molar Relationship - Left Side. Ninety percent of the orthodontists determined the molar relationship to be Class II, and 10% thought end-to-end.

Among the participants, those who chose Class II included 21 or 38.2% Freshmen, 38 or 70.4% Sophomores, 16 or 51.6% Juniors and 14 or 45.2% Seniors, which totalled 89 or 52% overall. Class I was chosen by 32 or 18.7% overall, specifically, 18 or 32.7% Freshmen, 4 or 7.4% Sophomores, 7 or 22.6% Juniors, and 3 or 9.7% Seniors. End-to-end was the choice of 14 or 25.4% Freshmen, 11 or

20.4% Sophomores, 7 or 22.6% Juniors and 14 or 45.2% Seniors, which equalled 46 or 26.9% overall. Only 2 or 3.6% Freshmen decided it was a Class III relationship, and only 1 or 1.8% Sophomores gave no answer to this question. Overall, just about half of the participants were able to determine the correct molar relationship in this case, and only 45% of the Seniors were able to do so. The Pearson statistic was significant, as the correct answer stood out, and the majority of individuals overall, as well as in the Sophomore and Junior groups, answered correctly.

+Q 14 - Treatment for the Molar Relationship. All of the orthodontists determined that this molar relationship needed to be treated.

Overall, 114 or 66.7% of the respondents decided that treatment was needed, specifically, 33 or 60% Freshmen, 45 or 83.3% Sophomores, 17 or 54.8% Juniors, and 19 or 61.3% Seniors. However, a total of 51 or 29.8% decided against treatment, including 21 or 38.2% Freshmen, 9 or 16.7% Sophomores, 14 or 45.2% Juniors, and 7 or 22.6% Seniors. Of interest is that only 54.8% Juniors and 61.3% Seniors decided to treat this problem, when approximately 77% of the Juniors recognized some sort of problem existed, as well as approximately 91% of the seniors. The Pearson statistic was significant, as the correct answer stood out, and the majority of individuals overall, as well as in each group answered this question correctly.

+Q 15 - Presence of an Overbite. All of the orthodontists agreed that an overbite was present in this case.

Overall, 159 or 93% of the dental students identified the presence of an overbite, specifically, 53 or 96.4% Freshmen, 51 or 94.4% Sophomores, 29 or 93.5% Juniors, and 26 or 83.9% Seniors. Only 5 or 2.9% overall thought no overbite existed. Since such a great number of participants in all four groups recognized the presence of an overbite, this question was not a good determinator of ability, as it was

extremely easy to correctly answer. The Pearson statistic was significant, as the correct answer really stood out. The great majority of participants overall, as well as in each group, answered this question correctly.

+Q 16 - Amount of Overbite. Ninety percent of the orthodontists thought that an excessive amount of overbite was present, while 10% felt it was a moderate amount.

Eighty point seven percent or 138 overall, determined that the amount of overbite was excessive. This included 45 or 81.8% Freshmen, 37 or 68.5% Sophomores, 26 or 83.9% Juniors, and 30 or 96.8% Seniors. Only 29 or 17% overall decided the overbite was moderate, specifically, 7 or 12.7% Freshmen, 16 or 29.6% Sophomores, 5 or 16.1% Juniors, and 1 or 3.2% Seniors. Just 3 or 1.8% thought a acceptable amount of overbite existed, including 2 or 3.6% Freshmen, and 1 or 1.8% Sophomores. Only 1 or 1.8% Freshmen gave no answer to this question.

+Q 17 - Treatment for the Overbite. All of the orthodontists concurred that treatment of this overbite was necessary.

One-hundred-fifty-five or 90.6% overall also decided that this amount of overbite needed to be treated. This included 48 or 87.3% Freshmen, 48 or 88.9% Sophomores, 28 or 90.3% Juniors, and all 31 or 100% of the seniors, and this indicated a trend. Only 14 or 8.2% overall chose not to treat, which included 7 or 12.7% Freshmen, 4 or 7.4% Sophomores, and 3 or 9.7% Junior students. With such a large percentage who correctly chose to treat this problem, it appears that this question was very easy to answer correctly, and was not a good determinator of ability.

+Q 18 - Presence of an Open Bite. All of the orthodontists found that no open bite existed in this case.

One-hundred-fifty-two or 88.9% overall, including 46 or 83.6% Freshmen, 49 or 90.7% Sophomores, 27 or 87.1% Juniors, and 30 or 96.8% Seniors, determined

that no open bite was present. Only 18 or 10.5% overall thought an open bite did exist, and consisted of 9 or 16.4% Freshmen, 4 or 7.4% Sophomores, 4 or 12.9% Juniors, and 1 or 3.2% Seniors. Therefore, since this was such an easy question to respond to correctly, it was not a good determinator of ability.

+Q 19 - Presence of Overjet. All the orthodontists diagnosed the presence of overjet in this subject's dentition.

One-hundred-forty-one or 82.5% overall, specifically, 47 or 85.5% Freshmen, 45 or 83.3% Sophomores, 26 or 83.9% Juniors, and 23 or 74.2% Seniors found overjet to exist in this case, whereas, 30 or 17.5% overall, specifically, 8 or 14.5% Freshmen, 9 or 16.7% Sophomores, 5 or 16.1% Juniors, and 8 or 25.8% Seniors, thought no overjet was present.

+Q 20 - Amount of Overjet. Regarding the amount of overjet present in this subject's dentition, all of the orthodontists agreed that a moderate amount of overjet existed in this case.

Of the 171 participants, the largest number decided that moderate overjet existed. This translated into 70 or 40.9% overall, specifically, 19 or 34.5% Freshmen, 21 or 38.9% Sophomores, 15 or 48.4% Juniors, and 15 or 48.4% Seniors. Those who answered excessive overjet included 20 or 36.4% Freshmen, 13 or 24.1% Sophomores, 7 or 22.6% Juniors, and 5 or 16.1% Seniors, equalling 45 or 26.3% overall. Acceptable overjet was chosen by 11 or 20% Freshmen, 14 or 25.9% Sophomores, 6 or 19.3% Juniors, and 11 or 35.5% Seniors, to give 42 or 24.6% overall. Only a total of 14 or 8.2% gave no answer to this question, including 5 or 9.1% Freshmen, 6 or 11.1% Sophomores, and 3 or 9.7% Juniors. Of interest here was that 35.5% of the Senior students thought that this amount of overjet was within the norm. Therefore, since the majority of students overall, as well as in each of the

four groups responded incorrectly, this indicated a reversal.

+Q 21 - Treatment for the Overjet. All of the orthodontists decided that this amount of overjet required treatment.

Even though 115 or 67% overall thought overjet outside of the norm existed, just 96 or 56.1% overall thought that treatment of the overjet was needed. This included 36 or 65.4% Freshmen, 26 or 48.1% Sophomores, 17 or 54.8% Juniors, and 17 or 54.8% Seniors. Those who answered that no treatment was needed included 15 or 27.3% Freshmen, 27 or 50% Sophomores, 11 or 35.5% Juniors, and 14 or 45.2% Seniors to give a total of 67 or 39.2% overall. Only 8 or 4.7% gave no answer, including 4 or 7.3% Freshmen, 1 or 1.8% Sophomores, and 3 or 9.7% Juniors.

+Q 22 - Presence of a Cross-Bite. All the orthodontists agreed that no cross-bite existed in this case.

The majority, 162 or 94.7% overall, determined that this patient did not exhibit a cross-bite. This included 51 or 92.7% Freshmen, 51 or 94.4% Sophomores, 30 or 96.8% Juniors, and 30 or 96.8% Seniors. Only 7 or 4.1% overall thought a cross-bite existed in this patient's dentition, including 3 or 5.4% Freshmen, 2 or 3.7% Sophomores,1 or 3.2% Juniors, and 1 or 3.2% Seniors. Only 1 or 1.8% Freshmen gave no answer to this question. This question was not a good determinator of actual ability as it was extremely easy since so many in each group correctly answered it.

+Q 23 - Location of Cross-Bite. All of the orthodontists agreed that, since no cross-bite existed, this question did not apply.

Overall, 147 or 86% of the respondents decided that this question did not apply to this case. This included 44 or 80% Freshmen, 47 or 87% Sophomores, 27 or 87.1% Juniors, and 29 or 93.6% Seniors, and indicated a trend, for as the level of education increased, so did the percentage of students who answered correctly. Only 7

or 4.1% overall thought an anterior cross-bite existed, but a few more, 16 or 9.4% overall, thought a posterior cross-bite was present. Specifically, this included 2 or 3.6% Freshmen, 1 or 1.8% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors for the former, and 9 or 16.4% Freshmen, 5 or 9.3% Sophomores, and 2 or 6.4% Juniors for the latter. Only 1 or 1.8% Sophomores gave no answer to this question. Since so many students answered this question correctly, it was not a good determinator of ability.

+Q 24 - Presence of a Maxillary Transverse Deficiency. All of the orthodontists found that no maxillary transverse deficiency existed in this case.

Overall, 143 or 83.6% of the participants found no maxillary transverse deficiency present as well. This included 47 or 85.4% Freshmen, 44 or 81.5% Sophomores, 27 or 87.1% Juniors, and 25 or 80.6% Seniors. A total of 25 or 14.6% did find one present, specifically 7 or 12.7% Freshmen, 8 or 14.8% Sophomores, 4 or 12.9% Juniors, and 6 or 19.3% Seniors. Only 1 or 1.8% Freshmen did not answer this question. Therefore, this question was not a good determinator of ability, as it was very easy to accurately answer.

+Q 25 -Presence of Spacing. Eighty percent of the orthodontists found that no spacing was present, whereas 20% found that some spacing existed.

Only 60 or 35.1% overall thought no spacing in the arches was present. This included 17 or 30.9% Freshmen, 20 or 37% Sophomores, 12 or 38.7% Juniors, and 11 or 35.5% Seniors. However, a large number, 64.9% or 111 participants, identified that spacing was present, specifically, 38 or 69.1% Freshmen, 34 or 63% Sophomores, 19 or 61.3% Juniors, and 20 or 64.5% Seniors. This question indicated a reversal, as the majority of individuals overall, as well as in each group, answered incorrectly.

+Q 26 - Presence of Crowding. Ninety percent of the orthodontists detected crowding in the dentition, while 10% did not find any crowding.

Overall, 85 or 49.7% of the participants determined that crowding was present which included 29 or 52.7% Freshmen, 19 or 35.2% Sophomores, 16 or 51.6% Juniors, and 21 or 67.7% Seniors, which was the group with the largest percentage who chose this answer. Nearly an equal number of participants, 83 or 48.5% overall, found no crowding present, specifically, 26 or 47.3% Freshmen, 32 or 59.3% Sophomores, 15 or 48.4% Juniors, and 10 or 32.3% Seniors. Since the majority of students overall, as well as the majority in the Sophomore group, answered this question incorrectly, a reversal was indicated.

+Q 27 - Amount of Crowding - Maxilla. All of the orthodontists concurred that there was no crowding present in the maxillary arch.

Overall, 110 or 64.3% agreed with the experts and found no crowding to be present in the maxillary arch. This included 31 or 56.4% Freshmen, 39 or 72.2% Sophomores, 20 or 64.5% Juniors, and 20 or 64.5% Seniors. Those who detected a slight amount of crowding included 14 or 25.4% Freshmen, 8 or 14.4% Sophomores, 9 or 29% Juniors, and 7 or 22.6% Seniors, which totalled 38 or 22.2%. Only 7 or 4.1% overall found moderate crowding present, which included 4 or 7.3% Freshmen, and 3 or 5.6% Sophomores, and only 8 or 4.7% overall thought the crowding was severe, specifically, 4 or 7.3% Freshmen, 1 or 3.2% Juniors and 3 or 9.7% Seniors. A total of 8 or 4.7% gave no answer to this question which included 2 or 3.6% Freshmen, 4 or 7.4% Sophomores, 1 or 3.2% Juniors and 1 or 3.2% Seniors.

+Q 28 - Amount of Crowding - Mandible. Ninety percent of the orthodontists found that a slight amount of crowding was present in the mandibular arch, while 10% found no crowding present.

Seventy-five or 43.9% of the participants found a slight amount of crowding to exist in the mandibular arch. This included 27 or 49.1% Freshmen, 16 or 29.6% Sophomores, 11 or 35.5% Juniors, and 21 or 67.7% Seniors, which was the highest percentage answering correctly. Those who thought that no crowding was present included 18 or 32.7% Freshmen, 28 or 51.8% Sophomores, 14 or 45.2% Juniors and 5 or 16.1% Seniors which totalled 65 or 38%. Overall, 20 or 11.7% noticed that a moderate amount of crowding, which included 8 or 14.5% Freshmen, 5 or 9.3% Sophomores, 5 or 16.1% Juniors, and 2 or 6.4% Seniors. Only 4 or 2.3% thought a severe amount of crowding in the mandibular arch existed, specifically, 1 or 1.8% Freshmen, 1 or 1.8% Sophomores, and 2 or 6.4% Seniors. A total of 7 or 4.1% gave no answer to this question, including 1 or 1.8% Freshmen, 4 or 7.4% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors. The Pearson statistic was significant as the correct answer stood out, with the majority of individuals in the Senior group answering correctly. However, the majority of students overall, as well as Freshman, Sophomore, and Junior groups gave an incorrect response to this question, and this indicated a reversal.

+Q 29 - Treatment for the Crowding. Seventy percent of the orthodontists thought that this amount of crowding did not need to be treated, while 30% thought treatment was indicated.

A total of 108 or 63.2% found that no crowding was present and, therefore, no treatment would be needed. Specifically, this included 27 or 49.1% Freshmen, 37 or 67.7% Sophomores, 25 or 80.6% Juniors, and 19 or 61.2% Seniors. Overall, 62 or 36.3% thought that treatment was required, including 27 or 49.1% Freshmen, 17 or 31.5% Sophomores, 6 or 19.3% Juniors, and 12 or 38.7% Seniors. These results seem to mirror the opinions of the orthodontists. The Pearson statistic was significant,

as the majority of individuals overall, as well as in each of the four groups, answered correctly.

+Q 30 - Co-incidence of Midlines. Ninety percent of the orthodontists decided that the midlines were co-incident, and 10% found that the midlines were not co-incident.

Overall, 149 or 87.1% thought the midlines were co-incident, specifically 48 or 87.3% Freshmen, 46 or 85.2% Sophomores, 26 or 83.9% Juniors, and 29 or 93.5% Seniors. A total of 21 or 12.3% decided that the midlines were not co-incident, which included 7 or 12.7% Freshmen, 7 or 13% Sophomores, 5 or 16.1% Juniors, and 2 or 6.4% Seniors. Only 1 or 1.8% Sophomores gave no answer to this question. All the answers were rather uniform regarding identification of this problem, thus it was not a good determinator of ability, as it was a very easy question to answer correctly.

+Q 31 - Presence of Dental Conditions: A) congenitally missing teeth, B) supernumerary teeth, C) impacted teeth, D) malformed teeth, or E) none of the above. All of the orthodontists agreed that a tooth was congenitally missing, which was the mandibular left 2nd premolar.

Of the 171 participants, 69 or 40.4% identified that this tooth was absent. This included 15 or 27.3% Freshmen, 19 or 35.2% Sophomores, 14 or 45.2% Juniors and 21 or 67.7% Seniors, which was the highest of all four groups. This indicated a trend was present with regard to the level of education. Those who chose that no abnormal dental conditions were present included: 15 or 27.3% Freshmen, 14 or 25.9% Sophomores, 13 or 41.9% Juniors and 8 or 25.8% Seniors, which totalled 50 or 29.2%. Overall, only 5 or 2.9% thought supernumerary teeth were present and 9 or 5.3% thought malformed teeth existed, while 20 or 11.7% diagnosed impacted teeth. Overall, 18 or 10.5% answered with multiple answers. These included 7 or 12.7%

Freshmen - 5 AC, 1 AD, 1 ACD; 10 or 18.5% Sophomores - 5 AC, 2 AD, 1 AB, 1 CD, 1 ACD; and 1 or 3.2% Seniors - 1 CD. The Pearson statistic was significant as the majority in the Senior group answered correctly. Also a trend was evident as the percentage of those who answered correctly increased from the Freshman through the Senior groups. However, a reversal was noted as the majority of students overall, as well as in the Freshman, Sophomore, and Junior groups, responded with an incorrect choice.

+Q 32 - Gingival Health. All of the orthodontists determined that this subject's gingiva appeared healthy.

Overall, 156 or 91.2% of the students also decided that this patient had acceptable gingival health. This included 49 or 89.1% Freshmen, 48 or 88.9% Sophomores, 28 or 90.3% Juniors, and all 31 or 100% Seniors. Only a total of 12 or 7% did not find the gingiva to be healthy. This included 3 or 5.4% Freshmen, 6 or 11.4% Sophomores, and 3 or 9.7% Juniors. Just 2 or 3.6% Freshmen did not answer this question. This question was answered correctly by over 90% of the participants and, therefore, was not a good determinator of ability as it was extremely easy to answer accurately.

+Q 33 - Presence of Periodontal Conditions: A) recession of the gum tissue B) defects of the gingiva, C) bone loss or D) none of the above. All of the orthodontists found no abnormal periodontal conditions to be present.

One-hundred-fifty or 87.7% overall also found no abnormal periodontal conditions present, which included 51 or 92.7% Freshmen, 44 or 81.5% Sophomores, 26 or 83.9% Juniors, and 29 or 93.5% Seniors. A total of only 16 or 9.3% thought either recession of the gingiva, defects in the gingiva, or bone loss was present. Only 1 or 1.8% Sophomores gave no answer to this question. This question was really not a

good determinator of ability since it was so consistently and correctly answered.

+Q 34 - Need for Orthodontic Treatment. All of the orthodontists determined that this patient required orthodontic treatment.

Out of 171 participants, 142 or 83% decided that orthodontic treatment was needed, which included 47 or 85.5% Freshmen, 36 or 66.7% Sophomores, 28 or 90.3% Juniors, and all 31 or 100% Seniors. Only 27 or 15.8% thought no treatment was required. This consisted of 7 or 12.7% Freshmen, 18 or 33.3% Sophomores, and 2 or 6.4% Juniors. Only 1 or 3.2% Juniors gave no answer to this question. The Pearson statistic was significant as the correct answer stood out as the majority of students overall, as well as in each group, responded correctly to this question.

+Q 35 - Provider for Orthodontic Treatment: A) a general dentist who treats limited aspects of orthodontics, B) a general dentist who treats all aspects of orthodontics, C) a general dentist who only practices orthodontics, D) a pedodontist, E) an orthodontist. All the experts decided that only an orthodontist should provide treatment in this case.

Overall, 98 or 57.3% of the respondents thought an orthodontist should provide orthodontic treatment for this patient, which included 31 or 56.4% Freshmen, 23 or 42.6% Sophomores, 18 or 58.1% Juniors, and 26 or 83.9% Seniors. Those who decided that choice "A" was correct consisted of 9 or 16.4% Freshmen, 5 or 9.3% Sophomores, and 6 or 19.3% Juniors, which totalled 20 or 11.7%. Overall, 21 or 12.3% answered choice "B", which included 6 or 10.9% Freshmen, 11 or 20.4% Sophomores, 3 or 9.7% Juniors, and 1 or 3.2% Seniors. Only 5 or 2.9% overall chose "C", specifically 2 or 3.6% Freshmen, 1 or 1.8% Sophomores, and 2 or 6.4% Juniors, and just 3 or 1.8% overall selected "D", which included 1 or 1.8% Sophomores and 2 or 6.4% Juniors. Those who responded with multiple answers

included 3 or 5.4% Freshmen - 1 BCDE, 1 AE, and 1 CE; 5 or 9.3% Sophomores - 2 BCE, 2 BE, 1 CE; and 4 or 12.9% Seniors - 1 ABCE, 1 BCDE, 1 BCE, and 1 CE. Also twelve or 7% overall gave no answer to this question which included 4 or 7.3% Freshmen and 8 or 14.8% Sophomores. It was interesting to see that so many, especially in the Freshman, Sophomore and Junior groups, chose general dentists to treat this case, which totalled 46 or 26.9% overall. The Pearson statistic was significant, as the correct answer stood out, and the majority of individuals overall, as well as in the Freshmen, Junior and Senior groups, responded correctly to this question.

+Q 36 - Necessity for Extractions. Sixty percent of the orthodontists decided that no extractions were needed, while the other 40% did think extractions were required to treat this case.

Overall, 123 or 71.9% thought extractions were not needed, specifically 36 or 65.4% Freshmen, 44 or 81.5% Sophomores, 23 or 74.2% Juniors, and 20 or 64.5% Seniors. Those who decided extractions were required included 16 or 29.1% Freshmen, 9 or 16.7% Sophomores, 8 or 25.8% Juniors, and 11 or 35.5% Seniors, to equal 44 or 25.7% overall. Only a total of 3 or 1.8% gave no answer, including 2 or 3.6% Freshmen and 1 or 1.8% Sophomores.

+Q 37 - Diagnostic Records: Models. Ninety percent of the orthodontists decided they relied on the models in a large part.

Overall, 136 or 79.5% answered that they relied on the models in large part, specifically, 41 or 74.5% Freshmen, 43 or 79.6% Sophomores, 25 or 80.6% Juniors and 27 or 87.1% Seniors, which indicated a trend. A total of 26 or 15.2% answered in small part, which included 12 or 21.8% Freshmen, 8 or 14.8% Sophomores, 3 or 9.7% Juniors, and 3 or 9.7% Seniors. Only 7 or 4.1% overall decided that they totally

relied on the models to diagnose this case, while 2 or 1.2% answered they did not need the models at all.

+Q 38 - Diagnostic Records: Photographs. Half of the orthodontists decided they relied on the photographs in large part to diagnose this case, and the other half decided in small part.

The participants responded in a manner similar to that of the orthodontists. Overall 78 or 45.6% answered in large part, and 84 or 49.1% answered in small part. This included 25 or 45.5% Freshmen, 25 or 46.3% Sophomores, 18 or 58.1% Juniors, and 10 or 32.3% Seniors for the former choice, and 24 or 43.6% Freshmen, 29 or 53.7% Sophomores, 11 or 35.5% Juniors, and 20 or 64.5% Seniors for the latter choice. Only 7 or 4.1% overall decided that they relied upon them totally, and 2 or 1.2% answered not at all. Since the orthodontists were evenly divided on the answer to this question, it was not a good indicator by which to measure the participants' ability.

+Q 39 - Diagnostic Records: X-Rays. Half of the orthodontists decided that they relied on it in a large part in order to diagnose this case, while the other half decided in a small part.

Overall, 79 or 46.2% answered in large part, and 69 or 40.4% answered in small part. Specifically, this included 21 or 38.2% Freshmen, 24 or 44.4% Sophomores, 19 or 61.3% Juniors, and 15 or 48.4% Seniors, and 23 or 41.8% Freshmen, 23 or 42.6% Sophomores, 9 or 29% Juniors and 14 or 45.2% Seniors respectively. Overall, only 12 or 7% answered that they totally needed the radiograph to diagnose this case, while 11 or 6.4% thought they did not need it at all. This included 3 or 5.4% Freshmen, 6 or 11.1% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors for the former, and 8 or 14.5% Freshmen, 1 or 1.8% Sophomores, 1 or

3.2% Juniors, and 1 or 3.2% Seniors for the latter. Since the orthodontists were evenly divided on the answer to this question, it was not a good indicator by which to measure the participants' ability.

Case Three

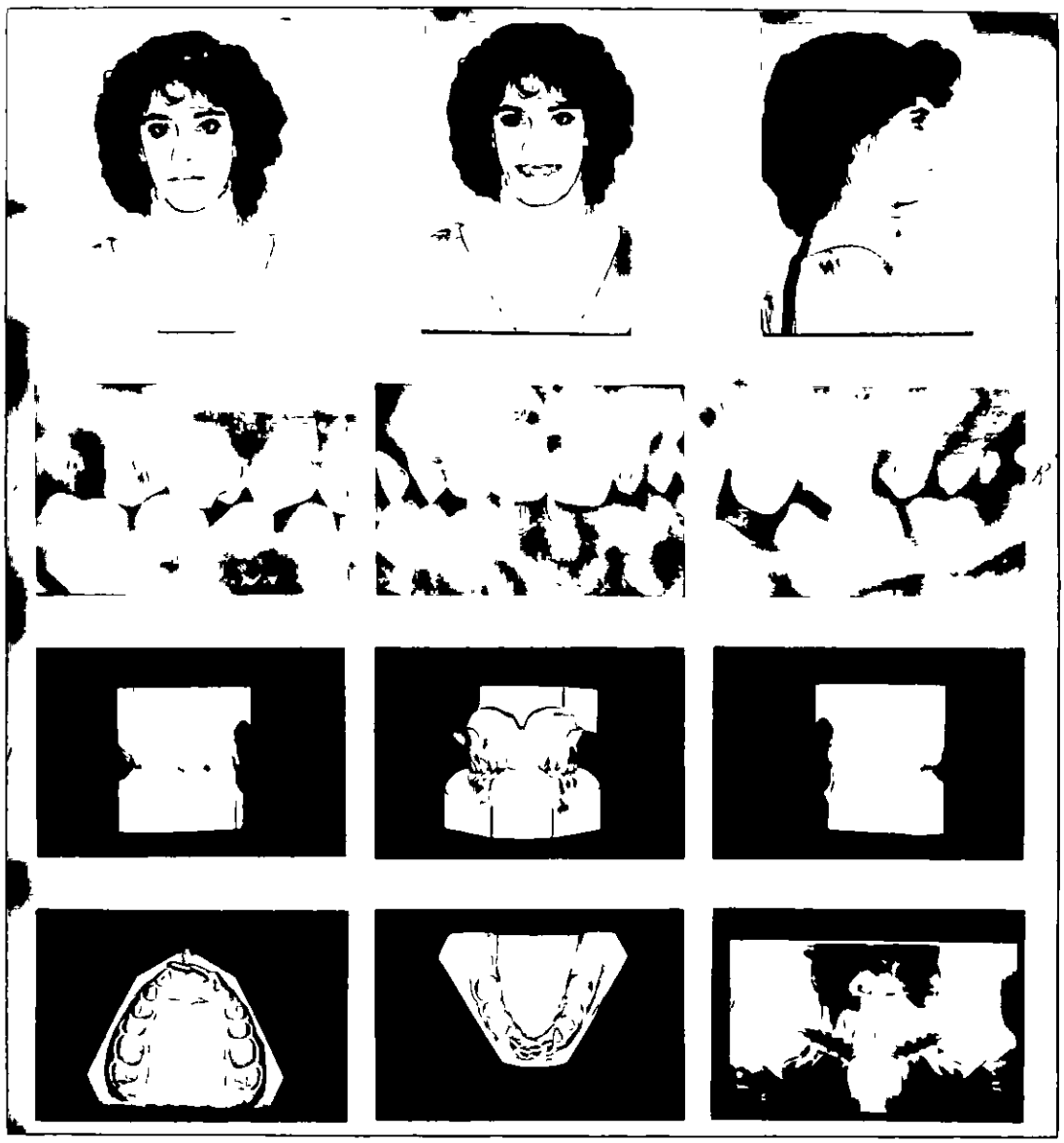
Caucasian Female

15 years, 1 month

Medical History: Tonsils removed at age 4

Dental History: Habits - Bites her lips

Class I skeletal in the mixed dentition with retained maxillary primary cuspids and impacted permanent maxillary cuspids. The cuspid relationship is end-to-end on the right side and Class I on the left side and the molar relationship is Class I. There is moderate maxillary and mandibular crowding and a moderate overbite. The dental midlines are not co-incident. Figure 4



Case Three

+Q 1 - Appearance of the Facial Profile. Ninety percent of the orthodontists determined that the facial profile was straight or Class I and 10% decided that it was bimaxillary protrusive.

Overall, 121 out of the 171 participants or 70.8% decided that the facial profile was straight or Class I, and included 35 or 63.6% Freshmen, 47 or 87% Sophomores, 19 or 61.3% Juniors, and 20 or 64.5% Seniors. Thirty-six or 21.1% overall thought the profile was convex or Class II, specifically 15 or 27.3% Freshmen, 6 or 11.1% Sophomores, 10 or 32.3% Juniors, and 5 or 16.1% Seniors. Overall, 8 or 4.7% responded concave or Class III, specifically, 3 or 5.4% Freshmen, 2 or 6.4% Juniors, and 3 or 9.7% Seniors, while a total of 5 or 2.9% responded bimaxillary protrusive which included 2 or 3.6% Freshmen and 3 or 9.7% Seniors. About 30% answered this question incorrectly, mostly answering Class II or convex, especially the Junior group, while the Senior group had their answers spread out a bit more. The Pearson statistic was significant as the correct answer stood out, and the majority of participants overall, as well as in each group, answered correctly.

+Q 2 - Position of the Mandible. All of the orthodontists agreed that the mandible was in a straight position.

Overall, 119 or 69.6% decided that the mandible was in a straight position, which included 29 or 52.7% Freshmen, 44 or 81.5% Sophomores, 21 or 67.7% Juniors and 25 or 80.6% Seniors. Overall 45 or 26.3% answered retruded, specifically, 23 or 41.8% Freshmen,8 or 14.8% Sophomores, 10 or 32.3% Juniors and 4 or 12.9% Seniors. Only 7 or 4.1% stated prominent, which included 3 or 5.4% Freshmen, 2 or 3.7% Sophomores, and 2 or 6.4% Seniors. Some 80% of the Seniors and Sophomores identified the mandibular position as being straight while only about

Table 42.--Chi-Square Results for Case Three
Undergraduate Dental Students

Question Number	Pearson Chi-Square	Degrees of Freedom	Significance
1	22.77610	12	0.02969*
2	16.13540	6	0.01305*
3	14.90242	6	0.02103*
4	22.29438	6	0.00107*
5	12.42617	6	0.05311
6	7.69372	6	0.26141
7	4.22218	6	0.64664
8	11.39685	3	0.00976*
9	31.88475	12	0.00144*
10	66.92640	12	0.00000*
11	23.69503	9	0.00481*
12	20.53046	9	0.01491*
13	14.74893	9	0.09807
14	11.51829	3	0.00923
15	3.50548	6	0.74324
16	24.07601	9	0.00418*
17	16.41257	9	0.05875
18	10.66260	6	0.09938
19	8.13020	6	0.22872
20	17.63689	9	0.03963*
21	11.04397	6	0.08703
22	23.03074	9	0.00613*
23	20.08649	9	0.01739*
24	14.97572	9	0.09161
25	0.32323	3	0.95560
26	12.95111	6	0.04382*
27	19.29705	9	0.02278*
28	18.43982	9	0.03040*
29	15.60230	6	0.01606*
30	15.49193	9	0.07828
31	19.94548	18	0.33590
32	15.14747	9	0.08696
33	12.01896	15	0.67759
34	11.99359	12	0.44619
35	41.17615	18	0.00144*
36	9.82644	12	0.63118
37	7.46730	6	0.27978
38	12.80568	9	0.17160
39	12.05505	9	0.21022

***p<.05**

68% of the Juniors could do so. The Pearson statistic was significant as the correct answer stood out, and the majority of individuals overall, as well as in each group, answered correctly.

+Q 3 - Treatment for the Mandibular Position. All of the orthodontists agreed that the position of the mandible required no treatment.

Out of 171 participants, 142 or 83% agreed with the orthodontists that no treatment was necessary, specifically, 41 or 74.5% Freshmen, 50 or 92.6% Sophomores, 27 or 87.1% Juniors and 24 or 77.4% Seniors. Those who decided treatment was needed, included 14 or 25.4% Freshmen, 2 or 3.7% Sophomores, 4 or 12.9% Juniors, and 7 or 22.6% Seniors. Even though overall some 70% answered correctly that the mandible was straight, 83% overall answered correctly that no treatment was necessary. This must, therefore, include some individuals who identified a less than ideal mandibular position. The Pearson statistic was significant, as the correct answer stood out and the majority of students overall, as well as in each group, answered correctly.

+Q 4 - Treatment for the Facial Profile. Ninety percent of the orthodontists determined that the facial profile did not need to be treated, while 10% did determine that treatment was needed.

Overall, 128 or 74.9% of the respondents decided that no treatment was necessary. This included 36 or 65.4% Freshmen, 48 or 88.9% Sophomores, 27 or 87.1% Juniors, and 17 or 54.8% Seniors. Those who answered that treatment was necessary was comprised of 18 or 32.7% Freshmen, 4 or 7.4% Sophomores, 4 or 12.9% Juniors, and 14 or 45.2% Seniors, which totalled 40 or 23.4% overall. About 30% of the Seniors in question one determined that the profile was not Class I or ideal, however, several more, or 45%, decided that treatment of the profile was necessary.

+Q 5 - Appearance of the Lips. All of the orthodontists agreed that the subject's lips appeared normal.

Overall, 129 or 75.4% of the students agreed with the orthodontists' assessment, specifically, 39 or 70.9% Freshmen, 45 or 83.3% Sophomores, 23 or 74.2% Juniors, and 22 or 71% Seniors. Overall, 20 or 11.7% thought the lips appeared tense which included 6 or 10.9% Freshmen, 2 or 3.7% Sophomores, 4 or 12.9% Juniors, and 8 or 25.8% Seniors. Ten or 18.2% Freshmen, 7 or 13% Sophomores, 4 or 12.9% Juniors, and 1 or 3.2% Seniors thought that the lips appeared flaccid which totalled 22 or 12.9%. Approximately one-quarter of the Senior group thought that this subject's lips appeared to be tense, which was twice the number from any other of the three groups.

+Q 6 - Treatment for the Labial Appearance. Ninety percent of the orthodontists decided that no treatment was needed, while 10% thought treatment was necessary.

Overall 145 or 84.8% thought that treatment for the appearance of the lips was necessary. This included 44 or 80% Freshmen, 47 or 87% Sophomores, 29 or 93.5% Juniors and 25 or 80.6% Seniors. Just 25 or 14.6% overall decided treatment was needed, specifically, 11 or 20% Freshmen, 7 or 13% Sophomores, 2 or 6.4% Juniors, and 5 or 16.1% Seniors. Therefore, this question was not a good determinator of ability as it was very easy to answer correctly. As stated previously, 129 or 75.4% overall thought the appearance of the lips was normal (Question 5), however, several more participants, 145 or 84.8% felt that no treatment was necessary.

+Q 7 - Stage of Dentition. All of the orthodontists agreed that this patient is in the mixed stage of dentition.

Overall, 116 or 67.8% decided that this subject exhibited the mixed dentition,

specifically, 38 or 69.1% Freshmen, 39 or 72.2% Sophomores, 20 or 64.5% Juniors and 19 or 61.3% Seniors. Those students who answered permanent dentition included 15 or 27.3% Freshmen, 15 or 27.8% Sophomores, 11 or 35.5% Juniors and 11 or 35.5% Seniors, which totalled 52 or 30.4%. Only 3 or 1.8% overall chose the primary dentition. Nearly one-third of the participants in this study thought that this patient was in the permanent stage of dentition, especially the Junior and Senior groups, both of whom answered at 35%.

+Q 8 - Appropriate Dentition. Ninety percent of the orthodontists determined that the existing dentition was not appropriate for this female subject's age of 15 years and 1 month, while 10% thought that it was appropriate.

A total of 96 or 56.1% decided that the dentition was not appropriate for this subject, specifically, 34 or 61.8% Freshmen, 33 or 61.1% Sophomores, 20 or 64.5% Juniors, and only 9 or 29% Seniors. Those who thought the dentition was appropriate included 21 or 38.2% Freshmen, 21 or 38.9% Sophomores, 11 or 35.5% Juniors, and 22 or 71% Seniors which equalled 75 or 43.9%.

Only about 56% overall were able to identify the correct response to this question, but a large number of students, 75 or 43.9% overall, answered that the dentition was appropriate in this case, of note 71% of the Seniors, which was nearly double what any of the other three groups answered. The Pearson statistic was significant, as the correct answer stood out, and the majority of individuals overall, as well as in the Freshmen, Sophomore, and Junior groups, answered correctly. However, the majority in the Senior group answered this question incorrectly.

+Q 9 - Cuspid Relationship - Right Side. Eighty percent of the orthodontists decided that the cuspid relationship was end-to-end and 20% thought it was a Class I relationship.

Overall, only 20 or 11.7% of the participants thought this relationship was end-to-end, specifically, 7 or 12.7% Freshmen, 3 or 5.6% Sophomores, 7 or 22.6% Juniors, and 3 or 9.7% Seniors. The largest number of students chose a Class I relationship and included 23 or 41.8% Freshmen, 34 or 63% Sophomores,11 or 35.5% Juniors and 26 or 83.9% Seniors, which totalled 94 or 55%. Thirty-seven or 21.6% overall decided on a Class II relationship, specifically, 19 or 34.5% Freshmen, 10 or 18.5% Sophomores, 7 or 22.6% Juniors, and 1 or 3.2% Seniors, while a total of 18 or 10.5% chose a Class III relationship, which included 6 or 10.9% Freshmen, 5 or 9.3% Sophomores, 6 or 19.3% Juniors, and 1 or 3.2% Seniors.

More than half of the participants in this study, 94 or 55%, misdiagnosed the end-to-end relationship for a Class I, and the group with the most individuals answering Class I, 26 or 83.9%, were the Senior dental students. Only 20 participants or 11.7% answered this question correctly. The Pearson statistic was significant, however, a very low percentage of participants overall answered this question correctly, as well as a low percentage in each of the four groups. Therefore, this question indicated a reversal as the majority overall, as well as in each group, gave the incorrect answer.

+Q 10 - Cuspid Relationship - Left Side. All of the orthodontists concurred that the cuspid relationship was Class I.

One-hundred-twenty-three or 71.9% of the participants overall determined that the cuspid relationship was Class I. This included 27 or 49.1% Freshmen, 47 or 87% Sophomores, 18 or 58.1% Juniors and all 31 or 100% of the Seniors. Overall, 21 or 12.3% thought the relationship was Class II, which included 18 or 32.7% Freshmen, 1 or 1.8% Sophomores, and 2 or 6.4% Juniors. Only a total of 10 or 5.8% answered end-to-end and a total of 15 or 8.8% answered Class III, which included 4 or 7.3%

Freshmen, 4 or 7.4% Sophomores, and 2 or 6.4% Juniors for the former and 6 or 10.9% Freshmen and 9 or 29% Juniors for the latter. Only 2 or 3.7% Sophomores gave no answer to this question.

Nearly 30% of the Freshmen, Sophomore and Junior groups diagnosed this as other than a Class I relationship, while all of the Senior students answered correctly. The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall, as well as in the Sophomore, Junior, and Senior groups, answered correctly. Just under half of the Freshman students answered correctly.

+Q 11 - Treatment for the Cuspid Relationship. Sixty percent of the orthodontists decided that treatment of the cuspid relationship was necessary while 40% thought no treatment was required.

Overall, 74 or 43.3% answered that the cuspid relationship needed to be treated. This included 32 or 58.2% Freshmen, 14 or 25.9% Sophomores, 19 or 61.3% Juniors and 9 or 29% Seniors. Among those who decided no treatment was necessary were 21 or 38.2% Freshmen, 38 or 70.4% Sophomores, 12 or 38.7% Juniors and 20 or 64.5% Seniors, which totalled 91 or 53.2%. Just 2 or 3.7% Sophomores and 1 or 3.2% Seniors gave no answer to this question. It is interesting to note that a very small number of Sophomores and Seniors answered correctly that treatment was needed. The Pearson statistic was significant, however, there was a reversal, as the majority of individuals overall answered incorrectly. Only a majority in the Freshmen and Junior groups responded with the correct answer.

+Q 12 - Molar Relationship - Right Side. All of the orthodontists agreed that the molar relationship was Class I.

Of the 171 participants, 154 or 90.1% answered that the molar relationship was Class I. This included 43 or 78.2% Freshmen, 53 or 98.1% Sophomores, 30 or

96.8% Juniors, and 28 or 90.3% Seniors. Only 6 or 3.5% thought it was end-to-end, which included 4 or 7.3% Freshmen and 2 or 6.4% Seniors. Just 8 or 4.7% decided on Class II, which included 7 or 12.7% Freshmen, and 1 or 1.8% Sophomores. Among those who answered Class III were 1 or 1.8% Freshmen, 1 or 3.2% Juniors, and 1 or 3.2% Seniors, which totalled 3 or 1.8%. The Pearson statistic was significant as the correct answer really stood out, and the majority of students overall, as well as in each of the four groups, answered correctly. Therefore, this question was not a good determinator of ability as it was very easy to correctly answer.

+Q 13 - Molar Relationship - Left Side. All of the orthodontists concurred that the molar relationship was Class I.

Overall, 156 or 91.2% answered that the molar relationship was Class I, specifically, 45 or 81.8% Freshmen, 53 or 98.1% Sophomores, 28 or 90.3% Juniors, and 30 or 96.8% Seniors. Among those who chose end-to-end were 1 or 1.8% Freshmen, 1 or 3.2% Juniors, 1 or 3.2% Seniors, to equal 3 or 1.8% overall. Six or 10.9% Freshmen, and 1 or 3.2% Juniors answered Class II, which totalled 7 or 4.1%. Those who responded Class III consisted of 3 or 5.4% Freshmen, 1 or 1.8% Sophomores, and 1 or 3.2% Juniors, to give 5 or 2.9% overall. Since this question was correctly answered so consistently, it was not a good determinator of ability. These last two questions on classification of the molar relationship were answered correctly by over 90% of those surveyed.

+Q 14 - Treatment for the Molar Relationship. All of the orthodontists agreed that no treatment was necessary for the molar relationship exhibited in this case.

Overall, 156 or 91.2% of the respondents decided that no treatment was necessary, specifically, 45 or 81.8% Freshmen, all 54 or 100% Sophomores, 28 or 90.3% Juniors, and 29 or 93.5% Seniors. Those who thought treatment was indicated

included 10 or 18.2% Freshmen, 3 or 9.7% Juniors, and 2 or 6.4% Seniors, which totalled 15 or 8.8% overall. The Pearson statistic was significant as the correct answer really stood out, and the majority of students overall, as well as in each of the four groups, responded to this question correctly. Since this question was very easy to answer correctly and, therefore, was not a good determinator of ability.

+Q 15 - Presence of an Overbite. All of the orthodontists identified the presence of an overbite.

One-hundred-fifty-seven or 91.8% of the students identified the presence of an overbite in this case, specifically, 50 or 90.9% Freshmen, 48 or 88.9% Sophomores, 30 or 96.8% Juniors and 29 or 93.5% Seniors. Only 13 or 7.6% overall answered that no overbite was present, including 5 or 9.1% Freshmen, 5 or 9.3% Sophomores, 1 or 3.2% Juniors and 2 or 6.4% Seniors. This question was not a good determinator of ability as it was extremely easy to answer correctly.

+Q 16 - Amount of Overbite. All of the orthodontists concurred that a moderate amount of overbite was present.

A total of 61 or 35.7% of the participants decided that a moderate amount of overbite was present, which included 15 or 27.3% Freshmen, 25 or 46.3% Sophomores, 15 or 48.4% Juniors, and 6 or 19.3% Seniors. The next most common answer was an excessive amount of overbite, which was indicated by 60 or 35.1% overall. This included 15 or 27.3% Freshmen, 15 or 27.8% Sophomores, 12 or 38.7% Juniors and 18 or 58.1% Seniors. A total of 45 or 26.3% thought that the overbite was acceptable, including 23 or 41.8% Freshmen, 13 or 24.1% Sophomores, 4 or 12.9% Juniors, and 5 or 16.1% Seniors. Just 5 or 2.9% overall gave no answer to this question.

Only about a third of the students were able to correctly identify the amount of

overbite present in this case with an equal number answering that the overbite was acceptable. The Pearson statistic was significant, however, the majority of individuals overall, as well as in each of the four groups answered this question incorrectly. Therefore, this indicated a reversal.

+Q 17 - Treatment for the Overbite. All of the orthodontists agreed that the amount of overbite in this case needed to be treated.

One-hundred-fourteen or 66.7% overall decided that treatment of the overbite was required. This included 30 or 54.5% Freshmen, 32 or 59.3% Sophomores, 26 or 83.9% Juniors, and 26 or 83.9% Seniors. A total of 55 or 32.2% did not think that treatment was needed. This included 23 or 41.8% Freshmen, 22 or 40.7% Sophomores, 5 or 16.1% Juniors and 5 or 16.1% Seniors. Only 1 or 1.8% Freshmen gave no answer to this question. Approximately one-third of the participants thought that the patient did not need treatment for this problem, however, 84% each in the Junior and Senior groups answered with the correct response.

+Q 18 - Presence of an Open Bite. All of the orthodontists determined that no open bite was present.

Overall, 139 or 81.3% answered that no open bite was present, specifically, 40 or 72.7% Freshmen, 45 or 83.3% Sophomores, 24 or 77.4% Juniors and 30 or 96.8% Seniors. A total of 31 or 18.1% thought an open bite existed, including 15 or 27.3% Freshmen, 8 or 14.8% Sophomores, 7 or 22.6% Juniors, and 1 or 3.2% Seniors. A high percentage of students were able to identify correctly that no open bite was present.

+Q 19 - Presence of Overjet. All of the orthodontists concurred that an overjet existed in this subject.

Overall, 113 of the 171 participants or 66.1% identified that an overjet was

present, which included 36 or 65.4% Freshmen, 41 or 75.9% Sophomores, 16 or 51.6% Juniors and 20 or 64.5% Seniors. A total of 57 or 33.3% responded that no overjet was present, specifically 19 or 34.5% Freshmen, 12 or 22.2% Sophomores, 15 or 48.4% Juniors and 11 or 35.5% Seniors. Therefore, one-third of those surveyed indicated that no overjet was present in this patient.

+Q 20 - Amount of Overjet. All of the orthodontists determined that an acceptable amount of overjet was present.

Overall, 111 or 64.9% agreed with the orthodontists' assessment of acceptable overjet and included 35 or 63.6% Freshmen, 37 or 68.5% Sophomores, 21 or 67.7% Juniors, and 18 or 58.1% Seniors. A total of 30 or 17.5% thought that a moderate amount of overjet was present, specifically, 8 or 14.5% Freshmen, 11 or 20.4% Sophomores, 1 or 3.2% Juniors, and 10 or 32.3% Seniors. Only 4 or 2.3%, which consisted of 2 or 3.6% Freshmen, and 2 or 3.7% Sophomores, decided it was excessive. Overall, 26 or 15.2% gave no answer, as they believed that there was no overjet present. This included 10 or 18.2% Freshmen, 4 or 7.4% Sophomores, 9 or 29% Juniors, and 3 or 9.7% Seniors. The Pearson statistic was significant, as the correct answer stood out, and the majority of participants overall, as well as in each of the four groups, responded correctly to this question.

+ Q 21 - Treatment for the Overjet. All of the orthodontists concurred that no treatment for this amount of overjet was necessary.

One-hundred-twenty-five of the 171 participants or 73.1% indicated that no treatment of the overjet was necessary, specifically, 35 or 63.6% Freshmen, 45 or 83.3% Sophomores, 24 or 77.4% Juniors, and 21 or 67.7% Seniors. Those who decided treatment was needed included 14 or 25.4% Freshmen, 7 or 13% Sophomores, 6 or 19.3% Juniors, and 10 or 32.3% Seniors, which equalled 37 or 21.6% overall. A

total of 9 or 5.3% gave no answer to this question. The same number of Senior students who answered that the overjet was moderate, 10 or 32.3%, also indicated that treatment was necessary.

+Q 22 - Presence of a Cross-Bite. All the orthodontists agreed that no cross-bite was present.

Overall, 145 or 84.8% agreed with the orthodontists, that no cross-bite existed in this patient. This included 48 or 87.3% Freshmen, 50 or 92.6% Sophomores, 23 or 74.2% Juniors and 24 or 77.4% Seniors. A total of 22 or 12.9%, specifically, 7 or 12.7% Freshmen, 3 or 5.6% Sophomores, 8 or 25.8% Juniors, and 4 or 12.9% Seniors responded that a cross-bite was present. Only 3 or 1.8% overall, gave no answer to this question. The Pearson statistic was significant, as the correct answer stood out, and the majority of individuals overall, as well as in each of the four groups, answered correctly.

+Q 23 - Location of Cross-Bite. All of the orthodontists agreed that, since no cross-bite was present, this question did not apply to this case.

Overall, 135 or 78.9% agreed with the orthodontists that this question did not apply to this case. This included 41 or 74.5% Freshmen, 50 or 92.6% Sophomores, 19 or 61.3% Juniors and 25 or 80.6% Seniors. A total of 13 or 7.6% thought that an anterior cross-bite was present, specifically, 5 or 9.1% Freshmen, 2 or 3.7% Sophomores, 3 or 9.7% Juniors and 3 or 9.7% Seniors. Among those who answered that a posterior cross-bite was present were 9 or 16.4% Freshmen, 2 or 3.7% Sophomores, 9 or 29% Juniors, and 2 or 6.4% Seniors, which totalled 22 or 12.9% overall. Only 1 or 3.2% Seniors gave no answer to this question.

Out of 171 participants, 135 identified the absence of a cross-bite, yet 35 identified that either an anterior or a posterior cross-bite was present, mostly because a

few Freshmen were not consistent in the answers from Q 22 to this question. On the whole, however, about 82% were able to identify the absence of a cross-bite. The Pearson statistic was significant, as the correct answer stood out, and the majority of participants overall, as well as in each group, gave the correct answer to this question.

+Q 24 - Presence of a Maxillary Transverse Deficiency. All of the orthodontists indicated that no maxillary transverse deficiency existed.

One-hundred-twenty or 70.2% agreed with the experts, specifically, 34 or 61.8% Freshmen, 35 or 64.8% Sophomores, 23 or 74.2% Juniors, and 28 or 90.3% Seniors, which showed a trend indicating that, as the educational level increased, from the Freshman through the Senior years, so did the scores. A total of 48 or 28.1% overall thought a maxillary transverse deficiency existed, specifically 21 or 38.2% Freshmen, 16 or 29.6% Sophomores, 8 or 25.8% Juniors, and 3 or 9.7% Seniors. Only 2 or 3.7% Sophomores gave no answer to this question.

+Q 25 - Presence of Spacing. Eighty percent of the orthodontists determined that no spacing existed in the arches, while 20% found spacing in the arches.

Overall, 91 or 53.2% responded that no spacing was present, which included 31 or 56.4% Freshmen, 28 or 51.8% Sophomores, 16 or 51.6% Juniors and 16 or 51.6% Seniors. A total of 80 or 46.8% believed spacing existed, specifically 24 or 43.6% Freshmen, 26 or 48.1% Sophomores, 15 or 48.4% Juniors, and 15 or 48.4% Seniors. The only visible spacing present is on either side of the maxillary 1° cuspids, but it is very minimal.

+Q 26 - Presence of Crowding. All the orthodontists agreed that crowding existed in this case.

Of the 171 participants, 148 or 86.5% identified the presence of crowding in this patient, specifically, 50 or 90.9% Freshmen, 50 or 92.6% Sophomores, 26 or

83.9% Juniors, and 22 or 71% Seniors. Overall, 21 or 12.3% thought that no crowding was evident, which included 4 or 7.3% Freshmen, 3 or 5.6% Sophomores, 5 or 16.1% Juniors, and surprisingly 9 or 29% of the Senior students. The Pearson statistic was significant as the correct answer really stood out, and the majority of participants overall, as well as in each group, responded correctly.

+Q 27 - Amount of Crowding - Maxilla. All of the orthodontists agreed that a moderate amount of crowding was present in the maxillary arch.

A total of 82 or 48% indicated they found a moderate amount of crowding, which included 26 or 47.3% Freshmen, 27 or 50% Sophomores, 17 or 54.8% Juniors, and 12 or 38.7% Seniors. Among those who diagnosed a slight amount of crowding were 20 or 36.4% Freshmen, 22 or 40.7% Sophomores, 11 or 35.5% Juniors, and 6 or 19.3% Seniors, which gave 59 or 34.5% overall. Only 13 or 7.6% identified a severe amount of crowding, specifically, 5 or 9.1% Freshmen, 2 or 3.7% Sophomores, and 6 or 19.3% Seniors. Overall, 17 or 9.9% answered that there was no crowding present, which included 4 or 7.3% Freshmen, 3 or 5.6% Sophomores,3 or 9.7% Juniors, and 7 or 22.6% Seniors.

Only about half of the Freshman, Sophomore and Junior students were able to recognize that moderate crowding existed here, yet only about 40% of the Senior students could do so. About 20% of the Seniors answered that only a slight amount of crowding was present, while at least 35% of the other three groups did so. Also, approximately another 20% of the Seniors thought that no crowding was present in this arch. The Pearson statistic was significant, however, this question indicated a reversal as the majority of students overall, as well as the majority in the Freshman and Senior groups, answered incorrectly.

+Q 28 - Amount of Crowding - Mandible. All of the orthodontists concurred

that a moderate amount of crowding was present in the mandibular arch.

Overall, 63 or 36.8% of the respondents recognized a moderate amount of crowding, specifically 21 or 38.2% Freshmen, 21 or 38.9% Sophomores, 8 or 25.8% Juniors, and 13 or 41.9% Seniors. A total of 79 or 46.2% thought that the amount of crowding present was slight, which consisted of 28 or 50.9% Freshmen, 27 or 50% Sophomores, 15 or 48.4% Juniors, and 9 or 29% Seniors. Only 13 or 7.6% believed that the amount of crowding was severe, which included 5 or 9.1% Freshmen, 1 or 1.8% Sophomores, 5 or 16.1% Juniors, and 2 or 6.4% Seniors. Overall, 16 or 9.4% found no crowding present in the mandibular arch, specifically, 1 or 1.8% Freshmen, 5 or 9.3% Sophomores, 3 or 9.7% Juniors and 7 or 22.6% Seniors.

Even though 41.9% of the Seniors found moderate crowding, 29% thought the crowding was slight, as did about 50% of each of the other three groups. Also, about 23% of the Seniors answered that there was no crowding present in this arch. The Pearson statistic was significant, however, there was a reversal, as the majority of participants overall, as well as in each of the four groups, answered this question incorrectly.

+Q 29 - Treatment for the Crowding. All of the orthodontists determined that treatment for the crowding was necessary.

Overall, 143 or 83.6% agreed with the orthodontists that treatment for the crowding was needed. This included 49 or 89.1% Freshmen, 48 or 88.9% Sophomores, 26 or 83.9% Juniors and 20 or 64.5% Seniors. A total of 27 or 15.8% answered that no treatment was required, specifically, 6 or 10.9% Freshmen, 6 or 11.1% Sophomores, 4 or 12.9% Juniors, and 11 or 35.5% Seniors. Only 1 or 3.2% Juniors gave no answer to this question.

A very high percentage from the first three groups decided to treat the

crowding. Even though 77% of the Seniors identified that crowding was present to a certain degree, only 65% answered that they would treat it. The Pearson statistic was significant, as the correct answer really stood out, and the majority of participants overall, as well as in each group, responded to this question correctly.

+Q 30 - Co-incidence of Midlines. All of the orthodontists reached the conclusion that the dental midlines were not co-incident.

One-hundred-forty-two of the 171 participants or 83% answered that the midlines were not co-incident, including 42 or 76.4% Freshmen, 45 or 83.3% Sophomores, 24 or 77.4% Juniors, and all 31 or 100% of the Seniors. Overall, 27 or 15.8% thought that the midlines were co-incident, specifically 13 or 23.6% Freshmen, 8 or 14.8% Sophomores and 6 or 19.3% Juniors. Only 1 or 3.2% Juniors gave no answer to this question.

+Q 31 - Presence of Dental Conditions: A) missing teeth, B) supernumerary teeth, C) impacted teeth, D) malformed teeth, or E) none of the above. Ninety percent of the orthodontists diagnosed that there were impacted teeth present and 10% thought that none of these conditions were present.

Overall, 71 or 41.5% of the students, specifically 16 or 29.1% Freshmen, 27 or 50% Sophomores, 15 or 48.4% Juniors and 13 or 41.9% Seniors, determined that impacted teeth were present in this case. Only 10 or 5.8% overall thought that there were congenitally missing teeth, which included 3 or 5.4% Freshmen, 3 or 5.6% Sophomores, 3 or 9.7% Juniors and 1 or 3.2% Seniors. Overall, 14 or 8.2% believed there were supernumerary teeth, which consisted of 8 or 14.5% Freshmen, 2 or 3.7% Sophomores, 3 or 9.7% Juniors, and 1 or 3.2% Seniors. Those who diagnosed malformed teeth were present included 4 or 7.3% Freshmen, 2 or 3.7% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors, which totalled 10 or 5.8%. Overall, 58 or

33.9% indicated that none of these dental conditions were present, specifically 20 or 36.4% Freshmen, 19 or 35.2% Sophomores, 7 or 22.6% Juniors, and 12 or 38.7% Seniors. A total of 7 or 4.1% responded with multiple answers, 4 or 7.3% Freshmen - 2 CD, 1 AC, 1 BC; 1 or 1.8% Sophomores - 1 BC; and 2 or 6.4% Seniors - 1 AC, 1 BE. Only 1 or 3.2% Juniors gave no answer to this question.

Overall, 41.5% answered that impacted teeth were present, however, 33.9% thought no unusual dental conditions existed. This corresponds to the 30.4% overall in question seven, who answered that this patient was in the permanent stage of dentition. Specifically, 38.7% of the Seniors responded that no unusual conditions existed which correlated with the 35.5% Seniors who thought this patient was in the permanent stage of dentition. This raises some concern, as they failed to recognize that the maxillary primary cuspids were retained and the permanent cuspids were impacted. This question indicated a reversal as the majority of individuals overall, as well as in the Freshman, Junior and Senior groups, responded incorrectly. Also the Sophomores were evenly divided with correct as well as incorrect responses.

+Q 32 - Gingival Health. All of the orthodontists agreed that the gingiva was healthy.

One-hundred-fifty-one of the 171 participants or 88.3% found the gingival tissue to be healthy, which included 47 or 85.5% Freshmen, 51 or 94.4% Sophomores, 25 or 80.6% Juniors, and 28 or 90.3% Seniors. Only 16 or 9.4% overall thought the tissue was not healthy, specifically, 6 or 10.9% Freshmen, 3 or 5.6% Sophomores, 4 or 12.9% Juniors and 3 or 9.7% Seniors. The responses were very consistent as the students were able to easily recognize the healthy tissue. Therefore, this question was not a good determinator of ability, since it was too easy to answer correctly.

+Q 33 - Presence of Periodontal Conditions: A) Recession of the gum tissue, B) defects of the gingiva, C) bone loss or D) none of the above. All of the orthodontists found no periodontal conditions present.

A total of 141 or 82.5% agreed with the experts that no unusual periodontal conditions existed in this case, which included 42 or 76.4% Freshmen, 46 or 85.2% Sophomores, 25 or 80.6% Juniors and 28 or 90.3% Seniors. Overall, only 7 or 4.1% and 12 or 7% answered that either gingival recession or gingival defects were present, specifically, 3 or 5.4% Freshmen, 3 or 5.6% Sophomores, and 1 or 3.2% Juniors, and 4 or 7.3% Freshmen, 2 or 3.7% Sophomores, 3 or 9.7% Juniors and 3 or 9.7% Seniors, respectively. Bone loss was indicated by just 2 or 3.6% Freshmen, and only 1 or 1.8% Freshmen gave no answer to this question.

+Q 34 - Need for Orthodontic Treatment. All the orthodontists agreed that this patient needed orthodontic treatment.

Overall, 163 of the 171 participants or 95.3% determined that orthodontic treatment was necessary, which included 51 or 92.7% Freshmen, 52 or 96.3% Sophomores, all 31 or 100% Juniors and 29 or 93.5% Seniors. Only 3 or 1.8% thought no treatment was needed, specifically 2 or 3.6% Freshmen and 1 or 1.8% Sophomores. Since such a high percentage decided on treatment, this question was not a good determinator of ability as it was extremely easy to answer correctly.

+Q 35 - Provider for Orthodontic Treatment: A) A general dentist who treats limited aspects of orthodontics, B) A general dentist who treats all aspects of orthodontics, C) A general dentist who only practices orthodontics, D) A pedodontist, E) An orthodontist, F) Other. All the orthodontists concurred that an orthodontist should provide treatment to this patient.

Overall, 92 or 53.8%, specifically 26 or 47.3% Freshmen, 23 or 42.6%

Sophomores, 20 or 64.5% Juniors and 23 or 74.2% Seniors responded that an orthodontist should treat this patient. A total of 19 or 11.1% chose A which included 11 or 20% Freshmen, 3 or 9.7% Juniors, and 5 or 16.1% Seniors, and a total of 30 or 17.5% chose B which included 10 or 18.2% Freshmen, 14 or 25.9% Sophomores, and 6 or 19.3% Juniors. Overall, 9 or 5.3% decided on C and only 1 or 6% decided on D, which included 2 or 3.6% Freshmen, 5 or 9.3% Sophomores, and 2 or 6.4% Juniors for the former and 1 or 1.8% for the latter. Those who gave multiple answers totalled 19 or 11.1% overall, specifically, 4 or 7.3% Freshmen - 1 AE, 1 BCE, 1 ABCE, 1 BCDE; 12 or 22.2% Sophomores - 9 BCE, 2 BE, 1 AE; and 3 or 9.7% Seniors - 1 BE, 1 CE, 1 BCE.

Therefore, nearly half of the students overall thought that general dental practitioners would be able to treat this patient. The Pearson statistic was significant as the correct answer stood out, and the majority of participants overall, as well as in the Junior and Senior groups, responded correctly.

+Q 36 - Necessity for Extractions. Seventy percent of the orthodontists decided that extractions were indicated in this case, while 30% thought they were not needed to treat this patient.

The participants in this study answered in a similar manner. Overall, 104 or 60.8% decided extractions were necessary, specifically, 33 or 60% Freshmen, 33 or 61.1% Sophomores, 22 or 71% Juniors, and 16 or 51.6% Seniors. A total of 63 or 36.8% thought no extractions were required in this case, which included 20 or 36.4% Freshmen, 20 or 37% Sophomores, 9 or 29% Juniors and 14 or 45.2% Seniors. Only 1 or 1.8% Freshmen gave no answer to this question.

+Q 37 - Diagnostic Records: Models. Ninety percent of the orthodontists relied on the models in a large part, and 10% in a small part to diagnose this case.

One-hundred-forty-five or 84.8% of the respondents needed the models in large part to diagnose this case, specifically, 43 or 78.2% Freshmen, 48 or 88.9% Sophomores, 28 or 90.3% Juniors, and 26 or 83.9% Seniors. Ten or 18.2% Freshmen, 5 or 9.3% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors, totalling 19 or 11.1% found they required the models in a small part. Only 7 or 4.1% overall answered they totally utilized the models, specifically, 2 or 3.6% Freshmen, 1 or 1.8% Sophomores, 1 or 3.2% Juniors, and 3 or 9.7% Seniors.

+Q 38 - Diagnostic Records: Photographs. Sixty percent of the orthodontists determined they relied on the photographs in a small part and the other 40% decided they needed them in a large part to diagnose this case.

Overall, 69 or 40.4% answered that they needed the photographs in a small part, including 21 or 38.2% Freshmen, 27 or 50% Sophomores, 11 or 35.5% Juniors and 10 or 32.3% Seniors. A total of 90 or 52.6% indicated they used them in a large part and consisted of 26 or 47.3% Freshmen, 27 or 50% Sophomores, 18 or 58.1% Juniors, and 19 or 61.3% Seniors. Among those who answered totally were 6 or 10.9% Freshmen, 2 or 6.4% Juniors, and 2 or 6.4% Seniors, which equalled 10 or 5.8%. Only 2 or 3.6% Freshmen decided they did not need the photographs at all to diagnose this case. This question indicated a reversal, as the majority of participants overall, as well as in the Freshmen, Junior and Senior groups, answered with an incorrect response. Also, the Sophomore students were evenly divided with correct and incorrect responses.

+Q 39 - Diagnostic Records: X-Rays. Sixty percent of the orthodontists found they needed the radiograph in a large part in order to diagnose this case, while the other 40% thought it was in a small part.

Seventy-five or 43.9% overall responded they needed the radiograph in a large

part, which included 21 or 38.2% Freshmen, 26 or 48.1% Sophomores, 17 or 54.8% Juniors and 11 or 35.5% Seniors. The same number, 75 or 43.9% overall, answered in a small part which included 23 or 41.8% Freshmen, 23 or 42.6% Sophomores, 10 or 32.3% Juniors, and 19 or 61.3% Seniors. Among those who decided they totally relied on the radiograph were 5 or 9.1% Freshmen, 3 or 5.6% Sophomores, 3 or 9.7% Juniors, and 1 or 3.2% Seniors, which equalled 12 or 7%. Only 9 or 5.3% overall thought they did not need the radiograph at all to diagnose this case, and this consisted of 6 or 10.9% Freshmen, 2 or 3.7% Sophomores, and 1 or 3.2% Juniors. This question indicated a reversal as the majority of participants overall, as well as in the Freshman, Sophomore, and Senior groups, responded incorrectly.

Case Four

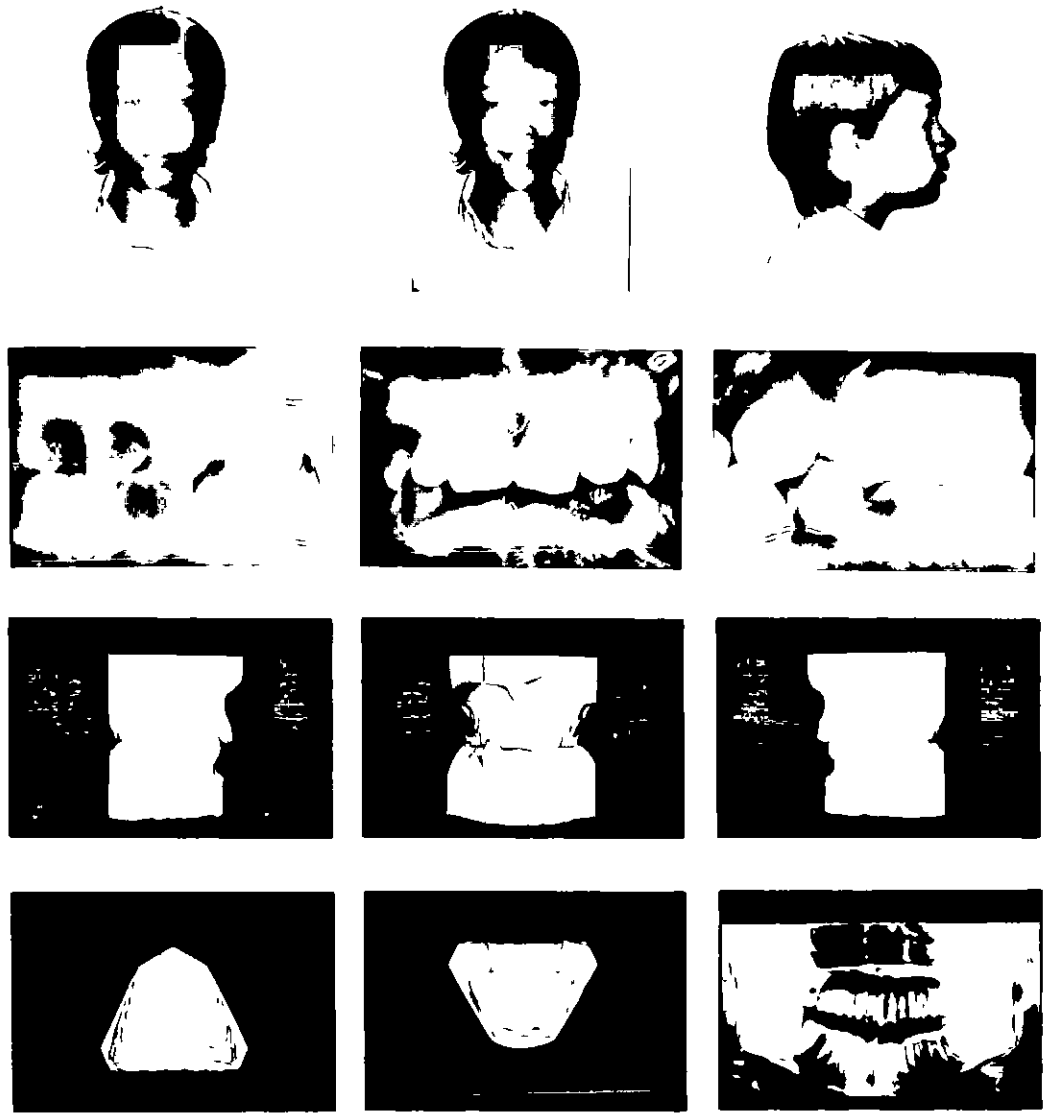
Caucasian Male

12 years, 11 months

Medical History: Non-Contributory

Dental History: Non-Contributory

Class II skeletal with a retruded mandible in the permanent dentition with Class I cuspid and molar relationships. There is moderate maxillary and severe mandibular crowding with moderate overbite and overjet. There is gingival inflammation and, when closed, the lips are tense. Figure 5



Case Four

+Q 1 - Appearance of the Facial Profile. Eighty percent of the orthodontists determined that the facial profile was convex or Class II and 20% thought that it was straight or Class I.

Overall 98 of the 171 participants or 57.3% decided this profile was convex or Class II, which included 34 or 61.8% Freshmen, 23 or 42.6% Sophomores, 26 or 83.9% Juniors, and 15 or 48.4% Seniors. Those who selected straight or Class I included 11 or 20% Freshmen, 29 or 53.7% Sophomores, 3 or 9.7% Juniors, and 15 or 48.4% Seniors, which totalled 58 or 33.9% overall. A concave or Class III profile was chosen by 10 or 5.8% overall, specifically, 5 or 9.1% Freshmen, 2 or 3.7% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors. Only 5 or 9.1% Freshmen believed it was bimaxillary protrusive.

Therefore, 98 or 57.3% overall correctly identified that the profile was convex which included only 15 or 48.4% of the Seniors, whereas a high number of Juniors, 26 or 83.9%, were able to correctly diagnose the profile. The same number of seniors, 15 or 48.4%, thought the profile was straight. The Pearson statistic was significant as the correct answer stood out, and the majority of participants overall, as well as in the Freshman and Junior groups, answered this question correctly, while the majority of students in the Sophomore group answered incorrectly, and an equal percentage in the Senior group responded with the correct as well as one of the incorrect answers.

+Q 2 - Position of the Mandible. Seventy percent of the orthodontists diagnosed that the position of the mandible was retruded, while 30% thought it was straight.

Overall, 82 or 48% believed the mandible was retruded, which included 32 or 58.2% Freshmen, 19 or 35.2% Sophomores, 19 or 61.3% Juniors, and 12 or 38.7%

Table 43.--Chi-Square Results for Case Four Undergraduate Dental Students

Question Number	Pearson Chi-Square	Degrees of Freedom	Significance
1	35.48325	9	0.00005*
2	13.13792	6	0.04090*
3	14.45917	6	0.02491*
4	7.21291	3	0.06541
5	16.46941	6	0.01144*
6	9.29293	6	0.15776
7	16.99804	6	0.00929*
8	10.68042	6	0.09877
9	14.95157	12	0.24410
10	21.35235	9	0.01117*
11	7.00259	9	0.63685
12	19.62774	9	0.02035*
13	23.88131	9	0.00449*
14	7.22980	6	0.30012
15	6.56798	6	0.36265
16	9.61196	9	0.38280
17	17.06657	9	0.04768*
18	14.65115	6	0.02315*
19	3.60571	3	0.30731
20	12.90349	9	0.16702
21	7.59175	6	0.26956
22	7.64417	6	0.26535
23	15.47535	6	0.01686*
24	9.74200	6	0.13595
25	1.49979	3	0.68232
26	3.60163	3	0.30782
27	21.67486	9	0.00997*
28	8.54865	9	0.47993
29	14.65586	12	0.26080
30	23.85576	9	0.00454*
31	16.06977	18	0.58768
32	9.60431	12	0.65063
33	22.33768	15	0.09925
34	6.29385	6	0.39109
35	19.98564	18	0.33363
36	3.90160	3	0.27229
37	11.98696	9	0.21405
38	14.49892	12	0.26999
39	20.62537	12	0.05614

*p<.05

Seniors. The same number overall, 82 or 48% thought the mandible was in a straight position, specifically 19 or 34.5% Freshmen, 34 or 63% Sophomores, 11 or 35.5% Juniors, and 18 or 58.1% Seniors, while only a total of 7 or 4.1% answered that it was prominent, which consisted of 4 or 7.3% Freshmen, 1 or 1.8% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors.

Overall, just under half of those surveyed thought the mandibular position was retruded, therefore, this question indicated a reversal as the majority overall responded incorrectly. The Pearson statistic was significant with 48% overall answering correctly, but with an equal percentage responding with one of the incorrect answers. The majority of participants in the Freshman and Junior groups answered this question correctly, however, the majority in the Sophomore and Senior groups answered incorrectly.

+Q 3 - Treatment for the Mandibular Position. Sixty percent of the orthodontists thought that no treatment for the mandibular position was needed, while 40% believed that treatment was necessary.

Overall, 113 or 66.1% decided no treatment was necessary, including 29 or 52.7% Freshmen, 37 or 68.5% Sophomores, 28 or 90.3% Juniors, and 19 or 61.3% Seniors, while a total of 57 or 33.3% thought no treatment was indicated, specifically 25 or 45.5% Freshmen, 17 or 31.5% Sophomores, 3 or 9.7% Juniors and 12 or 38.7% Seniors. The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall, as well as in each group, responded correctly to this question.

+Q 4 - Treatment for the Facial Profile. Seventy percent of the orthodontists determined the profile needed to be treated, while 30% thought no treatment was necessary.

The participants in this study were divided on the answer to this question. Overall, 84 or 49.1% decided treatment was indicated, specifically 33 or 60% Freshmen, 19 or 35.2% Sophomores, 15 or 48.4% Juniors, and 17 or 54.8% Seniors, while a total of 87 or 50.9% thought no treatment was needed, which included 22 or 40% Freshmen, 35 or 64.8% Sophomores, 16 or 51.6% Juniors, and 14 or 45.2% Seniors.

Therefore, a large percentage in the Sophomore, Junior and Senior groups incorrectly reached the conclusion that no treatment was required. This question indicated a reversal as the majority of individuals overall, as well as in the Sophomore and Junior groups, responded incorrectly. However, just over a majority of students in the Freshman and Senior groups answered correctly.

+Q 5 - Appearance of the Lips. All the orthodontists agreed that the appearance of the lips appeared to be tense.

Overall, 82 of the 171 participants or 48% identified that the appearance of the lips was tense, specifically, 27 or 49.1% Freshmen, 26 or 48.1% Sophomores, 8 or 25.8% Juniors, and 21 or 67.7% Seniors. Among those who thought the lips appeared normal were 23 or 41.8% Freshmen, 22 or 40.7% Sophomores, 14 or 45.2% Juniors, and 5 or 16.1% Seniors, which equalled 64 or 37.4%. A total of 25 or 14.6% believed the lips appeared flaccid and included 5 or 9.1% Freshmen, 6 or 11.1% Sophomores, 9 or 29% Juniors and 5 or 16.1% Seniors.

Two-thirds of the Seniors diagnosed this problem correctly, while the other groups were divided among the choices. The Pearson statistic was significant, however, the majority of participants overall, as well as in the Freshman, Sophomore and Junior groups, answered this question incorrectly, but the majority of students in the Senior group did respond correctly. Therefore, this question indicated a reversal.

+Q 6 - Treatment for the Labial Appearance. Seventy percent of the orthodontists determined that treatment for the appearance of the lips was indicated, while the other 30% thought it was not needed.

Overall, only 66 or 38.6% decided to treat the appearance of the lips, specifically, 19 or 34.5% Freshmen, 21 or 38.9% Sophomores, 10 or 32.3% Juniors, and 16 or 51.6% Seniors. A total of 99 or 57.9% responded that no treatment was necessary, which included 36 or 65.4% Freshmen, 29 or 53.7% Sophomores, 19 or 61.3% Juniors and 15 or 48.4% Seniors. Even though 107 or 62.6% overall thought the appearance of the lips was not normal, only 66 or 38.6% felt treatment was needed. This included 26 or 83.8% of the Seniors who did not find a normal labial appearance compared to only 16 or 51.6% who would treat this problem.

Therefore, even though a good number of students recognized a problem with the soft tissue, a much smaller number actually wished to correct it in each of the four groups surveyed. This question indicated a reversal, as the majority overall, as well as in the Freshman, Sophomore and Junior groups, responded incorrectly. However, just over a majority in the Senior group answered it correctly.

+Q 7 - Stage of Dentition. All of the orthodontists agreed that this patient was in the permanent stage of dentition.

Overall, 151 or 88.3% identified that this subject exhibited permanent dentition, specifically 42 or 76.4% Freshmen, 50 or 92.6% Sophomores, 29 or 93.5% Juniors, and 30 or 96.8% Seniors, which indicated a trend. Only a total of 16 or 9.4% thought this was the mixed dentition, which included 11 or 20% Freshmen, 4 or 7.4% Sophomores, and 1 or 3.2% Seniors, while 2 or 3.6% Freshmen and 2 or 6.4% Juniors answered primary dentition which equalled 4 or 2.3% overall. The Pearson statistic was significant, as the correct answer really stood out with an evident trend,

since the majority of students in each group answered correctly in an increasing manner from the first year through the fourth year.

+Q 8 - Appropriate Dentition. All of the orthodontists concurred that the dentition was appropriate for this male subject's age of 12 years and 11 months.

Overall 156 or 91.2%, specifically, 47 or 85.5% Freshmen, 51 or 94.4% Sophomores, 28 or 90.3% Juniors, and 30 or 96.8% Seniors, determined that the dentition was appropriate for this patient. Only 14 or 8.2% thought the dentition was not appropriate and included 8 or 14.5% Freshmen, 3 or 5.6% Sophomores, and 3 or 9.7% Juniors. Therefore, since so many answered this question correctly, it was not a good determinator of ability.

+Q 9 - Cuspid Relationship - Right Side. All of the orthodontists agreed that the cuspid relationship was Class I.

Overall, 120 or 70.2% determined that the cuspid relationship was Class I, which included 30 or 54.5% Freshmen, 40 or 74.1% Sophomores, 24 or 77.4% Juniors, and 26 or 83.9% Seniors. This indicated a trend, for as the level of education increased, so did the percentage who answered correctly in each group. Class II relationship was chosen by 37 or 21.6% overall, specifically, 18 or 32.7% Freshmen, 10 or 18.5% Sophomores, 5 or 16.1% Juniors, and 4 or 12.9% Seniors. Only a total of 11 or 6.4% selected Class III, and included 4 or 7.3% Freshmen, 4 or 7.4% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors. Only 2 or 3.6% Freshmen, decided it was an end-to-end relationship, and 1 or 1.8% Freshmen did not have any answer for this question.

+Q 10 - Cuspid Relationship - Left Side. All of the orthodontists agreed that the cuspid relationship was Class I.

Overall, 120 or 70.2% indicated that the cuspid relationship was Class I,

specifically, 30 or 54.5% Freshmen, 47 or 87% Sophomores, 24 or 77.4% Juniors, and 19 or 61.3% Seniors. Among those who answered Class II included 18 or 32.7% Freshmen, 5 or 9.3% Sophomores, 4 or 12.9% Juniors, and 11 or 35.5% Seniors, which equalled 38 or 22.2%. Only 8 or 4.7% overall chose Class III including 4 or 7.3% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors, and those who believed it was end-to-end included 3 or 5.4% Freshmen and 2 or 6.4% Juniors which totalled 5 or 2.9%.

One may note that 26 or 83.9% of the Seniors answered Class I on the right side, yet on the left side only 19 or 61.3% did so, while 11 or 35.5% decided it was a Class II relationship. The other three groups answered these last two questions on cuspid relationship more consistently than did the Senior group. The Pearson statistic was significant as the correct answer stood out and the majority of students overall, as well as in each of the four groups, responded correctly to this question.

+Q 11 - Treatment for the Cuspid Relationship. All the orthodontists agreed that no treatment was required in this case.

Overall, 69% or 118 responded that no treatment for the cuspid relationship was needed and included 32 or 58.2% Freshmen, 39 or 72.2% Sophomores, 23 or 74.2% Juniors and 24 or 77.4% Seniors. This indicated a slight trend, for as the education level increased, so did the scores in each group responding correctly. The individuals who decided to treat consisted of 21 or 38.2% Freshmen, 14 or 25.9% Sophomores, 8 or 25.8% Juniors, and 7 or 22.6% Seniors. Overall, 120 or 70.2% determined the patient had a Class I cuspid relationship and a similar number overall, 118 or 69%, decided no treatment was necessary in this case. About a quarter of the Junior and Senior students wanted to treat this patient and erroneously identified that a problem existed as detailed in the previous two questions.

+Q 12 - Molar Relationship - Right Side. All of the orthodontists agreed that the molar relationship was Class I.

A very large number, 146 of the 171 participants or 85.4% overall, determined that the molar relationship was Class I, including 42 or 76.4% Freshmen, 46 or 85.2% Sophomores, 29 or 93.5% Juniors, and 29 or 93.5% Seniors. Overall, 6 or 3.5% answered end-to-end and 6 or 3.5% answered Class II, specifically 5 or 9.1% Freshmen and 1 or 3.2% Juniors for the former and 1 or 1.8% Freshmen, and 5 or 9.3% Sophomores for the latter. A total of 13 or 7.6% believed this was a Class III relationship, and included 7 or 12.7% Freshmen, 3 or 5.6% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors. The Pearson statistic was significant as the correct answer really stood out, and the majority of participants overall, as well as in each group, responded correctly.

+Q 13 - Molar Relationship - Left Side. All the orthodontists agreed that the molar relationship was Class I.

Overall, 126 or 73.7% identified that the molar relationship was Class I, specifically, 34 or 61.8% Freshmen, 38 or 70.4% Sophomores, 25 or 80.6% Juniors, and 29 or 93.5% Seniors, which indicated a trend for as the education level increased, so did the percentage of students who answered this question correctly. End-to-end was selected by 10 or 5.8% overall and Class II by a total of 11 or 6.4%. This included 8 or 14.5% Freshmen and 2 or 6.4% Juniors for the former classification, and 3 or 5.4% Freshmen, 7 or 13% Sophomores, and 1 or 3.2% Juniors for the latter one. Twenty-four or 14% overall, believed it was Class III, and this was comprised of 10 or 18.2% Freshmen, 9 or 16.7% Sophomores, 3 or 9.7% Juniors and 2 or 6.4% Seniors.

A slightly smaller number in the Freshmen, Sophomore and Junior groups did not correctly answer this question as compared to the previous question, however, the

same number in the Senior group answered this question exactly as they did previously. The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall, as well as in each group, answered correctly. A trend was also evident with the percentage of correct answers increasing from the Freshmen through the Senior groups.

+Q 14 - Treatment for the Molar Relationship. All of the orthodontists concurred that no treatment was necessary in this case.

Overall, 135 or 78.9% reached the conclusion that no treatment was necessary for this patient, specifically, 38 or 69.1% Freshmen, 44 or 81.5% Sophomores, 25 or 80.6% Juniors and 28 or 90.3% Seniors. This was answered consistently with the previous two questions. Those who responded that treatment of the molar relationship was needed included 16 or 29.1% Freshmen, 10 or 18.5% Sophomores, 6 or 19.3% Juniors, and 3 or 9.7% Seniors, which totalled 35 or 20.5%. Only 1 or 1.8% Freshmen gave no answer to this question.

+Q 15 - Presence of an Overbite. All of the orthodontists agreed that an overbite was present in this case.

Nearly all of the 171 participants, 163 or 95.3% found an overbite to exist, which included 51 or 92.7% Freshmen, 50 or 92.6% Sophomores, all 31 or 100% Juniors, and all 31 or 100% Seniors. Only a total of 7 or 4.1% believed no overbite existed, and included 3 or 5.4% Freshmen and 4 or 7.4% Sophomores. Also, just 1 or 1.8% Freshmen gave no answer to this question. The large number of participants that correctly answered this question indicated that it was not a good determinator of ability as it was extremely easy.

+Q 16 - Amount of Overbite. Fifty percent of the orthodontists diagnosed a moderate amount of overbite to be present and the other 50% thought it was an

excessive amount.

The students who thought the overbite was either moderate or excessive totalled 161 or 94.2% overall. Specifically those who indicated moderate included 10 or 18.2% Freshmen, 5 or 9.3% Sophomores, 4 or 12.9% Juniors, and 3 or 9.7% Seniors, which totalled 22 or 12.9%. Those who answered excessive consisted of 39 or 70.9% Freshmen, 45 or 83.3% Sophomores, 27 or 87.1% Juniors, and 28 or 90.3% Seniors, which equalled 139 or 81.3%. Only 8 or 4.7% thought the amount of overbite was acceptable, specifically 5 or 9.1% Freshmen and 3 or 5.6% Sophomores. Only 1 or 1.8% Freshmen and 1 or 1.8% Sophomores did not give any answer for this question. Since the experts were divided on the answer to this question, it was not a good indicator by which to measure the participants' ability.

+Q 17 - Treatment for the Overbite. All of the orthodontists determined that the amount of overbite present required treatment.

A large number of participants, 151 or 88.3% overall, indicated treatment for this overbite was necessary, specifically, 46 or 83.6% Freshmen, 50 or 92.6% Sophomores, 24 or 77.4% Juniors, and all 31 or 100% Seniors. Only a total of 17 or 9.9% thought no treatment was needed, and included 7 or 12.7% Freshmen, 3 or 5.6% Sophomores, and 7 or 22.6% Juniors, which seemed to be a bit high for third year students. The Pearson statistic was significant as the correct answer really stood out as the majority of participants overall, as well as in each group, answered this question correctly.

+Q 18 - Presence of an Open Bite. All of the orthodontists concurred that no open bite was present in this case.

Overall, 156 of the 171 participants or 91.2% determined that there was no open bite in this patient, and included 49 or 89.1% Freshmen, 53 or 98.1%

Sophomores, 24 or 77.4% Juniors, and 30 or 96.8% Seniors. Only a total of 14 or 8.2% thought an open bite existed, specifically, 5 or 9.1% Freshmen, 1 or 1.8% Sophomores, 7 or 22.6% Juniors, which seemed high, and 1 or 3.2% Seniors. Since this question was answered correctly by so many students, it was not a good determinator of ability. The Pearson statistic was significant as the correct answer really stood out, since the great majority of participants overall, as well as in each of the four groups, answered it correctly.

+Q 19 - Presence of Overjet. All of the orthodontists agreed that overjet was present in this subject.

A very large number of participants overall, 162 or 94.7% identified that overjet existed in this patient, specifically, 50 or 90.9% Freshmen, 51 or 94.4% Sophomores, all 31 or 100% Juniors, and 30 or 96.8% Seniors. Only a total of 9 or 5.3% overall thought no overjet was present, which included 5 or 9.1% Freshmen, 3 or 5.6% Sophomores, and 1 or 3.2% Seniors. This question was not a good determinator of ability since it was correctly answered by so many individuals and, therefore, was too easy.

+Q 20 - Amount of Overjet. All of the orthodontists agreed that this patient exhibited a moderate amount of overjet.

Overall, 76 or 44.4% diagnosed a moderate amount of overjet present, which included 26 or 47.3% Freshmen, 24 or 44.4% Sophomores, 14 or 45.2% Juniors and 12 or 38.7% Seniors. Those who believed the overjet was excessive consisted of 20 or 36.4% Freshmen, 21 or 38.9% Sophomores, 7 or 22.6% Juniors, and 7 or 22.6% Seniors, which equalled 55 or 32.2%. An acceptable amount of overjet was indicated by 35 or 20.5% overall, specifically 7 or 12.7% Freshmen, 7 or 13% Sophomores, 10 or 32.3% Juniors, and 11 or 35.5% Seniors. Only 2 or 3.6% Freshmen, 2 or 3.7%

Sophomores, and 1 or 3.2% Seniors did not give any answer for this question.

There was no real agreement by the students on the amount of overjet that was exhibited by this patient. Since the majority overall, as well as in each of the four groups, responded to this question incorrectly, a reversal was indicated.

+Q 21 - Treatment for the Overjet. All of the orthodontists concurred that the amount of overjet present needed to be treated.

Overall, 119 or 69.6% identified that the overjet required treatment, including 41 or 74.5% Freshmen, 33 or 61.1% Sophomores, 19 or 61.3% Juniors, and 26 or 83.9% Seniors. A total of fifty or 29.2% responded that no treatment was necessary, specifically, 13 or 23.6% Freshmen, 20 or 37% Sophomores, 12 or 38.7% Juniors, and 5 or 16.1% Seniors. Only 1 or 1.8% Freshmen and 1 or 1.8% Sophomores gave no answer to this question.

Even though 61.3% of the Seniors thought that the overjet present was moderate or excessive, a greater number of Seniors, 83.9%, indicated that treatment was required. Those in the Freshmen, Sophomore and Junior groups who determined the overjet was not acceptable were 83.7%, 83.3% and 67.3% respectively, while 74.5% of the Freshmen, 61.1% of the Sophomores,and 61.3% of the Juniors decided treatment should be performed, which was in each instance, less than the percentage that identified a problem existed.

+Q 22 - Presence of a Cross-Bite. All of the orthodontists agreed that no cross-bite was present in this patient.

The great majority of the participants, 165 or 96.5% diagnosed that no cross-bite was present in this subject, and included 53 or 96.4% Freshmen, all 54 or 100% of the Sophomores, 29 or 93.5% Juniors, and 29 or 93.5% Seniors. Only 5 or 2.9% overall, specifically 2 or 3.6% Freshmen, 1 or 3.2% Juniors, and 2 or 6.4% Seniors,

thought a cross-bite existed. Just 1 or 3.2% Juniors gave no answer for this question. Therefore, since so many of those surveyed answered correctly, this question was not a good determinator of ability as it was extremely easy.

+Q 23 - Location of Cross-Bite. All the orthodontists agreed that, since no cross-bite existed, this question was not applicable.

The participants who answered that this question was not applicable included 45 or 81.8% Freshmen, 49 or 90.7% Sophomores, 27 or 87.1% Juniors, and 19 or 61.3% Seniors, which totalled 140 or 81.9%. Only 9 or 5.3% in all thought there was an anterior cross-bite, while 22 or 12.9% identified a posterior cross-bite. This consisted of 4 or 7.3% Freshmen, 1 or 1.8% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors, for the former, and 6 or 10.9% Freshmen, 4 or 7.4% Sophomores, 2 or 6.4% Juniors, and 10 or 32.3% Seniors for the latter.

This question was answered fairly consistently with the previous one except for the 10 or 32.3% Senior students who said a posterior cross-bite existed. The Pearson statistic was significant as the correct answer stood out and the majority of participants overall, as well as in each of the four groups, responded correctly.

+Q 24 - Presence of a Maxillary Transverse Deficiency. All the orthodontists concurred that no maxillary transverse deficiency existed in this case.

Overall, 137 or 80.1% diagnosed no maxillary transverse deficiency was evident, and included 43 or 78.2% Freshmen, 45 or 83.3% Sophomores, 23 or 74.2% Juniors, and 26 or 83.9% Seniors. Among those who located a maxillary transverse deficiency were 12 or 21.8% Freshmen, 6 or 11.1% Sophomores, 8 or 25.8% Juniors, and 5 or 16.1% Seniors. Also, only 3 or 5.6% Sophomores did not give any answer to this question.

+Q 25 - Presence of Spacing. Ninety percent of the orthodontists determined

that no spacing existed and 10% decided spacing was present.

Overall 138 or 80.7% identified no spacing in the arches, which included 42 or 76.4% Freshmen, 44 of 81.5% Sophomores, 27 or 87.1% Juniors and 25 or 80.6% Seniors. Among those who found spacing were 13 or 23.6% Freshmen, 10 or 18.5% Sophomores, 4 or 12.9% Juniors, and 6 or 19.3% Seniors.

+Q 26 - Presence of Crowding. All of the orthodontists agreed that there was crowding present in this case.

Out of 171 participants, 161 or 94.2% determined that crowding existed, specifically, 50 or 90.9% Freshmen, 50 or 92.6% Sophomores, 30 or 96.8% Juniors, and all 31 or 100% of the Seniors. This increasing progression of scores indicated a trend, yet since so many answered correctly, this question was not a good determinator of ability as it was too easy. Only 10 or 5.8% overall thought that no crowding was evident, and included 5 or 9.1% Freshmen, 4 or 7.4% Sophomores, and 1 or 3.2% Juniors.

+Q 27 - Amount of Crowding - Maxilla. Seventy percent of the orthodontists identified a moderate amount of crowding present in the maxillary arch, while 30% found a slight amount of crowding existed.

The largest number, 81 or 47.4% thought that a slight amount of crowding existed in the maxillary arch, specifically 32 or 58.2% Freshmen, 27 or 50% Sophomores, 10 or 32.3% Juniors, and 12 or 38.7% Seniors. Overall, 63 or 36.8% indicated that moderate crowding was present, which included 14 or 25.4% Freshmen, 15 or 27.8% Sophomores, 15 or 48.4% Juniors, and 19 or 61.3% Seniors. Only a total of 8 or 4.7% found the crowding to be severe, which in detail was 4 or 7.3% Freshmen, 2 or 3.7% Sophomores, and 2 or 6.4% Juniors. Overall, 19 or 11.1% decided there was no crowding present in this arch, including 5 or 9.1% Freshmen, 10

or 18.5% Sophomores, and 4 or 12.9% Juniors.

This increasing progression of scores of those who selected moderate crowding indicated a trend. The Senior students most closely approximated the findings of the experts regarding the amount of crowding. The Pearson statistic was significant, however, this question indicated a reversal, as the majority of participants answered this question incorrectly. Only a majority of Seniors responded with the correct answer, however, a trend was observed from the Freshmen through the Senior groups as they answered in an increasingly correct manner.

+Q 28 - Amount of Crowding - Mandible. Sixty percent of the orthodontists diagnosed a severe amount of crowding in the mandibular arch, while 40% found a moderate amount.

The majority of respondents, 102 or 59.6%, determined that the crowding present in the mandibular arch was severe, which included 32 or 58.2% Freshmen, 33 or 61.1% Sophomores, 16 or 51.6% Juniors, and 21 or 67.7% Seniors. The next most common answer was moderate crowding and was chosen by 55 or 32.2% overall, specifically, 17 or 30.9% Freshmen, 17 or 31.5% Sophomores, 13 or 41.9% Juniors, and 8 or 25.8% Seniors, and only 3 or 5.4% of the Freshmen thought there was no crowding present. A slight amount of crowding was selected by 3 or 5.4% Freshmen, 4 or 7.4% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors, which totalled 11 or 6.4%. This question was answered more consistently by those surveyed and better mirrored the findings of the experts than did the last question.

+Q 29 - Treatment for the Crowding. All of the orthodontists agreed that this amount of crowding needed to be treated.

Overall, 159 or 93%, found that crowding required treatment, specifically 49 or 89.1% Freshmen, 52 or 96.3% Sophomores, 28 or 90.3% Juniors, and 30 or 96.8%

Seniors. Only 8 or 4.7% found no treatment was necessary, and included 4 or 7.3% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors. Only 1 or 1.8% Freshmen gave no answer to this question. Since so many students answered this question correctly, it was not a good determinator to test their ability.

+Q 30 - Co-incidence of Midlines. Ninety percent of the orthodontists indicated the dental midlines were co-incident while 10% found them not to be co-incident.

Overall, 71 or 41.5% of the participants determined that the midlines were co-incident, whereas 98 or 57.3% found them not to be co-incident. Specifically, this included 21 or 38.2% Freshmen, 34 or 63% Sophomores, 8 or 25.8% Juniors, and 8 or 25.8% Seniors for the former, and 34 or 61.8% Freshmen, 19 or 35.2% Sophomores, 22 or 71% Juniors, and 23 or 74.2% Seniors for the latter. The Pearson statistic was significant, however, this question indicated a reversal, as the majority of individuals answered this question incorrectly. Only the majority of students in the Sophomore group responded correctly.

+Q 31 - Presence of Dental Conditions: A) Missing teeth, B) Supernumerary teeth, C) Impacted teeth, D) Malformed teeth, or E) none of the above. All of the orthodontists agreed that none of these dental conditions were present.

Overall, 135 or 78.9% identified no unusual dental conditions to be present which included 38 or 69.1% Freshmen, 45 or 83.3% Sophomores, 27 or 87.1% Juniors, and 25 or 80.6% Seniors. A total of 8 or 4.7% chose A, specifically 3 or 5.4% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors, while a total of 5 or 2.9% chose B, which included 3 or 5.4% Freshmen, 1 or 1.8% Sophomores, and 1 or 3.2% Juniors. Overall, 7 or 4.1% selected C, and 14 or 8.2% answered D, including 3 or 5.4% Freshmen, 1 or 1.8% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors for the former, and 7 or 12.7% Freshmen, 5 or 9.3%

Sophomores, and 2 or 6.4% Seniors for the latter. Only 1 or 3.2% Seniors gave no answer, and only 1 or 1.8% Freshmen answered C and D. Overall, this question was answered correctly in a rather consistent manner.

+Q 32 - Gingival Health: All the orthodontists agreed that the gingiva did not appear to be healthy in this patient.

Only 37 or 21.6% overall found the gingiva not to be healthy in this case. This included 10 or 18.2% Freshmen, 15 or 27.8% Sophomores, 7 or 22.6% Juniors, and 5 or 16.1% Seniors. A total of 129 or 75.4% did find the gingival health to be good, specifically, 43 or 81.8% Freshmen, 38 or 70.4% Sophomores, 23 or 74.2% Juniors, and 25 or 80.6% Seniors. Just 1 or 3.2% Seniors did not give any answer for this question. About three-quarters of those surveyed were not able to recognize that the gingiva was unhealthy. This question indicated a reversal, as the majority of participants overall, as well as in each of the four groups, responded with the incorrect answer.

+Q 33 - Presence of Periodontal Conditions: A) Recession of the gum tissue, B) Defects in the gingiva, C) Bone loss, or D) none of the above. All of the orthodontists found that no unusual periodontal conditions were present in this patient.

Overall, 141 or 82.5% found none of these conditions present, specifically, 49 or 89.1% Freshmen, 38 or 70.4% Sophomores, 27 or 87.1% Juniors, and 27 or 87.1% Seniors. A total of 4 or 2.3% thought recession was present, which included 2 or 3.6% Freshmen, 1 or 1.8% Sophomores, and 1 or 3.2% Juniors, and 16 or 9.4% overall found gingival defects and included 1 or 1.8% Freshmen, 11 or 20.4% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors. Just 4 or 2.3% noticed bone loss, specifically, 1 or 1.8% Freshmen, and 3 or 5.6% Sophomores, and only 1 or 3.2% Seniors did not give any answer for this question. This question was answered

quite consistently except for the 11 or 20.4% in the Sophomore group who thought gingival defects existed in this case.

+Q 34 - Need for Orthodontic Treatment. All of the orthodontists agreed that orthodontic treatment was required in this case.

Overall, 164 of the 171 participants or 95.9% responded that orthodontic treatment was needed by this patient, which included 52 or 94.5% Freshmen, 52 or 96.3% Sophomores, 29 or 93.5% Juniors, and all 31 or 100% Seniors. Only a total of 6 or 3.5% thought no treatment was necessary, specifically 3 or 5.4% Freshmen, 2 or 3.7% Sophomores, and 1 or 3.2% Juniors. This question was not a good determinator of ability, as the great majority of participants responded correctly, therefore, it was too easy.

+Q 35 - Provider for Orthodontic Treatment: A) A general dentist who treats limited aspects of orthodontics, B) A general dentist who treats all aspects of orthodontics, C) A general dentist who only practices orthodontics, D) A pedodontist, E) An orthodontist. All the orthodontists agreed that an orthodontist should provide treatment for this patient.

Overall, 100 or 58.5% decided that an orthodontist should provide treatment in this case, specifically 35 or 63.6% Freshmen, 29 or 53.7% Sophomores, 20 or 64.5% Juniors, and 16 or 51.6% Seniors. A total of 19 or 11.1% chose A, which included 5 or 9.1% Freshmen, 4 or 7.4% Sophomores, 2 or 6.4% Juniors, and 8 or 25.8% Seniors. Twenty-eight or 16.4% overall decided on B, specifically, 9 or 16.4% Freshmen, 9 or 16.7% Sophomores, 7 or 22.6% Juniors, and 3 or 9.7% Seniors. Overall, 4 or 2.3% Chose C, and 2 or 1.2% Chose D, and consisted of 1 or 1.8% Freshmen, 2 or 3.7% Sophomores, and 1 or 3.2% Juniors for the former, and 1 or 1.8% Freshmen, and 1 or 3.2% Seniors for the latter. A total of 2 or 1.2% gave no

answer, while 16 or 9.4% overall gave multiple answers: 3 or 5.4% Freshmen - 2 BCE, 1 BCDE; 9 or 16.7% Sophomores - 6 BCE, 2 BE, and 1 CE; 1 or 3.2% Juniors - 1 BCE; and 3 or 9.7% Seniors - 1 CE, 1 BCE, 1 ABCDE.

Just 20 or 64.5% Juniors, and 16 or 51.6% Seniors thought only an orthodontist should treat this patient, while 7 or 22.6% Juniors decided that a general dentist who treats all aspects of orthodontics should treat this case, and 8 or 25.8% Seniors felt that a general dentist who treats limited aspects of orthodontics should provide care. Therefore, it appears that over 40% of those surveyed felt this case was too easy for a specialist and that a general dentist could treat it.

+Q 36 - Necessity for Extractions. Ninety percent of the orthodontists determined that extractions were necessary in this case, whereas 10% found that no extractions were required.

Overall, 96 or 56.1% indicated that extractions were necessary in preparation for orthodontic treatment, specifically, 29 or 52.7% Freshmen, 27 or 50% Sophomores, 18 or 58.1% Juniors, and 22 or 71% Seniors. A total of 75 or 43.9% which included 26 or 47.3% Freshmen, 27 or 50% Sophomores, 13 or 41.9% Juniors, and 9 or 29% Seniors believed that no extractions were needed to treat this patient orthodontically. The majority of the Senior group, 71%, recognized the need for extractions to successfully treat this patient, while an average of only 54% of the other three groups thought it necessary to extract.

+Q 37 - Diagnostic Records: Models. Ninety percent of the orthodontists found that they utilized the models in a large part to diagnose this case, while 10% used them in a small part.

Overall, 150 or 87.7% of the participants used the models in a large part, which included 45 or 81.8% Freshmen, 50 or 92.6% Sophomores, 27 or 87.1% Juniors, and

28 or 90.3% Seniors. Only a total of 7 or 4.1% found they totally used the models to diagnose this case, specifically, 1 or 1.8% Freshmen, 1 or 1.8% Sophomores, 3 or 9.7% Juniors, and 2 or 6.4% Seniors, while 13 or 7.6% overall indicated they used them in a small part, including 8 or 14.5% Freshmen, 3 or 5.6% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors. Just 1 or 1.8% Freshman did not use the models at all. This question was correctly answered in a very consistent manner by all the groups, however, it was not a good determinator of ability as it was too easy.

+Q 38 - Diagnostic Records: Photographs. Sixty percent of the orthodontists determined they used the photographs in a large part to diagnose this case, while the other 40% decided they needed them in a small part.

Overall, 94 or 55% found they used the photographs in a large part, specifically, 27 or 49.1% Freshmen, 27 or 50% Sophomores, 18 or 58.1% Juniors, and 22 or 71% Seniors, which indicated a trend. A total of 69 or 40.4% decided they needed them in a small part, which included 23 or 41.8% Freshmen, 27 or 50% Sophomores, 11 or 35.5% Juniors, and 8 or 25.8% Seniors. Only 5 or 2.9% overall answered that they totally used the photographs to diagnose this case, specifically 2 or 3.6% Freshmen, 2 or 6.4% Juniors, and 1 or 3.2% Seniors, while only 2 or 3.6% Freshmen did not use them at all.

+Q 39 - Diagnostic Records: X-Rays. Sixty percent of the orthodontists determined that they relied on the radiograph in a small part, while 40% used it in a large part.

Overall, 102 or 59.6%, specifically, 34 or 61.8% Freshmen, 36 or 66.7% Sophomores, 20 or 64.5% Juniors, and 12 or 38.7% Seniors, used the radiograph in a small part, while 49 or 28.7% overall needed it in a large part and included 11 or 20% Freshmen, 14 or 25.9% Sophomores, 7 or 22.6% Juniors, and 17 or 54.8% Seniors.

A total of only 8 or 4.7% answered they used it totally to diagnose this case, including 3 or 5.4% Freshmen, 2 or 3.7% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors. Overall 11 or 6.4% responded they did not use it at all, specifically, 7 or 12.7% Freshmen, 1 or 1.8% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors.

Case Five

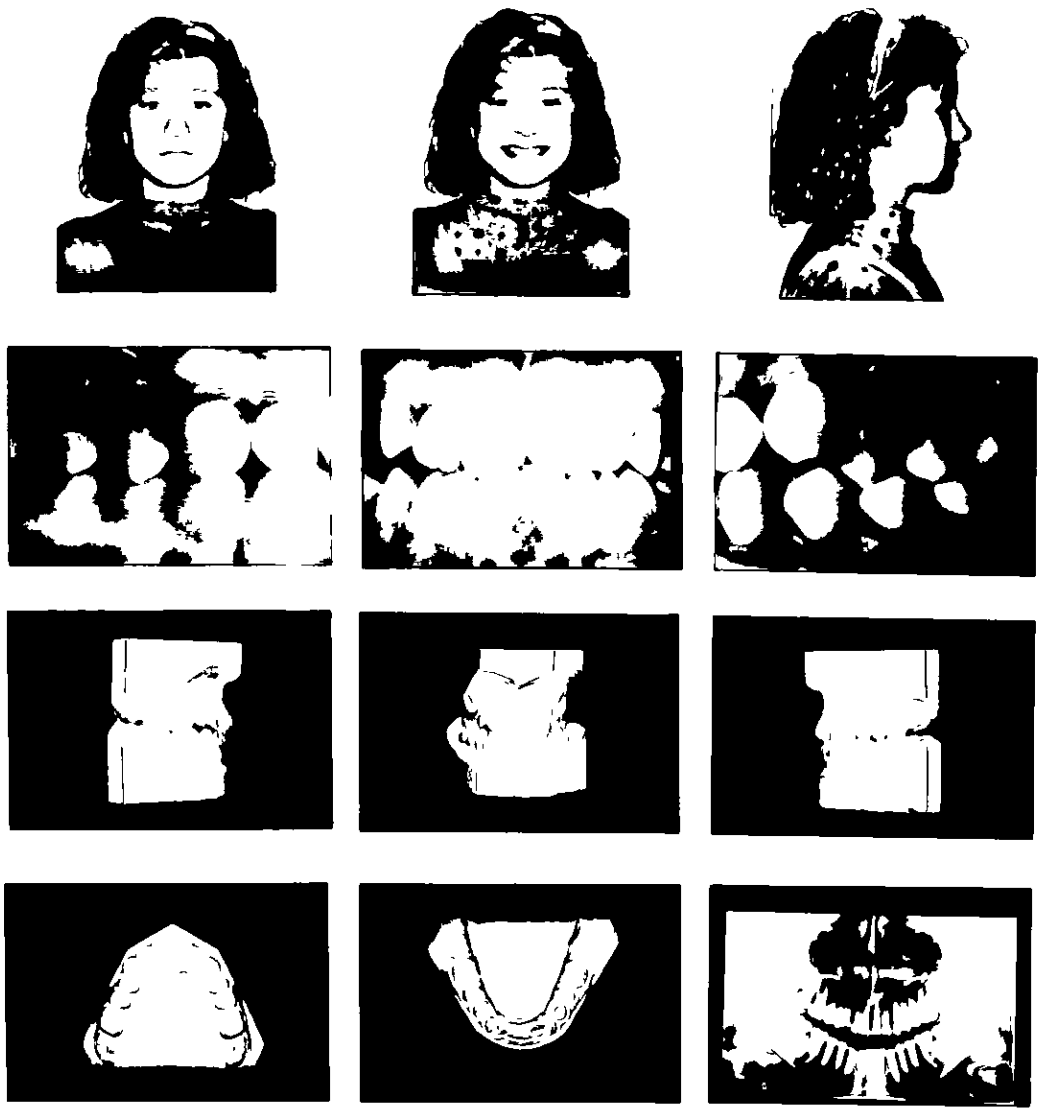
Caucasian Female

12 years, 5 mouths

Medical History: Allergic to bee stings

Dental History: Non-Contributory

Class I skeletal in the permanent dentition with a bilateral Class I cuspid relationship, a Class I molar relationship on the right side, and a Class III molar relationship on the left side. There is moderate crowding in both arches and anterior and posterior cross-bites. The midlines are not co-incident and the mandibular right third molar is congenitally missing. Figure 6



Case Five

+Q 1 - Appearance of the Facial Profile. All of the orthodontists agreed that the patient's facial profile was Class I or straight.

Overall, 120 of the 171 participants or 70.2% identified the facial profile to be straight, which included 41 or 74.5% Freshmen, 42 or 77.8% Sophomores, 23 or 74.2% Juniors and 14 or 45.2% Seniors. A total of 34 or 19.9% decided the facial profile was Class II or convex, specifically, 12 or 21.8% Freshmen, 9 or 16.7% Sophomores, 3 or 9.7% Juniors, and 10 or 32.3% Seniors. Overall 16 or 9.4% believed the profile was Class III or concave, specifically, 2 or 3.6% Freshmen, 2 or 3.7% Sophomores, 5 or 16.1% Juniors, and 7 or 22.6% Seniors. Only 1 or 1.8% Sophomores thought it was bimaxillary protrusive.

As one may observe, only 45.2% of the Senior group answered correctly with Class I, while 32.3% thought it was Class II, and another 22.6% responded Class III, especially since approximately three-quarters of the Freshmen, Sophomores, and Juniors answered Class I or a straight profile. The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall, as well as in each of the groups, answered correctly, except for the Senior group, which answered incorrectly.

+Q 2 - Position of the Mandible. All of the orthodontists concurred that the position of the mandible was straight.

Overall, 106 or 62% determined that the mandible was straight, specifically 39 or 70.9% Freshmen, 40 or 74.1% Sophomores, 16 or 51.6% Juniors, and 11 or 35.5% Seniors. A total of 33 or 19.3% thought the mandible was retruded, while 32 or 18.7% overall found it to be in a prominent position. This included 8 or 14.5% Freshmen, 11 or 20.4% Sophomores, 5 or 16.1% Juniors, and 9 or 29% Seniors for

Table 44.--Chi-Square Results for Case Five Undergraduate Dental Students

Question Number	Pearson Chi-Square	Degrees of Freedom	Significance
1	21.07359	9	0.01233*
2	21.59386	6	0.00143*
3	33.44652	9	0.00011*
4	11.16853	9	0.26433
5	10.34959	6	0.11068
6	3.43600	6	0.75246
7	15.83479	9	0.07041
8	5.77068	9	0.76263
9	21.26059	9	0.01154*
10	23.04598	9	0.00609*
11	8.39653	3	0.03849*
12	37.24652	9	0.00002*
13	40.48804	12	0.00006*
14	3.28833	6	0.77188
15	3.83965	6	0.69837
16	11.21297	12	0.51076
17	5.28220	6	0.50816
18	2.38957	3	0.49558
19	7.69169	9	0.56549
20	11.77298	9	0.22641
21	15.51555	9	0.07771
22	10.72657	6	0.09720
23	26.34556	12	0.00959*
24	5.39075	9	0.79900
25	11.79429	6	0.06672
26	9.04960	3	0.02864*
27	16.24572	9	0.06192
28	13.38282	9	0.14604
29	5.40734	6	0.49273
30	2.46229	3	0.48214
31	16.07846	15	0.37686
32	15.63645	6	0.01584*
33	13.93347	12	0.30498
34	5.22462	6	0.51534
35	40.45637	18	0.00181*
36	6.99313	9	0.63783
37	12.89225	12	0.37692
38	24.02126	6	0.00052*
39	20.58413	9	0.01463*

***p<.05**

the former, and 8 or 14.5% Freshmen, 3 or 5.6% Sophomores, 10 or 32.3% Juniors, and 11 or 35.5% Seniors for the latter.

Again, only 35.5% of the Senior group answered correctly with a straight mandible, while 35.5% thought the position of the mandible was prominent and 29% found it to be retruded. This group answered the question with the least consistency, and was followed by the Junior group. The Pearson statistic was significant as the correct answer stood out, and overall the majority of participants answered correctly, as well as the majority of students in the Freshman, Sophomore, and Junior groups. However, the majority of Senior students responded with incorrect choices.

+Q 3 - Treatment for the Mandibular Position. All of the orthodontists agreed that no treatment for the position of the mandible was required.

Overall, 125 or 73.1% indicated that no treatment was needed, which included 41 or 74.5% Freshmen, 46 or 85.2% Sophomores, 26 or 83.9% Juniors, and 12 or 38.7% Seniors. A total of 43 or 25.1% thought treatment was necessary, specifically, 13 or 23.6% Freshmen, 7 or 13.% Sophomores, 4 or 12.9% Juniors, and 19 or 61.3% Seniors. In the previous question 35.5% of the Seniors correctly determined that the mandibular position was straight and in answering this question they were consistent when 38.7% decided no treatment was necessary. Therefore, a total of 64.5% of the Seniors incorrectly diagnosed that the mandibular position was not ideal, and 61.3% of them thought treatment was necessary. The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall, answered correctly as well as the majority in the Freshman, Sophomore and Junior groups. However, the majority of participants in the Senior group answered this question incorrectly.

+Q 4 - Treatment for the Facial Profile. All of the orthodontists agreed that no treatment of this patient's profile was necessary.

One-hundred-thirty-five or 78.9% overall thought no treatment was needed, including 40 or 72.7% Freshmen, 48 or 88.9% Sophomores, 24 or 77.4% Juniors, and 23 or 74.2% Seniors. A total of 34 or 19.9% decided that treatment was necessary, specifically, 14 or 25.4% Freshmen, 6 or 11.1% Sophomores, 6 or 19.3% Juniors, and 8 or 25.8% Seniors. In Question One, only 45% of the Senior students diagnosed that the profile was straight, but in this question about three-quarters of the Seniors decided no treatment was necessary. Since 55% of the Seniors reached the conclusion that a problem existed with the patient's profile, it is unusual that only 25.8% wished to treat it.

+Q 5 - Appearance of the Lips. All of the orthodontists concurred that the appearance of the patients lips was normal.

The great majority of the 171 participants, 156 or 91.2%, determined that the appearance of the subject's lips was normal, and included 45 or 81.8% Freshmen, 52 or 96.3% Sophomores, 30 or 96.8% Juniors, and 29 or 93.5% Seniors. Only 12 or 7% of those surveyed found the lips to be tense, specifically, 8 or 14.5% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors, while just 3 or 1.8% overall thought the lips were flaccid, and consisted of 2 or 3.6% Freshmen, and 1 or 3.2% Seniors. This question was answered very consistently in a correct manner by the majority of individuals and, therefore, was not a good determinator of ability as it was very easy.

+Q 6 - Treatment for the Labial Appearance. All of the orthodontists agreed that no treatment for the appearance of the patient's lips was necessary.

The majority of the participants, 159 or 93.% determined that no treatment was needed, specifically, 50 or 90.9% Freshmen, 51 or 94.4% Sophomores, 29 or 93.5% Juniors, and 29 or 93.5% Seniors. Only a total of 11 or 6.4% believed treatment was

indicated,and included 5 or 9.1% Freshmen, 2 or 3.7% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors. The answers the participants gave for this question are consistent with those given for the preceding question. This question was answered very consistently, and since so many responded correctly, it was not a good determinator of ability as it was extremely easy.

+Q 7 - Stage of Dentition. All of the orthodontists agreed that this patient is in the permanent stage of dentition.

Overall, 159 or 93% identified that this subject is in the permanent stage of dentition, which included 46 or 83.6% Freshmen, 52 or 96.3% Sophomores, all 31 or 100% Juniors, and 30 or 96.8% Seniors. Only 10 or 5.8% overall answered that this patient exhibited the mixed dentition stage, specifically, 8 or 14.5% Freshmen, 1 or 1.8% Sophomores, and 1 or 3.2% Seniors, while just 1 or 1.8% Freshman thought it was the primary dentition stage. Since this question was answered so consistently, it really was not a good determinator of ability, as it was too easy.

+Q 8 - Appropriate Dentition. All the orthodontists concurred that the dentition this female patient exhibited was appropriate for her age of 12 years and 5 months.

Overall, the majority of the participants, 159 or 93% found the dentition to be appropriate for this subject, specifically, 51 or 92.7% Freshmen, 51 or 94.4% Sophomores, 28 or 90.3% Juniors, and 29 or 93.5% Seniors. Just 9 or 5.3% overall thought it was not appropriate for this subject, and included 3 or 5.4% Freshmen, 1 or 1.8% Sophomores, 3 or 9.7% Juniors, and 2 or 6.4% Seniors. Only 1 or 1.8% Freshmen and 1 or 1.8% Sophomores gave no answer for this question. Since so many answered this question correctly, it was not a good determinator of ability as it was too easy.

+Q 9 - Cuspid Relationship - Right Side. All of the orthodontists agreed that

the cuspid relationship was Class I.

A total of 55 or 32.2% of the participants determined that the cuspid relationship was Class I, which included 9 or 16.4% Freshmen, 22 or 22.2% Sophomores, 12 or 38.7% Juniors, and 12 or 38.7% Seniors. Overall, 44 or 25.7% thought the relationship was end-to-end, specifically, 19 or 34.5% Freshmen, 6 or 11.1% Sophomores, 11 or 35.5% Juniors, and 8 or 25.8% Seniors. Thirty or 17.5% overall responded that this was a Class II relationship, including 14 or 25.4% Freshmen, 12 or 22.2% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors, while a total of 42 or 24.6% found this to be a Class III relationship, and included 13 or 23.6% Freshmen, 14 or 25.9% Sophomores, 6 or 19.3% Juniors, and 9 or 29% Seniors.

The Pearson statistic was significant, however, the majority of individuals overall, as well as in each of the four groups, answered this question incorrectly which indicated a reversal. The students in the Junior and Senior groups that answered correctly did so with higher percentages than did the students in the Freshman and Sophomore groups.

+Q 10 - Cuspid Relationship - Left Side. Ninety percent of the orthodontists determined that the cuspid relationship was Class I, while 10% decided it was Class III.

Overall 88 or 51.5%, including 27 or 49.1% Freshmen, 33 or 61.1% Sophomores, 17 or 54.8% Juniors, and 11 or 35.5% Seniors determined that this was a Class I relationship. A total of 24 or 14% thought the relationship was end-to-end, specifically, 14 or 25.4% Freshmen, 3 or 5.6% Sophomores, 2 or 6.4% Juniors, and 5 or 16.1% Seniors. Twenty-two or 12.9% overall decided the relationship was Class II, while 37 or 21.6% overall identified it to be Class III. This included 10 or 18.2% Freshmen, 4 or 7.4% Sophomores, 4 or 12.9% Juniors, and 4 or 12.9% Seniors for

the former, and 4 or 7.3% Freshmen, 14 or 25.9% Sophomores, 8 or 25.8% Juniors, and 11 or 35.5% Seniors for the latter.

Even though 51.5% answered this question correctly, only 32.2% answered the previous question correctly. Even the Seniors did not have a score higher than 39% for these two questions. Class I, which is the ideal, should be the easiest relationship to recognize, yet the majority of students determined it was other than Class I. The Pearson statistic was significant as the correct answer stood out, and the majority of individuals overall answered this question correctly, as did the students in the Sophomore and Junior groups. However, the majority of students in the Freshman and Senior groups gave incorrect responses.

+Q 11 - Treatment for the Cuspid Relationship. Sixty percent of the orthodontists determined that the cuspid relationship required no treatment, while 40% thought treatment was indicated.

A total of 48 or 28.1% decided that no treatment was needed, which included 8 or 14.5% Freshmen, 21 or 38.9% Sophomores, 10 or 32.3% Juniors, and 9 or 29% Seniors, which was consistent with the answers from the previous two questions. Overall, 123 or 71.9% believed that treatment was indicated in this case, specifically, 47 or 85.5% Freshmen, 33 or 61.1% Sophomores, 21 or 67.7% Juniors, and 22 or 71% Seniors. The Pearson statistic was significant, however, this indicated a reversal as the majority of individuals overall, as well as in each of the four groups, answered this question incorrectly.

+Q 12 - Molar Relationship - Right Side. All of the orthodontists agreed that the molar relationship was Class I.

Overall, 109 or 63.7% determined the molar relationship was Class I, which included 28 or 50.9% Freshmen, 41 or 75.9% Sophomores, 26 or 83.9% Juniors, and

14 or 45.2% Seniors. A total of 14 or 8.2% found the relationship to be end-to-end, while 10 or 5.8% decided it was a Class II relationship. This included 9 or 16.4% Freshmen, 4 or 7.4% Sophomores, and 1 or 3.2% Seniors for the former, and 8 or 14.5% Freshmen, 1 or 3.2% Juniors, and 1 or 3.2% Seniors for the latter. Overall, 38 or 22.2% answered this was a Class III relationship, specifically, 10 or 18.2% Freshmen, 9 or 16.7% Sophomores, 4 or 12.9% Juniors, and 15 or 48.4% Seniors.

The Junior students did well in answering this question as 83.9% were correct, yet only 45.2% of the Senior students answered correctly, with 48.4% incorrectly diagnosing Class III. The Pearson statistic was significant, as the correct answer stood out, and the majority of participants overall answered correctly, as did the majority in the Freshman, Sophomore, and Junior groups. However, the majority in the Senior group answered this question incorrectly.

+Q 13 - Molar Relationship - Left Side. All the orthodontists agreed that the molar relationship was Class III.

Overall, 108 or 63.2% determined that the molar relationship was Class II, specifically, 24 or 43.6% Freshmen, 46 or 85.2% Sophomores, 23 or 74.2% Juniors, and 15 or 48.4% Seniors. A total of 35 or 20.5% indicated that the molar was in a Class I relationship, including 13 or 23.6% Freshmen, 5 or 9.3% Sophomores, 5 or 16.1% Juniors, and 12 or 38.7% Seniors. Nine or 5.3% overall answered end-to-end, and 18 or 10.5% responded Class II, which, in detail, was 7 or 12.7% Freshmen, and 2 or 6.4% Juniors for the former, and 11 or 20% Freshmen, 3 or 5.3% Sophomores, 1 or 3.2% Juniors, and 3 or 9.7% Seniors for the latter.

The Junior group once again did well, as 74.2% answered correctly with Class III. However, in the Senior group, only 48.4% identified Class III, while 38.7% incorrectly decided that the relationship was Class I. The Seniors answered Class III,

48.4% on the right and on the left sides, and a similar percentage answered Class I bilaterally. The Pearson statistic was significant as the correct answer stood out with the majority of participants answering correctly overall, as well as the majority in the Sophomore and Junior groups, but the majority of students in the Freshman and Senior groups selected incorrect responses.

+Q 14 - Treatment for the Molar Relationship. All of the orthodontists concurred that the molar relationship required treatment in this case.

Overall, 140 of the 171 participants or 81.9% determined that treatment of this molar relationship was necessary, and included 42 or 76.4% Freshmen, 46 or 85.2% Sophomores, 26 or 83.9% Juniors, and 26 or 83.9% Seniors. A total of 30 or 17.5% thought no treatment was needed, specifically 12 or 21.8% Freshmen, 8 or 14.8% Sophomores, 5 or 16.1% Juniors, and 5 or 16.1% Seniors. Even though many, especially the Senior students, did not accurately diagnose this molar relationship, the great majority still knew it was not ideal and, therefore, required treatment.

+Q 15 - Presence of an Overbite. All the orthodontists agreed that an overbite was present in this patient.

A total of 132 or 77.2% identified the presence of an overbite in this case, including 45 or 81.8% Freshmen, 40 or 74.1% Sophomores, 25 or 80.6% Juniors, and 22 or 71% Seniors. Overall, 38 or 22.2% thought no overbite existed, specifically 10 or 18.2% Freshmen, 13 or 24.1% Sophomores, 6 or 19.3% Juniors, and 9 or 29% Seniors. More participants than expected, 19.3% Juniors and 29% Seniors, answered that no overbite was present.

+Q 16 - Amount of Overbite. All of the orthodontists determined that an acceptable amount of overbite was present in this case.

Overall, 127 or 74.3% indicated that the overbite was acceptable in this patient,

including 39 or 70.9% Freshmen, 36 or 66.7% Sophomores, 26 or 83.9% Juniors, and 26 or 83.9% Seniors. A total of 25 or 14.6% decided a moderate amount of overbite was present, specifically, 11 or 20% Freshmen, 7 or 13% Sophomores, 4 or 7.3% Juniors, and 3 or 5.4% Seniors. Only 2 or 1.2% overall found an excessive amount of overbite, including 1 or 1.8% Freshmen, and 1 or 1.8% Sophomores. Overall, 16 or 9.4% believed that there was no overbite present and, therefore, gave no answer for this question. This included 4 or 7.3% Freshmen, 9 or 16.7% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors. The great majority of individuals did determine that the amount of overbite was acceptable with the Juniors and Seniors both answering at 83.9%.

+Q 17 - Treatment for the Overbite. All of the orthodontists agreed that no treatment of the overbite was necessary in this case.

Overall, 136 of the 171 participants or 79.5% determined that no treatment was needed in this case, which included 43 or 78.2% Freshmen, 40 or 74.1% Sophomores, 29 or 93.5% Juniors, and 24 or 77.4% Seniors. A total of 29 or 17% thought treatment should be undertaken, specifically 10 or 18.2% Freshmen, 11 or 20.4% Sophomores, 2 or 6.4% Juniors, and 6 or 19.3% Seniors. Overall, 6 or 3.5% gave no answer to this question, including 2 or 3.6% Freshmen, 3 or 5.6% Sophomores, and 1 or 3.2% Seniors. A few more Seniors, 6 or 19.3%, as compared to the last question, incorrectly thought treatment was required in this case.

+Q - 18 Presence of an Open Bite. All the orthodontists agreed that no open bite was present in this patient.

Overall, 108 or 63.2% determined that no open bite was evident, specifically, 33 or 60% Freshmen, 38 or 70.4% Sophomores, 20 or 64.5% Juniors, and 17 or 54.8% Seniors. A total of 63 or 36.8% located an open bite, and included 22 or 40%

Freshmen, 16 or 29.6% Sophomores, 11 or 35.5% Juniors, and 14 or 45.2% Seniors.

+Q 19 - Presence of Overjet. All the orthodontists concurred that overjet was present in this case.

One-hundred-thirty-eight or 80.7% overall determined that overjet existed in this patient, which included 44 or 80% Freshmen, 42 or 77.8% Sophomores, 25 or 80.6% Juniors, and 27 or 87.1% Seniors. A total of 31 or 18.1% decided that no overjet was evident in this case, specifically, 11 or 20% Freshmen, 11 or 20.4% Sophomores,5 or 16.1% Juniors, and 4 or 12.9% Seniors. Only 1 or 3.2% Juniors did not give an answer for this question.

+Q 20 - Amount of Overjet. All the orthodontists diagnosed that the amount of overjet was acceptable.

Overall, 115 or 67.3% identified the amount of overjet present to be acceptable, including 31 or 56.4% Freshmen, 35 or 64.8% Sophomores, 23 or 74.2% Juniors, and 26 or 83.9% Seniors, which indicated a trend, for as the amount of education increased, so did the percentages of those who answered correctly. A total of 34 or 19.9% thought there was a moderate amount of overjet, specifically, 16 or 29.1% Freshmen, 10 or 18.5% Sophomores, 6 or 19.3% Juniors, and 2 or 6.4% Seniors, while only 5 or 2.9% overall decided it was an excessive amount, including 3 or 5.4% Freshmen and 2 or 3.7% Sophomores. A total of 17 or 9.9% believed no overjet existed and, therefore, did not answer this question. This consisted of 5 or 9.1% Freshmen, 7 or 13% Sophomores, 2 or 6.4% Juniors, and 3 or 9.7% Seniors.

+Q 21 - Treatment for the Overjet. All the orthodontists agreed that no treatment for the overjet was necessary.

A total of 127 or 74.3% determined that no treatment was needed, which included 32 or 58.2% Freshmen, 42 or 77.8% Sophomores, 28 or 90.3% Juniors, and

25 or 80.6% Seniors. Thirty-five or 20.5% overall decided to treat this amount of overjet, specifically, 19 or 34.5% Freshmen, 9 or 16.7% Sophomores, 3 or 9.7% Juniors, and 4 or 12.9% Seniors. A total of 8 or 4.7%, including 3 or 5.4% Freshmen, 3 or 5.6% Sophomores, and 2 or 6.4% Seniors did not give an answer to this question. Overall, 115 or 67.3% diagnosed an acceptable amount of overjet, while an even higher number, 127 or 74.3%, indicated that no treatment was necessary. This was probably due to some of those who gave no answer in the previous question, and who also decided not to provide treatment in this case.

+Q 22 - Presence of a Cross-Bite. All the orthodontists agreed that a cross-bite existed in this case.

Overall, 79 or 46.2% of the participants determined that a cross-bite was present, which included 17 or 30.9% Freshmen, 29 or 53.7% Sophomores, 15 or 48.4% Juniors, and 18 or 58.1% Seniors. A total of 91 or 53.2% found that no cross-bite existed in this patient, specifically, 38 or 69.1% Freshmen, 24 or 44.4% Sophomores, 16 or 51.6% Juniors, and 13 or 41.9% Seniors. In each of the four groups, at least 41.9% of the students were unable to diagnose the presence of a cross-bite. This question indicated a reversal as the majority of students overall, as well as in the Freshman and Junior groups, answered incorrectly, but the majority in the Sophomore and Senior groups answered with the correct response.

+Q 23 - Location of Cross-Bite. All the orthodontists concurred that both an anterior and a posterior cross-bite were present in this subject.

Overall, 77 or 45% of the 171 respondents determined that both an anterior and a posterior cross-bite existed in this case, and included 34 or 61.8% Freshmen, 19 or 35.2% Sophomores, 12 or 38.7% Juniors, and 12 or 38.7% Seniors. A total of 34 or 19.9% identified only an anterior cross-bite, while 57 or 33.3% located only a posterior

cross-bite. This included 5 or 9.1% Freshmen, 8 or 14.8% Sophomores, 9 or 29% Juniors, and 12 or 38.7% Seniors for the former and 15 or 27.3% Freshmen, 26 or 48.1% Sophomores, 10 or 32.3% Juniors, and 6 or 19.3% Seniors for the latter. Also, only 1 or 1.8% Sophomores and 1 or 3.2% Seniors did not give an answer to this question.

Less than half of those surveyed, 77 or 45%, found both an anterior and posterior cross-bite existing in this patient, with only 38.7% doing so in the Junior and Senior groups. The Pearson statistic was significant, however, only a majority of individuals in the Freshman group answered this question correctly. Therefore, since the majority of students overall, as well as in the Sophomore, Junior and Senior groups responded incorrectly, a reversal was indicated.

+Q 24 - Presence of a Maxillary Transverse Deficiency. Half of the orthodontists diagnosed that a maxillary transverse deficiency was present, while the other 50% did not detect one.

Thirty-five or 20.5% of the participants overall identified that a maxillary transverse deficiency was present, while 134 or 78.4% did not recognize one. This included 12 or 21.8% Freshmen, 10 or 18.5% Sophomores, 8 or 25.8% Juniors, and 5 or 16.1% Seniors, for the former, and 43 or 78.2% Freshmen, 42 or 77.8% Sophomores, 23 or 74.2% Juniors, and 26 or 83.9% Seniors for the latter. Also, 1 or 1.8% Sophomores did not give an answer to this question. Since the experts were evenly divided on the answer to this question, it was not a good indicator by which to measure the participants' ability.

+Q 25 - Presence of Spacing. All the orthodontists agreed that no spacing existed in either of the arches.

A total of 136 or 79.5% determined that no spacing was present in this patient's

arches, specifically, 39 or 70.9% Freshmen, 42 or 77.8% Sophomores, 27 or 87.1% Juniors, and 28 or 90.3% Seniors, while 34 or 19.9% overall located some spacing, specifically, 16 or 29.1% Freshmen, 12 or 22.2% Sophomores, 4 or 12.9% Juniors, and 2 or 6.4% Seniors. Also, 1 or 3.2% Seniors gave no answer for this question.

There was absolutely no indication that any spacing was present in either of the arches. This question indicated a trend for, as the level of education increased, so did the number who answered correctly.

+Q 26 - Presence of Crowding. All of the orthodontists concurred that crowding was present in this case.

One-hundred-fifty-six of the 171 participants determined that crowding existed in this patient, including 52 or 94.5% Freshmen, 51 or 94.4% Sophomores, 24 or 77.4% Juniors, and 29 or 93.5% Seniors. Only 15 or 8.8% overall thought that crowding was not present, specifically 3 or 5.4% Freshmen, 3 or 5.6% Sophomores, 7 or 22.6% Juniors, and 2 or 6.4% Seniors. This question was answered correctly in a very consistent manner and, therefore, was not a good determinator of ability as it was too easy. The Pearson statistic was significant as the correct answer really stood out, with the majority of individuals overall, as well as in each of the four groups, answering correctly.

+ Q 27 - Amount of Crowding - Maxilla. Half of the orthodontists detected a slight amount of crowding present in the maxillary arch, while the other half thought a moderate amount existed.

Overall, 98 or 57.3% decided the amount of crowding present was slight, which included 29 or 52.7% Freshmen, 37 or 68.5% Sophomores, 17 or 54.8% Juniors, and 15 or 48.4% Seniors, while a total of 53 or 31% indicated a moderate amount of crowding existed, specifically 17 or 30.9% Freshmen, 11 or 20.4%

Sophomores, 10 or 32.3% Juniors, and 15 or 48.4% Seniors. Only 6 or 3.5% overall, specifically, 5 or 9.1% Freshmen and 1 or 1.8% Sophomores believed the crowding was severe. A total of 14 or 8.2% thought there was no crowding present, including 4 or 7.3% Freshmen, 5 or 9.3% Sophomores, 4 or 12.9% Juniors, and 1 or 3.2% Seniors. Since the experts were evenly divided on the answer to this question, it was not a good indicator by which to measure the participants' ability.

+Q 28 - Amount of Crowding - Mandible. All of the orthodontists agreed that a moderate amount of crowding existed in the mandibular arch.

A total of 93 or 54.4% of the participants determined that moderate crowding was present, specifically 27 or 49.1% Freshmen, 35 or 64.8% Sophomores, 14 or 45.2% Juniors, and 17 or 54.8% Seniors. Overall, 53 or 31% indicated the crowding was slight, while 21 or 12.3% decided it was severe. This included 17 or 30.9% Freshmen, 16 or 29.6% Sophomores, 14 or 45.2% Juniors, and 6 or 19.3% Seniors for the former, and 9 or 16.4% Freshmen, 3 or 5.6% Sophomores, 2 or 6.4% Juniors, and 7 or 22.6% Seniors for the latter. Only 4 or 2.3% overall detected no crowding present in the mandibular arch, specifically 2 or 3.6% Freshmen, 1 or 3.2% Juniors and 1 or 3.2% Seniors. Even though 45.2% of the Juniors answered correctly, an equal percentage thought the answer was slight. Fifty-four percent of the Seniors also answered correctly with moderate as their response, but 19% thought the answer was slight, while 22% thought it was severe.

+Q 29 - Treatment for the Crowding. All the orthodontists concurred that treatment was necessary in this case.

A total of 150 or 87.7% determined that treatment was needed for the crowding exhibited by this patient, specifically, 46 or 83.6% Freshmen, 46 or 85.2% Sophomores, 30 or 96.8% Juniors, and 28 or 90.3% Seniors. Only 20 or 11.7%

overall decided no treatment was necessary, including 8 or 14.5% Freshmen, 8 or 14.8% Sophomores, 1 or 3.2% Juniors, and 3 or 9.7% Seniors. Just 1 or 1.8% Freshmen gave no answer to this question. The Junior and Senior groups answered this question very consistently, as did the Freshman and Sophomore groups, but to a slightly lesser extent. Therefore, this question was not a good determinator of ability as it was very easy to correctly answer.

+Q 30 - Co-incidence of Midlines. Ninety percent of the orthodontists determined that the dental midlines were not co-incident, while 10% believed they were co-incident.

Overall, 80 or 46.8% identified the dental midlines not to be co-incident, which included 23 or 41.8% Freshmen, 26 or 48.1% Sophomores, 13 or 41.9% Juniors, and 18 or 58.1% Seniors. A total of 91 or 53.2% decided the midlines were co-incident, specifically, 32 or 58.2% Freshmen, 28 or 51.8% Sophomores, 18 or 58.1% Juniors, and 13 or 41.9% Seniors.

These results indicated that over half of the participants were either not studying the records well enough or were relying too heavily on the photographs of the models instead of on the intraoral frontal photograph. This question indicated a reversal, as the majority of students overall, as well as in the Freshman, Sophomore, and Junior groups answered incorrectly. The majority, however, in the Senior group gave the correct response.

+Q 31 - Presence of Dental Conditions: A) missing teeth, B) extra teeth, C) impacted teeth, D) malformed teeth, or E) none of the above. Sixty percent of the orthodontists determined there was a congenitally missing third molar and the other 40% decided that none of these conditions were present.

Overall, 9 or 5.3% chose answer A, either by chance or by identifying the

congenitally missing mandibular right third molar, and included 4 or 7.3% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors. A total of 4 or 2.3% selected B, while 16 or 9.4% each chose C and D. This included 2 or 3.6% Freshmen and 2 or 3.7% Sophomores for answer B, 8 or 14.5% Freshmen, 5 or 9.3% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors for answer C, and 6 or 10.9% Freshmen, 8 or 14.8% Sophomores, and 2 or 6.4% Juniors for answer D. The majority of participants decided on answer E, that none of these dental conditions existed, specifically, 35 or 63.6% Freshmen, 36 or 66.7% Sophomores, 26 or 83.9% Juniors, and 27 or 87.1% Seniors. Only 1 or 1.8% Sophomores and 1 or 3.2% Seniors gave no answer to this question.

Even though about two-thirds of the respondents chose E, the other 45, or excluding the 9 who chose A, the other 36 gave varied responses to this question. Most of the students most likely did not even consider third molars when diagnosing this case. This question indicated a trend, as the majority of students in each group answered this question in an increasingly correct manner as they progressed from the Freshman through the Senior years.

+Q 32 - Gingival Health. Eighty percent of the orthodontists determined that the gingival tissue appeared to be healthy, while 20% thought it was not healthy.

Overall, 135 or 78.9% found the gingiva to be healthy, which included 45 or 81.8% Freshmen, 47 or 87% Sophomores, 25 or 80.6% Juniors, and 18 or 58.1% Seniors. Among those who decided the tissue was not healthy included 10 or 18.2% Freshmen, 7 or 13% Sophomores, 5 or 16.1% Juniors, and 13 or 41.9% Seniors which totalled 35 or 20.5%. This question was answered consistently by over 80% each in the Freshman, Sophomore, and Junior groups, however, only 58.1% of the Senior group thought the tissue was healthy. The Pearson statistic was significant as

the correct answer stood out with the majority of individuals overall, as well as in each of the four groups, responding correctly.

+Q 33 - Presence of Periodontal Conditions: A) recession of the gum tissue, B) defects in the gum tissue, C) bone loss or, D) none of the above. All of the orthodontists agreed that none of these periodontal conditions were present in this patient.

The majority of the participants, 149 or 87.1% determined that no unusual periodontal conditions were present in this case, specifically, 46 or 83.6% Freshmen, 50 or 92.6% Sophomores, 24 or 77.4% Juniors, and 29 or 93.5% Seniors. A total of 9 or 5.3% selected answer A, while 6 or 3.5% chose answer B, which included 5 or 9.1% Freshmen, 2 or 3.7% Sophomores, and 2 or 6.4% Juniors for the former, and 2 or 3.6% Freshmen, 1 or 1.8% Sophomores, 2 or 6.4% Juniors and 1 or 3.2% Seniors for the latter. Just 2 or 1.2% overall decided on answer C, specifically 1 or 1.8% Freshmen and 1 or 3.2% Seniors.

+Q 34 - Need for Orthodontic Treatment. All the orthodontists concurred that orthodontic treatment was indicated for this patient.

Overall, 159 or 93% decided that orthodontic treatment was necessary in this case, while only 11 or 6.4% did not feel this patient required treatment. This included 51 or 92.7% Freshmen, 50 or 92.6% Sophomores, 28 or 90.3% Juniors, and 30 or 96.8% Seniors, for the former, and 4 or 7.3% Freshmen, 4 or 7.4% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors for the latter. This question was very consistently answered, so this was not a good determinator of ability, especially since the participants knew they were being tested for an orthodontic study.

+Q 35 - Provider for Orthodontic Treatment: A) A general dentist who treats limited aspects of orthodontics, B) A general dentist who treats all aspect of

orthodontics, C) A general dentist who only practices orthodontics, D) A pedodontist, E) An orthodontist. All of the experts agreed that an orthodontist should treat this patient.

Overall, 100 or 58.5% determined that an orthodontist should treat this patient, which included 27 or 49.1% Freshmen, 28 or 51.8% Sophomores, 20 or 64.5% Juniors, and 25 or 80.6% Seniors, which indicated a trend. A total of 17 or 9.9% chose A, while 28 or 16.4% selected B, specifically, 12 or 21.8% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors for the former, and 5 or 9.1% Freshmen, 14 or 25.9% Sophomores, and 9 or 29% Juniors for the latter. Overall, 6 or 3.5% decided on answer C, and 3 or 1.8% chose answer D, which included 3 or 5.4% Freshmen, 1 or 1.8% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors for the former, and 2 or 3.6% Freshmen and 1 or 1.8% Sophomores for the latter. Also, 2 or 3.6% Freshmen and 1 or 3.2% Seniors did not give an answer to this question. Fourteen or 8.2% overall gave multiple answers and included 4 or 7.3 % Freshmen - 1 AE, 1 CE, 1 BCDE, and 1 ABCE; 8 or 14.8% Sophomores - 4 BCE, 2 CE, 1 AE, and 1 BE; and 2 or 6.4% Seniors - 1 CE and 1 ABCDE.

There was a trend among those who selected answer E and demonstrated a progression in the percentage of participants from Group one through Group four who answered that an orthodontist should treat this patient. It ranged from a low of 49.1% of the Freshmen to a high of 80.6% of the Seniors. The Pearson statistic was significant as the majority of participants overall, as well as in the Sophomore, Junior and Senior groups, responded correctly, with just under half in the Freshmen group responding correctly. Also a trend can be observed, such that the percentage of those who answered correctly, increased from the Freshman through the Senior years.

+Q 36 - Necessity for Extractions. Forty percent of the orthodontists thought

extractions were necessary and 60% thought extractions were not needed in this case.

The respondents answered in a manner similar to the experts. A total of 71 or 41.5% decided extractions were needed, while 98 or 57.3% felt they were not necessary to treat this patient. This included 20 or 36.4% Freshmen, 21 or 38.9% Sophomores, 13 or 41.9% Juniors, and 17 or 54.8% Seniors for the former, and 33 or 60% Freshmen, 33 or 61.1% Sophomores, 18 or 58.1% Juniors, and 14 or 45.2% Seniors for the latter. Also, 1 or 1.8% Freshmen did not give an answer to this question.

+Q 37 - Diagnostic Records: Models. Eighty percent of the orthodontists relied on the models in a large part to diagnose this case, while the other 20% relied on them in a small part.

Overall, 147 or 86% relied on the models in a large part, specifically, 47 or 85.5% Freshmen, 47 or 87% Sophomores, 26 or 83.9% Juniors, and 27 or 87.1% Seniors. A total of 15 or 8.8% used the models in a small part, which included 7 or 12.7% Freshmen, 5 or 9.3% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors. One or 3.2% Seniors did not use the models at all to diagnose this case, while a total of 7 or 4.1%, including 1 or 1.8% Freshmen, 2 or 3.7% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors said they relied totally on the models to diagnose this case. Only 1 or 3.2% Juniors didn't answer this question. The students in all four groups answered this question quite consistently, therefore, it was not a good determinator of ability as it was very easy to answer correctly.

+Q 38 - Diagnostic Records: Photographs. Sixty percent of the orthodontists decided they relied upon the photographs in a large part to diagnose this case, while 40% relied upon them in a small part.

Overall, 88 or 51.5% needed the models in a large part, specifically, 32 or

58.2% Freshmen, 24 or 44.4% Sophomores, 21 or 67.7% Juniors, and 11 or 35.5% Seniors, while a total of 72 or 42.1% relied upon them in a small part, including 22 or 40% Freshmen, 29 or 53.7% Sophomores, 8 or 25.8% Juniors, and 13 or 41.9% Seniors. Only 11 or 6.4% overall found they used the photographs totally to diagnose the case, specifically, 1 or 1.8% Freshmen, 1 or 1.8% Sophomores, 2 or 6.4% Juniors, and 7 or 22.6% Seniors. There was no real consistency noted in the way the participants answered this question. The Pearson statistic was significant as the majority of participants overall, as well as in the Freshman and Junior groups, responded correctly, however, the majority of students in the Sophomore and Senior groups answered incorrectly.

+Q 39 - Diagnostic Records: X-rays. Forty percent of the orthodontists decided they used the radiograph in a large part to diagnose this case, while 60% found they used it in a small part.

Overall, 52 or 30.4% of the respondents decided they used the radiograph in a large part, while a total of 91 or 53.2% answered that they used it in a small part. This included 11 or 20% Freshmen, 16 or 29.6% Sophomores, 9 or 29% Juniors and 16 or 51.6% Seniors for the former, and 32 or 58.2% Freshmen, 32 or 59.3% Sophomores, 17 or 54.8% Juniors and 10 or 32.3% Seniors for the latter. A total of 11 or 6.4% indicated they used the radiograph totally in diagnosing this case, specifically, 2 or 3.6% Freshmen, 4 or 7.4% Sophomores, 4 or 12.9% Juniors, and 1 or 3.2% Seniors, while 17 or 9.9% overall responded that they did not use the radiograph at all, which included 10 or 18.2% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 4 or 12.9% Seniors.

The answers given to this question were rather consistent among the groups, except for the Senior group. They answered in a large part 51.6% while the other

groups answered an average of 26% and the Seniors answered in a small part 32.3% while the other groups answered an average of 57% . The Pearson statistic was significant as the majority of individuals overall, as well as in the Freshman, Sophomore, and Junior groups, responded correctly, except for the majority of students in the Senior group who gave the incorrect response.

Case Six

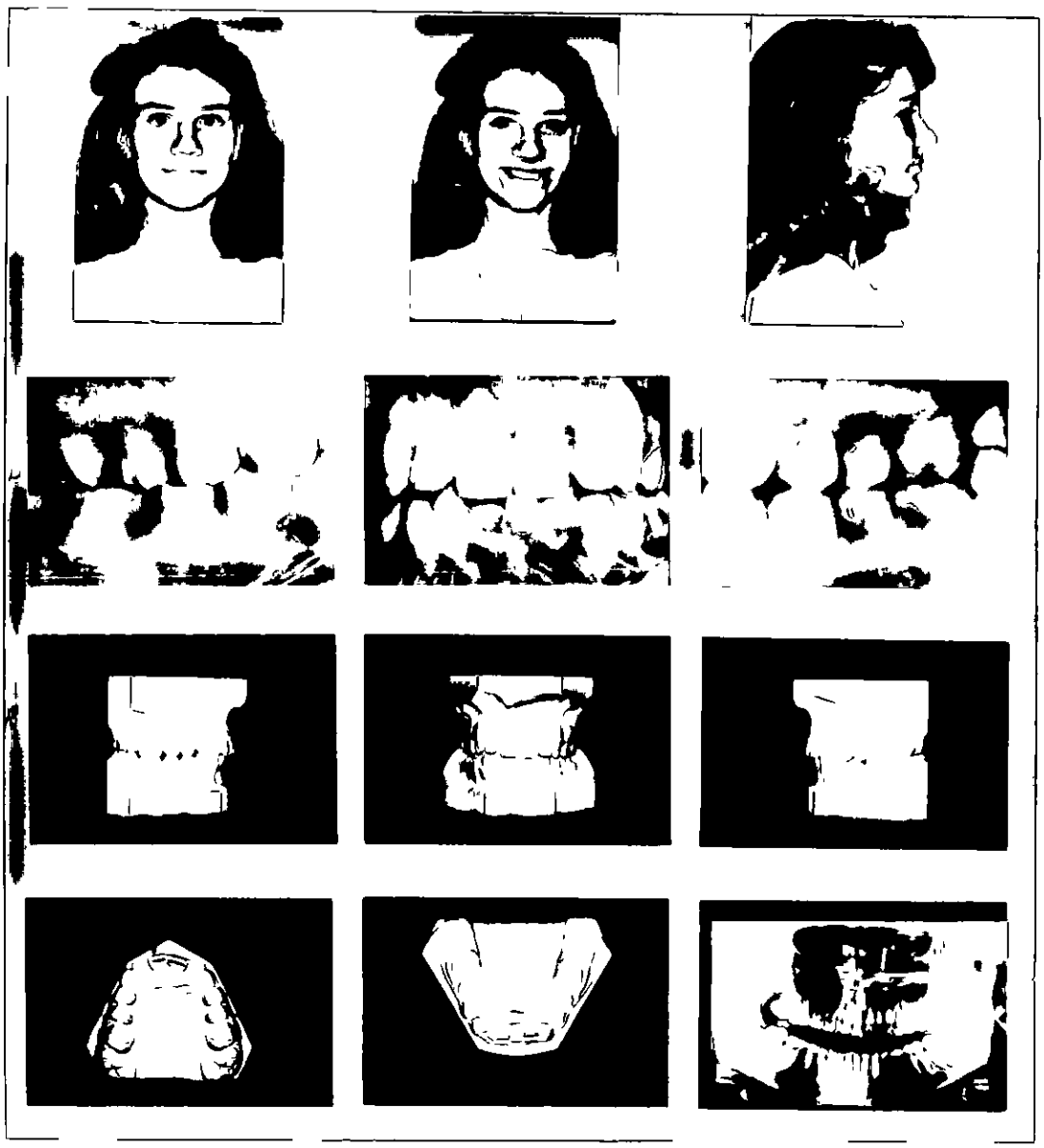
Caucasian Female

14 years, 6 months

Medical History: Non-Contributory

Dental History: Non-Contributory

Class I skeletal relationship in the permanent dentition with an end-to-end cuspid and molar relationship on the right side and a Class I cuspid and molar relationship on the left side. There is a moderate overbite and overjet and slight maxillary and moderate mandibular crowding. The dental midlines are not co-incident. Figure 7



Case Six

+Q 1 - Appearance of the Facial Profile. Eighty percent of the orthodontists determined that the patient's facial profile was Class I or straight, 10% decided the profile was Class II or convex, while another 10% thought it was Class III or concave.

Overall, 131 of the 171 respondents identified the facial profile was Class I or straight, which included 39 or 71% Freshmen, 43 or 79.6% Sophomores, 24 or 77.4% Juniors, and 25 or 80.6% Seniors. A total of 24 or 14% decided the profile was Class II or convex, specifically 9 or 16.4% Freshmen, 9 or 16.7% Sophomores, 1 or 3.2% Juniors, and 5 or 16.1% Seniors, while 14 or 8.2% overall considered it to be Class III or concave, including 5 or 9.1% Freshmen, 2 or 3.7% Sophomores, 6 or 19.3% Juniors, and 1 or 3.2% Seniors. Only 1 or 1.8% Freshmen thought the facial profile was bimaxillary protrusive, and 1 or 1.8% Freshmen gave no answer to this question.

+Q 2 - Position of the Mandible. Ninety percent of the orthodontists determined that the patient's mandibular position was straight, and the other 10% found it to be in a retruded position.

Overall, 128 or 74.9% observed that the position of the mandible was straight, specifically 41 or 74.5% Freshmen, 44 or 81.5% Sophomores, 21 or 67.7% Juniors, and 22 or 71% Seniors, while a total of 28 or 16.4% found the mandible to be in a retruded position, including 11 or 20% Freshmen, 6 or 11.1% Sophomores, 3 or 9.7% Juniors, and 8 or 25.8% Seniors. Overall, 15 or 8.8% believed the mandible was in a prominent position, which included 3 or 5.4% Freshmen, 4 or 7.4% Sophomores, 7 or 22.6% Juniors, and 1 or 3.2% Seniors.

Slightly more Freshman and Sophomore students decided the mandibular position was straight, than those who decided the profile was straight, while fewer Junior and Senior students found the mandibular position to be straight than found the

Table 45.--Chi-Square Results for Case Six Undergraduate Dental Students

Question Number	Pearson Chi-Square	Degrees of Freedom	Significance
1	14.77587	12	0.25392
2	13.10840	6	0.04135*
3	10.49900	6	0.10515
4	8.44324	6	0.20739
5	8.55550	6	0.20016
6	12.32787	12	0.41972
7	12.22656	6	0.05710
8	5.00694	6	0.54292
9	36.79879	9	0.00003*
10	9.32089	9	0.40820
11	13.20629	6	0.03987*
12	72.80793	9	0.00000*
13	7.34876	9	0.60086
14	11.22707	6	0.08161
15	1.55841	3	0.66886
16	9.92112	9	0.35691
17	5.08248	6	0.53328
18	4.66850	3	0.19774
19	1.49000	3	0.68458
20	11.57632	9	0.23826
21	4.30063	6	0.63606
22	6.46560	6	0.37310
23	15.26402	6	0.01830*
24	6.23740	6	0.39713
25	6.74859	6	0.34472
26	7.11396	6	0.31044
27	27.37040	12	0.00683*
28	53.11064	12	0.00000*
29	16.06709	9	0.06549
30	6.65351	6	0.35408
31	38.85549	15	0.00067*
32	30.50010	9	0.00036*
33	27.31524	15	0.02627*
34	16.77819	9	0.05231
35	33.90102	18	0.01295*
36	29.38514	12	0.00345*
37	9.15154	9	0.42341
38	16.78619	9	0.05217
39	13.93561	9	0.12463

***p<.05**

profile to be straight. Over 20% of the Juniors thought the mandible was prominent, while over 25% of the Seniors decided it was retruded. The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall, as well as in each group, responded correctly.

+Q 3 - Treatment for the Mandibular Position. All of the orthodontists concurred that the position of the mandible required no treatment.

A total of 142 or 83% diagnosed that no treatment was needed for the mandibular position in this case, including 45 or 81.8% Freshmen, 49 or 90.7% Sophomores, 22 or 71% Juniors, and 26 or 83.9% Seniors, while only 28 or 16.4% overall thought treatment was required, specifically 10 or 18.2% Freshmen, 5 or 9.3% Sophomores, 9 or 29% Juniors, and 4 or 12.9% Seniors. A few more participants in each of the four groups decided against providing treatment than those who answered in the previous question that the mandibular position was straight.

+Q 4 - Treatment for the Facial Profile. All of the orthodontists agreed that the facial profile required no treatment.

Overall, 131 or 76.6% of the participants determined that this patient's profile required no treatment, which included 36 or 65.4% Freshmen, 47 or 87% Sophomores, 24 or 77.4% Juniors and 24 or 77.4% Seniors. Thirty-nine or 22.8% overall decided that treatment was indicated, including 18 or 32.7% Freshmen, 7 or 13% Sophomores, 7 or 22.6% Juniors, and 7 or 22.6% Seniors. These answers were extremely consistent with those in question 1 as far as the overall numbers of individuals are concerned, however, one should still be concerned with the specific results. At least 20% of the Junior and Senior groups were not able to identify which type of profile this patient possessed, as well as whether treatment for the profile was indicated.

+Q 5 - Appearance of the Lips. All of the orthodontists concurred that the patient's lips appeared normal or relaxed.

A total of 116 or 67.8% identified that the appearance of the subject's lips was normal, which included 32 or 58.2% Freshmen, 36 or 66.7% Sophomores, 25 or 80.6% Juniors, and 23 or 74.2% Seniors. Twenty-one or 38.2% Freshmen, 18 or 33.3% Sophomores, 6 or 19.3% Juniors, and 8 or 25.8% Seniors thought that the lips appeared to be tense, which equalled 53 or 31% overall. Only 2 or 3.6% of the Freshman students found the lips to be flaccid. At least a third of the students in the Freshman and Sophomore groups did not answer correctly, while this occurred in about 20% of the Junior group and one-quarter of the Senior group.

+Q 6 - Treatment for the Labial Appearance. All of the orthodontists agreed that the appearance of the lips did not require treatment.

Overall, 139 or 81.3% decided that no treatment was needed, specifically, 43 or 78.2% Freshmen, 44 or 81.5% Sophomores, 27 or 87.1% Juniors, and 25 or 80.6% Seniors. A total of 28 or 16.4% responded that treatment was necessary, and included 12 or 21.8% Freshmen, 8 or 14.8% Sophomores, 2 or 6.4% Juniors and 6 or 19.3% Seniors. Only 1 or 1.8% of the Sophomores did not answer this question. Overall, 67.8% of the individuals found the appearance of the lips to be normal, however, an even greater percentage, 81.3% overall, decided that no treatment was needed in this case. One may conclude that, even though 55 or 32.2% of the participants thought the lips did not appear normal, only 28 or 16.4% decided treatment was required.

+Q 7 - Stage of Dentition. All the orthodontists determined that this patient was in the permanent stage of dentition.

Overall, 164 or 95.9% answered that this patient was in the permanent stage of dentition, which included 50 or 90.9% Freshmen, 53 or 98.1% Sophomores, 30 or

96.8% Juniors, and all 31 or 100% of the Seniors. Only 1 or 3.2% of the Juniors selected the primary dentition stage, and a total of 6 or 3.5% thought it was the mixed stage of dentition, specifically, 5 or 9.1% Freshmen and 1 or 1.8% Sophomores. Since this question was so very consistently answered, it was not a good determinator of ability as it was too easy to identify the correct response.

+Q 8 - Appropriate Dentition. All the orthodontists agreed that the dentition this female patient exhibited was appropriate for her age of 14 years, 6 months.

Overall 165 or 96.5% determined that the dentition was appropriate for her age, specifically, 52 or 94.5% Freshmen, 53 or 98.1% Sophomores, 30 or 96.8% Juniors, and 30 or 96.8% Seniors, while only a total of 5 or 2.9% believed it was not appropriate, including 3 or 5.4% Freshmen, 1 or 3.2% Juniors, and 1 or 3.2% Seniors. This question was answered very consistently and, therefore, was not a good determinator of ability as it was extremely easy to answer correctly.

+Q 9 - Cuspid Relationship - Right Side. All the orthodontists concurred that the cuspid relationship on the right side was end-to-end.

Overall 62 or 36.3% of the participants considered the cuspid relationship to be end-to-end, which included 13 or 23.6% Freshmen, 22 or 40.7% Sophomores, 18 or 58.1% Juniors, and 9 or 29% Seniors. The next most selected answer was Class I, and was chosen by 59 or 34.5% overall, including 33 or 60% Freshmen, 10 or 18.5% Sophomores, 7 or 22.6% Juniors, and 9 or 29% Seniors. Those who responded Class II included 5 or 9.1% Freshmen, 20 or 37% Sophomores, 5 or 16.1% Juniors, and 9 or 29% Seniors, which equalled 39 or 22.8%. Only a total of 11 or 6.4% found the relationship to be Class III, specifically 4 or 7.3% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors and 4 or 12.9% Seniors.

The Junior group answered correctly with the greatest percentage, but with only

58% overall. The Seniors could not seem to decide which answer was correct, as 29% answered each of the following classifications: Class I, end-to-end, and Class II, while 12.9% answered Class III. Even the Sophomores answered correctly with a greater percentage, 40.7%, than did the Seniors. The variety of answers the Senior group gave seemed to be more like guesses, as the diagnosis from the records is quite straight forward. The Pearson statistic was significant, however, the majority of individuals overall, as well as in the Freshman, Sophomore, and Senior groups, responded incorrectly, therefore, a reversal was indicated. Only the majority of students in the Junior group gave the correct response.

+ Q 10 - Cuspid Relationship - Left Side. All the orthodontists concurred that the cuspid relationship on the left side was Class I.

Overall, of the 171 individuals in this study, 115 or 67.3% determined that the cuspid relationship was Class I, specifically 36 or 65.4% Freshmen, 35 or 64.8% Sophomores, 22 or 71% Juniors, and 22 or 71% Seniors. The next most popular answer was Class II, and was chosen by a total of 32 or 18.7%, which included 7 or 12.7% Freshmen, 13 or 24.1% Sophomores, 4 or 12.9% Juniors, and 8 or 25.8% Seniors. Those who selected end-to-end totalled 14 or 8.2%, including 7 or 12.7% Freshmen, 4 or 7.4% Sophomores, and 3 or 9.7% Juniors. Just 10 or 5.8% overall believed it was a Class III relationship, and included 5 or 9.1% Freshmen, 2 or 3.7% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors.

More individuals were able to correctly identify the cuspid relationship on this side of the dentition than they could on the other side. The only unusually large percentages to incorrectly diagnose this relationship were the 25.8% of the Senior group that answered Class II, and the 24.1% of the Sophomore group who also responded Class II.

+Q 11 - Treatment for the Cuspid Relationship. All of the orthodontists agreed that it was necessary to treat this cuspid relationship.

Overall, 101 or 59.1% reached the conclusion that the cuspid relationship needed to be treated, including 31 or 56.4% Freshmen, 29 or 53.7% Sophomores, 16 or 51.6% Juniors. and 25 or 80.6% Seniors, while a total of 69 or 40.4% decided that this patient did not require treatment.

The responses to this question seemed to correlate with the responses from the two previous questions. However, the Seniors answered correctly with the highest percentage, namely 80.6%, while an average of about 54% of the other three groups answered correctly, which seemed rather low, considering this was a subdivision case. The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall, as well as in each of the four groups, answered correctly.

+Q 12 - Molar Relationship - Right Side. All the orthodontists agreed that the molar relationship on the right side was end-to-end.

Overall, only 46 or 26.9% of the 171 participants determined the relationship was end-to-end, including 7 or 12.7% Freshmen, 9 or 16.7% Sophomores, 16 or 51.6% Juniors, and 14 or 45.2% Seniors. The most popular answer was a Class II relationship which was selected by a total of 79 or 46.2%, specifically, 17 or 30.9% Freshmen,41 or 75.9% Sophomores, 11 or 35.5% Juniors, and 10 or 32.3% Seniors. Overall, 35 or 20.5% decided on a Class I relationship, including 27 or 49.1% Freshmen, 4 or 7.4% Sophomores, 2 or 6.4% Juniors, and 2 or 6.4% Seniors. Only a total of 11 or 6.4% thought that this was a Class III molar relationship, specifically, 4 or 7.3% Freshmen, 2 or 6.4% Juniors, and 5 or 16.1% Seniors.

A very small number of Freshman and Sophomore students answered this question correctly. The Juniors responded correctly with 51.6%, as did the Seniors

with 45.2%. The Pearson statistic was significant, however, this question indicated a reversal as the majority of individuals overall, as well as the majority in the Freshman, Sophomore and Senior groups responded incorrectly to this question. Only the majority of students in the Junior group answered correctly.

+Q 13 - Molar Relationship - Left Side. All of the orthodontists agreed that the molar relationship on the left side was Class I.

Overall, 148 or 86.5% of the participants were able to correctly identify the molar relationship as Class I, which included 44 or 80% Freshmen, 46 or 85.2% Sophomores, 29 or 93.5% Juniors, and 29 or 93.5% Seniors. Only a total of 15 or 8.8% decided this was a Class II relationship, specifically, 6 or 10.9% Freshmen, 6 or 11.1% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors. Only 7 or 4.1% overall considered it to be end-to-end, including 4 or 7.3% Freshmen, 2 or 3.7% Sophomores, and 1 or 3.2% Juniors, while only 1 or 1.8% Freshmen thought it was a Class III relationship. This question was consistently answered correctly by all of the groups, therefore, it was not a good determinator of ability as it was extremely easy.

+Q 14 - Treatment for the Molar Relationship. All of the orthodontists concurred that treatment of the molar relationship was necessary in this case.

Overall, 110 or 64.3% determined that treatment of the molar relationship was needed, which included 29 or 52.7% Freshmen, 36 or 66.7% Sophomores, 21 or 67.7% Juniors and 24 or 77.4% Seniors, which indicated a trend. A total of 60 or 35.1% responded that no treatment was necessary, specifically, 26 or 47.3% Freshmen, 18 or 33.3% Sophomores, 10 or 32.3% Juniors, and 6 or 19.3% Seniors. Even though a subdivision existed on one side of the dentition, about 80% overall were able to identify some sort of problem, albeit incorrectly at times. Still, a sizeable percentage concluded treatment was not needed.

+Q 15 - Presence of an Overbite. All the orthodontists believed that an overbite was present in this case.

A total of 159 or 93% identified that an overbite existed in this patient, which included 50 or 90.9% Freshmen, 51 or 94.6% Sophomores, 28 or 90.3% Juniors, and 30 or 96.8% Seniors. Only 12 or 7% overall observed no overbite, specifically, 5 or 9.1% Freshmen, 3 or 5.6% Sophomores, 3 or 9.7% Juniors, and 1 or 3.2% Seniors. Since such a large percentage of individuals answered this question correctly, it was not considered to be a good determinator of ability as it was too easy.

+Q 16 - Amount of Overbite. Ninety percent of the orthodontists determined that a moderate amount of overbite existed in this patient, while 10% thought it was an acceptable amount.

The majority of the participants, 96 or 56.1%, found that the amount of overbite present was acceptable, and included 33 or 60% Freshmen, 22 or 40.7% Sophomores, 20 or 64.5% Juniors, and 21 or 67.7% Seniors. The next most popular response was that a moderate amount of overbite existed, and was selected by a total of 63 or 36.8%, specifically, 18 or 32.7% Freshmen, 27 or 50% Sophomores, 9 or 29% Juniors, and 9 or 29% Seniors. Only 8 or 4.7% overall thought it was excessive, including 2 or 3.6% Freshmen, 4 or 7.4% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors. Just 4 or 2.3% gave no answer to this question, and consisted of 2 or 3.6% Freshmen, 1 or 1.8% Sophomores, and 1 or 3.2% Juniors.

Just 29% each in the Junior and Senior groups responded to this question correctly, while 50% of the Sophomore group and 32.7% of the Freshman group did so. The majority of the Juniors, 64.5% and 67.7% of the Seniors, thought the overbite was acceptable. Therefore, this question indicated a reversal as the majority of participants overall, as well as in the Freshman, Junior and Senior groups, responded

with the incorrect answer as did one-half of those in the Sophomore group.

+Q 17 - Treatment for the Overbite. Seventy percent of the orthodontists determined that the existing amount of overbite required treatment, while 30% decided that no treatment was needed.

Overall, only 55 or 32.2% concluded that treatment of the overbite was necessary, which included 13 or 23.6% Freshmen, 21 or 38.1% Sophomores, 11 or 35.5% Juniors, and 10 or 32.3% Seniors. The majority, 113 or 66.1% thought that no treatment was necessary in this case, specifically, 40 or 72.7% Freshmen, 32 or 59.3% Sophomores, 20 or 64.5% Juniors, and 21 or 67.7% Seniors. Just 2 or 3.6% Freshmen and 1 or 1.8% Sophomores gave no answer for this question.

Therefore, while 70% of the experts determined treatment of the overbite should be performed, less than one-third of the participants overall thought treatment was needed with the highest percentage, 38.1%, coming from the Sophomore group. The findings from the previous question correlated rather well with those from this question, especially regarding the Junior and Senior groups. Therefore, based on the amount of overbite present, the majority of those surveyed did not recognize the extent of this problem and would not treat it. This question indicated a reversal as the majority of participants overall, as well as in each of the four groups, responded with the incorrect answer.

+Q 18 - Presence of an Open Bite. All the orthodontists agreed that no open bite existed in this case.

The great majority, 158 or 92.4%, determined that this patient exhibited no open bite, including 48 or 87.3% Freshmen, 50 or 92.6% Sophomores, 29 or 93.5% Juniors, and all 31 or 100% of the Seniors, which indicated a trend. Only 13 or 7.6% overall believed an open bite was present, specifically, 7 or 12.7% Freshmen, 4 or

7.4% Sophomores, and 2 or 6.4% Juniors. Since such a large percentage of students answered this question correctly, it cannot be considered a good determinator of ability, as it was too easy.

+Q 19 - Presence of Overjet. All the orthodontists concurred the overjet was present in this patient.

Overall, 139 or 81.3% diagnosed that overjet was present in this case, which included 43 or 78.2% Freshmen, 45 or 83.3% Sophomores, 24 or 77.4% Juniors, and 27 or 87.1% Seniors. A total of 32 or 18.7% thought no overjet existed, specifically 12 or 21.8% Freshmen, 9 or 16.7% Sophomores, 7 or 22.6% Juniors, and 4 or 12.9% Seniors. Even though an average of 81.3% determined overjet existed, 22.6% of the Junior students thought there was none present, which was the group with the greatest percentage to answer incorrectly.

+Q 20 - Amount of Overjet. Eighty percent of the orthodontists determined that a moderate amount of overjet was exhibited by this patient, while 20% decided a slight amount was present.

Overall, a total of 37 or 21.6% identified that the amount of overjet present was moderate, specifically, 13 or 23.6% Freshmen, 16 or 29.6% Sophomores, 6 or 19.3% Juniors, and 2 or 6.4% Seniors. In all, 109 or 63.7% considered the overjet to be acceptable, which included 31 or 56.4% Freshmen, 32 or 59.3% Sophomores, 20 or 64.5% Juniors, and 26 or 83.9% Seniors. Only 10 or 5.8% responded it was excessive, including 5 or 9.1% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors, while 15 or 8.8% overall gave no answer to this question, specifically, 6 or 10.9% Freshmen, 4 or 7.4% Sophomores, 4 or 12.9% Juniors, and 1 or 3.2% Seniors.

The majority of participants in each of the four groups thought the overjet was

acceptable and, while just under 60% of the Freshman and Sophomore students responded as such, over 64% of the Junior students, and 84% of the Senior students did so as well. This question indicated a reversal as the majority of individuals overall, as well as in each of the groups, responded incorrectly.

+Q 21 - Treatment for the Overjet. Eighty percent of the orthodontists determined that treatment of the overjet was necessary, while the remaining 20% thought this required no treatment.

Overall, just 50 or 29.2% observed that the amount of overjet present needed to be treated, and included 16 or 29.1% Freshmen, 18 or 33.3% Sophomores, 9 or 29% Juniors, and 7 or 22.6% Seniors. Those who believed no treatment was indicated consisted of 36 or 65.4% Freshmen, 32 or 59.3% Sophomores, 21 or 67.7% Juniors, and 24 or 77.4% Seniors, which equalled 113 or 66.1%. A total of 8 or 4.7% gave no answer to this question, including 3 or 5.4% Freshmen, 4 or 7.4% Sophomores, and 1 or 3.2% Juniors.

The participants answered this question rather consistently with the last question. Again, the majority in each group answered that no treatment was necessary, with over 77% of the Seniors, the highest percentage of the four groups, doing so. This question indicated a reversal as the majority of participants overall, as well as in each of the four groups, responded with an incorrect answer.

+Q 22 - Presence of a Cross-Bite. All of the orthodontists agreed that no cross-bite was exhibited by this patient.

Overall, 158 or 92.4% located no cross-bite in this case, which included 48 or 87.3% Freshmen, 51 or 94.4% Sophomores, 30 or 96.8% Juniors, and 29 or 93.5% Seniors, while only a total of 12 or 7% decided a cross-bite was present, specifically 7 or 12.7% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4%

Seniors. Since the great majority answered that no cross-bite was present, this question was too easy to answer correctly, and was not a good determinator of ability.

+Q 23 - Location of Cross-Bite. All of the orthodontists determined that this question did not apply to this case.

Overall, 144 or 84.2%, specifically, 40 or 72.7% Freshmen, 50 or 92.6% Sophomores, 26 or 83.9% Juniors, and 28 or 90.3% Seniors indicated that this question did not apply to this case. A total of 10 or 5.8% responded that an anterior cross-bite existed, including 8 or 14.5% Freshmen, 1 or 1.8% Sophomores, and 1 or 3.2% Seniors, while a total of 17 or 9.9% believed a posterior cross-bite was present, including 7 or 12.7% Freshmen, 3 or 5.6% Sophomores, 5 or 16.1% Juniors, and 2 or 6.4% Seniors. The Pearson statistic was significant as the correct answer really stood out, as the majority of individuals overall, as well as in each group, responded to this question correctly.

+Q 24 - Presence of Maxillary Transverse Deficiency. All of the orthodontists agreed that a maxillary transverse deficiency was not present in this case.

Overall, 143 or 83.6% determined that no maxillary transverse deficiency existed in this patient, which included 44 or 80% Freshmen, 45 or 83.3% Sophomores, 28 or 90.3% Juniors, and 26 or 83.9% Seniors. A total of 26 or 15.2% thought it was present, specifically, 11 or 20% Freshmen, 7 or 13% Sophomores, 3 or 9.7% Juniors, and 5 or 16.1% Seniors. Only 2 or 3.7% Sophomores did not give an answer for this question. Since so many individuals responded correctly, this question was not a good determinator of ability as it was very easy.

+Q 25 - Presence of Spacing. Ninety percent of the orthodontists determined that no spacing existed in this patient's arches, while 10% decided spacing was present.

The majority of the participants, 145 or 84.8%, diagnosed that no spacing was

present in this patient's arches, and included 44 or 80% Freshmen, 45 or 83.3% Sophomores, 26 or 83.9% Juniors, and 30 or 96.8% Seniors which indicated a trend. A total of 25 or 14.6% decided that spacing was present, specifically, 11 or 20% Freshmen, 8 or 14.8% Sophomores, 5 or 16.1% Juniors, and 1 or 3.2% Seniors. This question was answered very consistently by all the groups, therefore, it was not a good determinator of ability as it was too easy.

+Q 26 - Presence of Crowding. All the orthodontists concurred that there was crowding present in this case.

Overall, 128 or 74.9% of the respondents identified there was crowding present, which included 36 or 65.4% Freshmen, 40 or 74.1% Sophomores, 25 or 80.6% Juniors, and 27 or 87.1% Seniors, which indicated a trend, while a total of 42 or 24.6% thought no crowding existed in this patient's arches. This consisted of 18 or 32.7% Freshmen, 14 or 25.9% Sophomores, 6 or 19.3% Juniors, and 4 or 12.9% Seniors.

+Q 27 - Amount of Crowding - Maxilla. All of the orthodontists agreed that there was a slight amount of crowding present in this patient's maxillary arch.

A total of 88 or 51.5% determined that a slight amount of crowding existed in the maxillary arch, which included 30 or 54.5% Freshmen, 33 or 61.1% Sophomores, 17 or 54.8% Juniors, and 8 or 25.8% Seniors, while a total of 35 or 20.5% considered the crowding to be moderate, specifically, 10 or 18.2% Freshmen, 5 or 9.3% Sophomores, 5 or 16.1% Juniors, and 15 or 48.4% Seniors. Only 1 or 1.8% Sophomores decided the crowding was severe, and just 2 or 3.7% Sophomores gave no answer to this question. Overall, 45 or 26.3% thought no crowding was present in the maxillary arch, including 15 or 27.3% Freshmen, 13 or 24.1% Sophomores, 9 or 29% Juniors and 8 or 25.8% Seniors.

Over half of the participants in the Freshman, Sophomore and Junior groups answered correctly, but only one-quarter of the Seniors did so. An equal number, one-quarter, of the Seniors answered that no crowding was present, while nearly half of them responded that the crowding was of a moderate degree. In this survey, an average of 26% thought no crowding was present in this case, and this was consistently answered among all four groups. The Pearson statistic was significant as the majority of participants overall, as well as in the Freshman, Sophomore, and Juniors groups, answered correctly. However, the majority in the Senior group responded incorrectly to this question.

+Q 28 - Amount of Crowding - Mandible. Ninety percent of the orthodontists determined that a moderate amount of crowding existed in this patient's mandibular arch, while 10% thought a slight amount of crowding was present.

Overall, 60 or 35.1% observed the amount of crowding in the mandibular arch to be moderate, which included 17 or 30.9% Freshmen, 14 or 25.9% Sophomores, 5 or 16.1% Juniors and 24 or 77.4% Seniors. A total of 84 or 49.1% thought the crowding was slight, specifically, 22 or 40% Freshmen, 32 or 59.3% Sophomores, 24 or 77.4% Juniors, and 6 or 19.3% Seniors. Only 4 or 7.3% Freshmen decided it was severe, while just 2 or 3.7% Sophomores did not answer this question. A total of 21 or 12.3% diagnosed no crowding was present in this arch, which included 12 or 21.8% Freshmen, 6 or 11.1% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors. The Pearson statistic was significant, however, this question indicated a reversal as the majority of individuals overall, as well as in the Freshman, Sophomore and Junior groups, answered with an incorrect response. Only a majority in the Senior group responded correctly.

+Q 29 - Treatment for the Crowding. All the orthodontists agreed that the

crowding present required treatment.

Overall, 121 or 70.8% determined that treatment for the crowding was necessary, which included 37 or 67.3% Freshmen, 32 or 59.3% Sophomores, 23 or 74.2% Juniors, and 29 or 93.5% Seniors. A total of 40 or 23.4% thought no treatment was needed, specifically, 12 or 21.8% Freshmen, 18 or 33.3% Sophomores, 8 or 25.8% Juniors, and 2 or 6.4% Seniors. Only 8 or 4.7% overall gave no answer to this question, including 5 or 9.1% Freshmen and 3 or 5.6% Sophomores. Overall, 128 or 74.9% recognized that crowding was present in this case, and overall, 121 or 70.8% reached the conclusion that treatment should be performed to correct this problem, which was consistent. The largest difference between these two questions came from the Sophomore group, as 74% identified crowding to be present, yet only 59% would render treatment to correct it.

+Q 30 - Co-incidence of Midlines. All of the orthodontists concurred that the dental midlines were not co-incident.

Overall, 148 or 86.5% determined that the midlines were not co-incident, and included 47 or 85.5% Freshmen, 45 or 83.3% Sophomores, 28 or 90.3% Juniors and 28 or 90.3% Seniors. Only a total of 22 or 12.9% found that the midlines were co-incident, specifically, 8 or 14.5% Freshmen, 9 or 16.7% Sophomores, 2 or 6.4% Juniors, and 3 or 9.7% Seniors. This question appears to have been answered rather consistently, therefore, it was not a good determinator of ability as it was very easy.

+Q 31 - Presence of Dental Conditions: A) missing teeth, B) extra teeth, C) impacted teeth, D) malformed teeth, or E) none of the above. All the orthodontists agreed that none of these dental conditions were present in this case.

Overall, 131 or 76.6% of the participants determined that no unusual dental conditions existed in this case, which included 39 or 71% Freshmen, 45 or 83.3%

Sophomores, 28 or 90.3% Juniors, and 19 or 61.3% Seniors. A total of 7 or 4.1% selected answer A, and 6 or 3.5% chose answer B, specifically, 4 or 7.3% Freshmen, 1 or 1.8% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors for the former, and 5 or 9.1% Freshmen and 1 or 1.8% Sophomores for the latter. Overall, 16 or 9.4% thought impactions were present, even though the question excluded third molars from consideration. This included 2 or 3.6% Freshmen, 2 or 3.7% Sophomores, 2 or 6.4% Juniors, and 10 or 32.3% Seniors, who must have identified the maxillary and/or the mandibular third molars as being impacted and, therefore, gave this answer. A total of 10 or 5.8% responded with choice D, which included 4 or 7.3% Freshmen, 5 or 9.3% Sophomores, and 1 or 3.2% Seniors. Only 1 or 1.8% Freshmen gave no answer to this question.

The students were answering this question in an increasingly correct manner from the Freshman, through the Junior groups,until one-third of the Seniors answered that impactions existed. The Pearson statistic was significant as the correct answer stood out and the majority of participants overall, as well as in each of the four groups surveyed, answered this question correctly.

+Q 32 - Gingival Health. All of the orthodontists concurred that the gingival tissue appeared to be healthy.

Overall, 154 or 90.1% of the 171 participants determined that the gingiva was healthy, which included 48 or 87.3% Freshmen, 49 or 90.7% Sophomores, 26 or 83.9% Juniors, and all 31 or 100% of the Seniors. Only a total of 10 or 5.8% believed the gingiva did not appear to be healthy, specifically, 6 or 10.9% Freshmen, and 4 or 7.4% Sophomores, while only 1 or 1.8% Freshmen and 1 or 1.8% Sophomores gave no answer to this question. This question was answered very consistently and, therefore, was not a good determinator of ability as it was too easy to answer correctly.

The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall, as well as in each of the four groups, responded correctly.

+Q 33 - Presence of Periodontal Conditions: A) recession of gum tissue, B) defects in the gum tissue, C) bone loss, or D) none of the above. All of the orthodontists agreed that no unusual periodontal conditions were displayed by this patient.

Overall, 120 or 70.2% of the participants located none of these periodontal conditions in this case, and included 43 or 78.2% Freshmen, 41 or 75.9% Sophomores, 20 or 64.5% Juniors, and 16 or 51.6% Seniors. A total of 21 or 12.3% indicated recession was present, specifically 5 or 9.1% Freshmen, 5 or 9.3% Sophomores, 6 or 19.3% Juniors, and 5 or 16.1% Seniors. Overall, 19 or 11.1% thought defects in the gingiva existed, including 3 or 5.4% Freshmen, 4 or 7.4% Sophomores, 2 or 6.4% Juniors, and 10 or 32.3% Seniors. Only 2 or 1.2% observed bone loss, including 1 or 1.8% Sophomores and 1 or 3.2% Juniors, and just 1 or 1.8% Sophomores gave no answer for this question.

An average of 73% of the Freshman, Sophomore and Junior groups answered correctly, however, this dropped to around 52% of the Senior group. Approximately 19% of the Junior students identified some recession of the tissue, as did 16% of the Senior students, while nearly one-third of the Seniors found some gingival defects. Therefore, nearly one-half of the Senior group answered incorrectly. The Pearson statistic was significant as the correct response stood out and the majority of individuals overall, as well as in each group, responded correctly.

+Q 34 - Need for Orthodontic Treatment. All of the orthodontists determined that this patient required orthodontic treatment.

Overall, 141 or 82.5% determined orthodontic treatment was necessary in this

case, and included 48 or 87.3% Freshmen, 43 or 79.6% Sophomores, 23 or 74.2% Juniors, and 27 or 87.1% Seniors. A total of 23 or 13.5% decided no treatment was indicated in this case, specifically, 5 or 9.1% Freshmen, 10 or 18.5% Sophomores, 4 or 12.9% Juniors, and 4 or 12.9% Seniors. Only 1 or 1.8% Freshmen and 1 or 1.8% Sophomores did not give any answer for this question.

+Q 35 - Provider for Orthodontic Treatment: A) A general dentist who treats limited aspects of orthodontics, B) A general dentist who treats all aspects of orthodontics, C) A general dentist who only practices orthodontics, D) A pedodontist, E) An orthodontist. All of the orthodontists agreed that an orthodontist should provide the treatment for this case.

Overall 59 or 34.5% determined that an orthodontist should treat this patient, which included 21 or 38.2% Freshmen, 16 or 29.6% Sophomores, 12 or 38.7% Juniors and 10 or 32.3% Seniors. A total of 43 or 25.1% gave choice A, while 35 or 20.5% answered choice B. This included 12 or 21.8% Freshmen, 12 or 22.2% Sophomores, 6 or 19.3% Juniors, and 13 or 41.9% Seniors for the former, and 13 or 23.6% Freshmen, 11 or 20.4% Sophomores, 8 or 25.8% Juniors, and 3 or 9.7% Seniors for the latter. A total of 6 or 3.5% indicated choice C, while only 3 or 1.8% answered choice D, specifically 3 or 5.4% Freshmen, 2 or 3.7% Sophomores, and 1 or 3.2% Juniors for the former, and 3 or 9.7% Juniors for the latter. A total of 16 or 9.4% responded with multiple answers to this question and included 4 or 7.3% Freshmen - 1 AE, 1 CE, 1 ABCE, 1 BCDE; 7 or 13% Sophomores - 3 ABCE, 2 BCE, 1 AE, 1 BE; and 5 or 16.1% Seniors - 2 BE, 2 ABCDE, 1 ABCE. Overall, 9 or 5.3% gave no answer to this question, including 2 or 3.6% Freshmen, 6 or 11.1% Sophomores, and 1 or 3.2% Juniors, probably indicating that they felt no treatment was required in this case.

Only 34.5% overall thought an orthodontist should provide treatment to this patient, but this was the choice given by the largest percentage of students, and was followed by 25.1%, who chose a general dentist who treats limited aspects of orthodontics, and 20.5% who selected a general dentist who treats all aspects of orthodontics. The largest percentage of Senior students, 41.9%, decided the provider should be a general dentist who treats limited aspects of orthodontics. The Pearson statistic was significant, however, the majority of individuals overall, as well as those in each of the four groups, responded incorrectly to this question. Therefore, this indicated a reversal.

+Q 36 - Necessity for Extractions. Seventy percent of the orthodontists determined that extractions were not necessary in this case, while 30% found extractions were needed.

Overall, 138 or 80.7% of the participants diagnosed that extractions were not required, specifically, 44 or 80% Freshmen, 42 or 77.8% Sophomores, 23 or 74.2% Juniors, and 29 or 93.5% Seniors. A total of 27 or 15.8% decided extractions were necessary, which included 11 or 20% Freshmen, 11 or 20.4% Sophomores, 3 or 9.7% Juniors, and 2 or 6.4% Seniors. Only 1 or 1.8% Sophomores did not give an answer to this question. The Pearson statistic was significant as the correct answer stood out and the majority of participants overall, as well as in each of the four groups, responded correctly.

+Q 37 - Diagnostic Records: Models. Ninety percent of the orthodontists relied on the models in a large part to diagnose this case, while 10% relied on them in a small part.

A total of 146 or 85.4% decided they relied on the models in a large part to diagnose this case, which included 44 or 80% Freshmen, 46 or 85.2% Sophomores,

29 or 93.5% Juniors, and 27 or 87.1% Seniors. Overall, 16 or 9.4% needed the models in a small part, whereas, 8 or 4.7% relied on them totally. This included 7 or 12.7% Freshmen, 5 or 9.3% Sophomores, and 4 or 12.9% Seniors for the former, and 4 or 7.3% Freshmen, 2 or 3.7% Sophomores, and 2 or 6.4% Juniors for the latter. Only 1 or 1.8% of the Sophomores gave no answer to this question. Since so many participants responded to this question correctly, it was not a good determinator of ability as it was very easy.

+Q 38 - Diagnostic Records: Photographs. Fifty percent of the orthodontists decided they relied upon the photographs in a large part in order to diagnose this case, while the other 50% relied upon them in a small part.

Overall, 100 or 58.5% indicated they relied upon the photographs in a large part to diagnose this case, specifically, 35 or 63.6% Freshmen, 27 or 50% Sophomores, 18 or 58.1% Juniors, and 20 or 64.5% Seniors, while 63 or 36.8% decided they needed them in a small part, which included 16 or 29.1% Freshmen, 27 or 50% Sophomores, 9 or 29% Juniors, and 11 or 35.5% Seniors. Only 7 or 4.1% answered they needed them totally, specifically 3 or 5.4% Freshmen, and 4 or 12.9% Juniors, and just 1 or 1.8% Freshmen answered that the photographs were not needed at all in order to diagnose this patient. Since the experts were evenly divided on the answer to this question, it was not a good indicator by which to measure the participants' ability.

+Q 39 - Diagnostic Records: X-Rays. Sixty percent of the orthodontists determined they relied upon the panoramic radiograph in a small part in order to diagnose this case, and 40% decided they needed it in a large part.

Overall, 94 or 55% responded they needed the radiograph in a small part, including 33 or 60% Freshmen, 33 or 61.1% Sophomores, 14 or 45.2% Juniors, and 14 or 45.2% Seniors. A total of 55 or 32.2% thought they needed it in a large part,

specifically, 11 or 20% Freshmen, 16 or 29.6% Sophomores, 13 or 41.9% Juniors and 15 or 48.4% Seniors. Two different groups, of only 11 or 6.4% each, found they relied upon the radiograph totally or not at all. This included 4 or 7.3% Freshmen, 3 or 5.6% Sophomores, 3 or 9.7% Juniors, and 1 or 3.2% Seniors for the former, and 7 or 12.7% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors for the latter.

Case Seven

Caucasian Male

11 years, 5 months

Medical History: Allergic to dust and outside molds

Dental History: Non-Contributory

Class I skeletal in the permanent dentition which is advanced for his age with Class II cuspid and molar relationships on the right side and end-to-end cuspid and molar relationships on the left side. There is an excessive overbite and a moderate overjet with moderate maxillary and mandibular crowding. Figure 8



Case Seven

+Q 1 - Appearance of the Facial Profile. Ninety percent of the orthodontists determined that this patient's facial profile was straight or Class I, and 10% decided it was concave or Class III.

Overall, 68 or 39.8% of the 171 participants in this study diagnosed the facial profile to be Class I or straight, which included 21 or 38.2% Freshmen, 23 or 42.6% Sophomores, 12 or 38.7% Juniors, and 12 or 38.7% Seniors. A total of 67 or 39.2% considered the profile to be Class III or concave, specifically, 19 or 34.5% Freshmen, 25 or 46.3% Sophomores, 16 or 51.6% Juniors, and 7 or 22.6% Seniors. Thirty-three or 19.3% overall thought the profile was Class II or convex, including 15 or 27.3% Freshmen, 5 or 9.3% Sophomores, 3 or 9.7% Juniors, and 10 or 32.3% Seniors, while a total of just 3 or 1.8% answered bimaxillary protrusive, specifically, 1 or 1.8% Sophomores, and 2 or 6.4% Seniors.

Only about 40% responded to this question correctly, with Class I, but it was consistently answered by each of the four groups surveyed. However, nearly an identical number of individuals overall answered Class III, yet not in a very uniform manner among the various groups. Also, over 32% of the Seniors chose Class II or convex to describe this profile. To sum up, over 60% of the students were not able to identify that the profile was within the norm. The Pearson statistic was significant, however, the majority of participants overall, as well as in each of the four groups, answered this question incorrectly, therefore, this indicated a reversal.

+Q 2 - Position of the Mandible. All of the orthodontists concurred that the position of this patient's mandible was straight.

Overall, 59 or 34.5% identified the position of the mandible to be straight, including 20 or 36.4% Freshmen, 19 or 35.2% Sophomores, 7 or 22.6% Juniors, and

Table 46.--Chi-Square Results for Case Seven Undergraduate Dental Students

Question Number	Pearson Chi-Square	Degrees of Freedom	Significance
1	18.79078	9	0.02703*
2	18.75539	9	0.02736*
3	10.76037	9	0.29249
4	3.63501	6	0.72593
5	12.56937	9	0.18308
6	10.49843	6	0.10517
7	17.76058	6	0.00686*
8	7.15913	3	0.06699
9	13.66482	9	0.13476
10	20.21139	9	0.01665*
11	20.90561	12	0.05178
12	24.24029	9	0.00394*
13	17.84615	9	0.03700*
14	14.01506	6	0.02947*
15	6.44026	3	0.09205
16	12.52602	9	0.18525
17	18.44075	6	0.00522*
18	15.39937	6	0.01737*
19	15.57442	6	0.01623*
20	14.48931	9	0.10595
21	14.15057	6	0.02800*
22	22.31984	6	0.00106*
23	18.98931	9	0.02528*
24	5.86427	6	0.43856
25	6.68592	6	0.35087
26	3.02889	3	0.38719
27	9.64830	9	0.37970
28	6.93754	9	0.64362
29	6.72156	6	0.34737
30	4.73225	6	0.57858
31	16.75977	12	0.15886
32	21.54576	9	0.01044*
33	15.07688	12	0.23726
34	4.29867	9	0.89068
35	26.96470	15	0.02903*
36	9.19702	9	0.41929
37	5.53733	9	0.78518
38	6.11893	9	0.72796
39	13.59770	9	0.13737

***p<.05**

13 or 41.9% Seniors. The majority of the participants, 78 or 45.6%, decided the mandibular position was prominent, specifically, 17 or 30.9% Freshmen, 27 or 50% Sophomores, 19 or 61.3% Juniors, and 15 or 48.4% Seniors. A total of 33 or 19.3% found the mandible to be retruded, which was comprised of 18 or 32.7% Freshmen, 8 or 14.8% Sophomores, 4 or 12.9% Juniors, and 3 or 9.7% Seniors. Only 1 or 3.2% Juniors did not answer this question. This question was consistently answered in relation to the previous one, except that fewer students chose a straight position and more chose a prominent one. The Pearson statistic was significant, however, this question indicated a reversal as the majority of individuals overall, as well as in the four groups, answered incorrectly.

+Q 3 - Treatment for the Mandibular Position. All the orthodontists agreed that no treatment for this mandibular position was necessary in this case.

Overall, 90 or 52.6% determined that no treatment for the position of the mandible was necessary, which included 25 or 45.5% Freshmen, 31 or 57.4% Sophomores, 14 or 45.2% Juniors, and 20 or 64.5% Seniors. A total of 79 or 46.2% thought treatment was indicated, specifically, 30 or 54.5% Freshmen, 22 or 40.7% Sophomores, 16 or 51.6% Juniors, and 11 or 35.5% Seniors. Only 1 or 3.2% Juniors gave no answer to this question. Therefore, this question indicated a reversal as the majority of participants overall, as well as in the Freshman and Junior groups, responded incorrectly. Even though 65% of the students identified the position of the mandible to be either prominent or retruded, only 46% wished to treat this problem. Therefore, while 34.5% correctly identified the position to be straight, over 52% would provide no treatment to this patient.

+Q 4 - Treatment for the Facial Profile. All the orthodontists agreed that no treatment of the patient's profile was necessary.

Overall, 85 or 49.7% reached the conclusion that no treatment was needed in this case, and included 26 or 47.3% Freshmen, 30 or 55.6% Sophomores, 13 or 41.9% Juniors, and 16 or 51.6% Seniors, while a total of 84 or 49.1% decided treatment was required, specifically, 28 or 50.9% Freshmen, 24 or 44.4% Sophomores, 17 or 54.8% Juniors, and 15 or 48.4% Seniors. Only 1 or 1.8% Freshmen and 1 or 3.2% Juniors did not give an answer to this question.

In Question One regarding the facial profile, approximately 40% correctly identified that the profile was straight, but nearly 50% of the participants answered that no treatment was required in this instance. The majority of individuals overall, as well as in the Freshman and Junior groups, responded incorrectly, therefore, this demonstrated a reversal.

+Q 5 - Appearance of the Lips. All the orthodontists concurred that the appearance of this patient's lips was normal.

Overall, 121 or 70.8% of the 171 participants indicated that the patient's lips appeared normal, which included 36 or 65.4% Freshmen, 44 or 81.5% Sophomores, 21 or 67.7% Juniors, and 20 or 64.5% Seniors. A total of 40 or 23.4% decided the lips were tense, specifically, 16 or 29.1% Freshmen, 10 or 18.5% Sophomores, 6 or 19.3% Juniors, and 8 or 25.8% Seniors. Only 9 or 5.3% overall believed they were flaccid, including 3 or 5.4% Freshmen, 3 or 9.7% Juniors, and 3 or 9.7% Seniors. Only 1 or 3.2% Juniors gave no answer to this question. Over 70% overall correctly answered this question with over 80% in the Sophomore group responding accurately. Yet 29% of the Junior group and 35% of the Senior group were not able to identify the normal appearance of the lips.

+Q 6 - Treatment for the Labial Appearance. All the orthodontists agreed that no treatment was required for the appearance of this patient's lips.

A total of 134 or 78.4% determined that the appearance of the patient's lips required no treatment, including 45 or 81.8% Freshmen, 47 or 87% Sophomores, 22 or 71% Juniors, and 20 or 64.5% Seniors. Overall, 36 or 21.1% decided treatment was necessary, specifically, 10 or 18.2% Freshmen, 6 or 11.1% Sophomores, 9 or 29% Juniors, and 11 or 35.5% Seniors. This question was answered rather consistently in relation to the previous one. The Senior group had the highest percentage of students in the four groups to answer that treatment was needed with 35.5%, and was closely followed by the Junior group with 29%.

+Q 7 - Stage of Dentition. All the orthodontists agreed that this subject was in the permanent stage of dentition.

Overall, 145 or 84.8% of the 171 participants determined that this patient was in the permanent dentition stage, which included 42 or 76.4% Freshmen, 51 or 94.4% Sophomores, 29 or 93.5% Juniors, and 23 or 74.2% Seniors. A total of 25 or 14.6% thought this patient exhibited mixed dentition, specifically, 13 or 23.6% Freshmen, 3 or 5.6% Sophomores, 1 or 3.2% Juniors, and 8 or 25.8% Seniors. Only 1 or 3.2% of the Juniors gave no answer to this question. The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall, as well as in each of the four groups surveyed, answered this question accurately.

+Q 8 - Appropriate Dentition. Ninety percent of the orthodontists diagnosed that this dentition was not appropriate for this male patient's age of 11 years and 5 months, while the other 10% thought it was appropriate.

A total of only 28 or 16.4% of the respondents determined that the dentition was not appropriate for this patient at his age, which included 4 or 7.3% Freshmen, 9 or 16.7% Sophomores, 6 or 19.3% Juniors, and 9 or 29% Seniors, which indicated a trend. Overall, 143 or 83.6% considered the dentition was appropriate, specifically 51

or 92.7% Freshmen, 45 or 83.3% Sophomores, 25 or 80.6% Juniors, and 22 or 71% Seniors. The great majority of participants, 83.6%, responded to this question incorrectly. The group with the highest percentage to answer correctly were the Seniors, with 29%, however, this was still a very low figure. It appears that the students really don't have a good idea regarding the typical ages at which the permanent teeth erupt for males, and possibly also for females.

This question indicated a reversal as the majority of participants overall, as well as those in each of the four groups, responded incorrectly. However, among the few that did answer correctly, a trend was observed from the Freshman through the Senior groups, as an increasing percentage of the participants gave the correct response.

+Q 9 - Cuspid Relationship - Right Side. All of the orthodontists agreed that the cuspid relationship on the right side was Class II.

Overall, 82 or 48% of the individuals in this study observed the cuspid relationship to be Class II, specifically, 21 or 38.2% Freshmen, 27 or 50% Sophomores, 14 or 45.2% Juniors, and 20 or 64.5% Seniors. The next most popular response was Class I, and was given by 25 or 45.5% Freshmen, 23 or 42.6% Sophomores, 15 or 48.4% Juniors, and 9 or 29% Seniors, for a total of 72 or 42.1%. Only 8 or 4.7% overall indicated the relationship was end-to-end, including 4 or 7.3% Freshmen, 2 or 6.4% Juniors, and 2 or 6.4% Seniors. Also a total of 9 or 5.3% answered with a Class III relationship, specifically, 5 or 9.1% Freshmen and 4 or 7.4% Sophomores. On the whole, the majority of the participants overall answered incorrectly, as did the majority in the Freshman and Junior groups, therefore, this indicated a reversal. Also, only one-half of the students in the Sophomore group responded correctly.

+Q 10 - Cuspid Relationship - Left Side. All the orthodontists agreed that the

cuspid relationship on the left side was end-to-end.

Overall, 28 or 16.4% diagnosed the cuspid relationship to be end-to-end, which included 6 or 10.9% Freshmen, 6 or 11.1% Sophomores, 13 or 41.9% Juniors, and 3 or 9.7% Seniors. The choice with the greatest response was Class II and consisted of 70 or 40.9% of those surveyed, specifically 23 or 41.8% Freshmen, 22 or 40.7% Sophomores, 10 or 32.3% Juniors, and 15 or 48.4% Seniors. The next most popular answer was Class I, and was chosen by a total of 57 or 33.3%, including 22 or 40% Freshmen, 20 or 37% Sophomores, 6 or 19.3% Juniors, and 9 or 29% Seniors. The fewest students selected Class III with a total of only 16 or 9.4%, and included 4 or 7.3% Freshmen, 6 or 11.1% Sophomores, 2 or 6.4% Juniors, and 4 or 12.9% Seniors.

The group with the highest percentage answering correctly was the Junior class with 41.9%, but only an average of 10% of the other three classes did so. Most of the Freshmen, Sophomores, and Seniors answered Class II, with 41.8%, 40.7% and 48.4% respectively. The Pearson statistic was significant, however, this question indicated a reversal, as a very low percentage of individuals overall, as well as in the Freshman, Sophomore, and Senior groups, answered correctly. Also, only about 42% of the students in the Junior group gave the correct response.

+Q 11 - Treatment for the Cuspid Relationship. All the orthodontists concurred that this cuspid relationship needed to be treated.

One-hundred-seven or 62.6% overall determined that the cuspid relationship required treatment, specifically, 35 or 63.6% Freshmen, 36 or 66.7% Sophomores, 19 or 61.3% Juniors, and 17 or 54.8% Seniors. Those who answered that no treatment was necessary included 20 or 36.4% Freshmen, 17 or 31.5% Sophomores, 11 or 35.5% Juniors, and 11 or 35.5% Seniors, which totalled 59 or 34.5%. Only 1 or

3.2% of the Junior groups did not answer this question. Therefore, approximately one-third of the participants decided no treatment was necessary in this case.

+Q 12 - Molar Relationship - Right Side. All the orthodontists agreed that the molar relationship on the right side was Class II.

A total of 122 or 71.3% identified the molar relationship to be Class II, which included 30 or 54.5% Freshmen, 45 or 83.3% Sophomores, 23 or 74.2% Juniors, and 24 or 77.4% Seniors. The next most popular answer was Class I and was selected by 24 or 14%, specifically, 14 or 25.4% Freshmen, 3 or 5.6% Sophomores, 2 or 6.4% Juniors, and 5 or 16.1% Seniors. Only 14 or 8.2% overall, indicated it was end-to-end, and just 11 or 6.4% answered Class III. This included 8 or 14.5% Freshmen, 1 or 1.8% Sophomores, and 5 or 16.1% Juniors for the former, and 3 or 5.4% Freshmen, 5 or 9.3% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors for the latter.

This question was answered correctly by three-quarters of the Junior and Senior groups, whereas the Sophomores responded to this question correctly with the highest percentage among the four groups, 83.3%, and the Freshmen with the lowest, 54.5%. The Pearson statistic was significant as the correct answer stood out and the majority of participants overall, as well as in each of the four groups, answered this question correctly.

+Q 13 - Molar Relationship - Left Side. All the orthodontists agreed that the molar relationship was end-to-end on the left side.

Overall, 38 or 22.2% of the participants determined the molar relationship was end-to-end, specifically, 10 or 18.2% Freshmen, 8 or 14.8% Sophomores, 10 or 32.3% Juniors, and 10 or 32.3% Seniors. The majority, 71 or 41.5% thought the relationship was Class I, including 30 or 54.5% Freshmen, 19 or 35.2% Sophomores,

13 or 41.9% Juniors, and 9 or 29% Seniors. The next most frequently chosen answer was Class II, and was selected by 51 or 29.8%, and included 12 or 21.8% Freshmen, 22 or 40.7% Sophomores, 5 or 16.1% Juniors, and 12 or 38.7% Seniors. Only a total of 11 or 6.4% believed it was Class III, and was composed of 3 or 5.4% Freshmen, 5 or 9.3% Sophomores, and 3 or 9.7% Juniors.

Therefore, only one-third of the Junior and Senior students responded to this question accurately, while just 15% and 18% of the Sophomore and Freshman students did so respectively. Most Senior students, 38.7%, answered Class II, as did 16.1% of the Junior students, while most Junior students, 41.9%, answered Class I, as did 29% of the Senior students. The Pearson statistic was significant, however, this question indicated a reversal as the majority overall, as well as in each of the four groups, answered with incorrect responses.

+Q 14 - Presence of an Overbite. All the orthodontists concurred that the molar relationship in this case required treatment.

Overall, 138 or 80.7% of the 171 surveyed found that treatment of the molar relationship was indicated. This included 44 or 80% Freshmen, 47 or 87% Sophomores, 22 or 71% Juniors, and 25 or 80.6% Seniors. A total of 29 or 17% thought no treatment was needed for this patient, specifically 10 or 18.2% Freshmen, 7 or 13% Sophomores, 9 or 29% Juniors, and 3 or 9.7% Seniors.

A high percentage, 80.7%, chose the correct response to this question. If the Junior group 29% felt no treatment was needed, but only 9.7% of the Seniors answered this way. The Pearson statistic was significant as the correct answer really stood out and the majority of individuals overall, as well as in each of the four groups surveyed, answered this question correctly.

+Q 15 - Presence of an Overbite. All the orthodontists agreed that this patient

presented with an overbite.

Overall, 168 or 98.2% determined that an overbite was present, including 52 or 94.5% Freshmen, all 54 or 100% Sophomores, all 31 or 100% Juniors, and all 31 or 100% Seniors. Only 3 or 5.4% Freshmen, observed that no overbite was present in this case. Since this question was answered so consistently, it was not a good determinator of ability as it was extremely easy for the individuals in this study to answer correctly.

+Q 16 - Amount of Overbite. All the orthodontists determined that the amount of overbite present in this case was excessive.

A total of 148 or 86.5% diagnosed the overbite was excessive, which included 42 or 76.4% Freshmen, 47 or 87% Sophomores, 30 or 96.8% Juniors, and 29 or 93.5% Seniors. Only a total of 11 or 6.4% each answered acceptable and moderate. This included 6 or 10.9% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors for the former, and 6 or 10.9% Freshmen and 5 or 9.3% Sophomores for the latter. Only 1 or 1.8% Freshmen gave no answer to this question. This question was answered correctly quite consistently by the Junior and Senior dental students. The Freshman and Sophomore students did not answer as consistently as did the other two groups, but nonetheless had high percentages who gave the correct response, with the Sophomores doing better than the Freshmen.

+Q 17 - Treatment for the Overbite. All the orthodontists agreed that the overbite present in this case required treatment.

Overall, 153 or 89.5% decided that treatment for the overbite was necessary, specifically, 43 or 78.2% Freshmen, 50 or 92.6% Sophomores, all 31 or 100% Juniors, and 29 or 93.5% Seniors. A total of 17 or 9.9% believed no treatment was needed, which included 12 or 21.8% Freshmen, 4 or 7.4% Sophomores, and 1 or

3.2% Seniors. The percentage of correct responses to this question was very high and consistent, except for the Freshman group. Even though only 10.9% of the Freshmen answered that the amount of overbite was acceptable, twice as many, 21.8%, responded that no treatment was indicated. The Pearson statistic was significant as the correct answer really stood out, and the majority of participants overall, as well as in each of the four groups, gave the correct response to this question.

+Q 18 - Treatment for the Open Bite. All the orthodontists concurred that no open-bite was observed in this patient.

A total of 152 or 88.9% determined that no open-bite existed in this case, including 45 or 81.8% Freshmen, 50 or 92.6% Sophomores, 29 or 93.5% Juniors, and 28 or 90.3% Seniors. Overall, only 17 or 9.9% located an open-bite, specifically 10 or 18.2% Freshmen, 4 or 7.4% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors.

One can see that, as the educational level increased, the number of individuals who responded that an open bite existed, was found to decrease. On the whole, this question was answered correctly rather consistently among the participants, and also in relation to the amount of education they received. The Pearson statistic was significant as the correct answer really stood out and the majority of participants overall, as well as in each of the groups, answered this question correctly, therefore, it was not a good determinator of ability as it was very easy.

+Q 19 - Presence of Overjet. All the orthodontists agreed that overjet was present in this chase.

Overall, 101 or 59.1% identified that this patient exhibited overjet, which included 39 or 70.9% Freshmen, 33 or 61.1% Sophomores, 14 or 45.2% Juniors, and 15 or 48.4% Seniors. A total of 68 or 39.8% felt no overjet was present, specifically

16 or 29.1% Freshmen, 21 or 38.9% Sophomores, 17 or 54.8% Juniors, and 14 or 45.2% Seniors. Of note, the group with the highest percentage correct were the Freshmen with 70.9%, and the group with the lowest percentage correct were the Juniors with 45.2%. Also, the Seniors did not fare much better with only 48.4% correct. The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall, as well as the majority in the Freshman and Sophomore groups, responded correctly. However, the majority of Junior and Senior students gave the incorrect response.

+Q 20 - Amount of Overjet. Eighty percent of the orthodontists determined the amount of overjet present to be moderate, while 20% found this amount to be acceptable.

Overall, 38 or 22.2% of the respondents decided the amount of overjet present was moderate, which included 12 or 21.8% Freshmen, 9 or 16.7% Sophomores, 7 or 22.6% Juniors, and 10 or 32.3% Seniors. Most of the participants, 83 or 48.5%, observed it was acceptable, including 27 or 49.1% Freshmen, 32 or 59.3% Sophomores, 14 or 45.2% Juniors, and 10 or 32.3% Seniors. Overall, 35 or 20.5% gave no answer to this question as they believed that no overjet was present. This included 8 or 14.5% Freshmen, 8 or 14.8% Sophomores, 9 or 29% Juniors and 10 or 32.3% Seniors. Therefore, this question indicated a reversal, as only a small percentage of participants overall, as well as in each of the four groups, responded with the correct answer.

+Q 21 - Treatment for the Overjet. Ninety percent of the orthodontists determined that this amount of overjet required treatment and 10% thought no treatment was needed.

Overall, 77 or 45% decided that treatment for the overjet was necessary,

including 19 or 34.5% Freshmen, 22 or 40.7% Sophomores, 15 or 48.4% Juniors, and 21 or 67.7% Seniors, which indicated a trend. A total of 82 or 48% felt no treatment was required, specifically 30 or 54.5% Freshmen, 29 or 53.7% Sophomores, 16 or 51.6% Juniors, and 7 or 22.6% Seniors. Overall, 12 or 7% gave no answer to this question, which consisted of 6 or 10.9% Freshmen, 3 or 5.6% Sophomores, and 3 or 9.7% Seniors.

The Pearson statistic was significant, however, this question indicated a reversal as the majority of participants overall, as well as in the Freshman, Sophomore, and Junior groups, answered incorrectly. Only a majority of individuals in the Senior group gave the correct response. Also, among those who answered correctly, a trend was observed, such that the percentages of students responding accurately increased from the Freshman through the Senior groups.

+Q 22 - Presence of a Cross-Bite. All the orthodontists concurred that no cross-bite was present in this case.

Of the 171 participants, 156 or 91.2% recognized that no cross-bite existed in this case, including 51 or 92.7% Freshmen, all 54 or 100% Sophomores, 28 or 90.3% Juniors, and 23 or 74.2% Seniors. A total of 14 or 8.2% found a cross-bite present, specifically, 4 or 7.3% Freshmen, 2 or 6.4% Juniors, and 8 or 25.8% Seniors. Only 1 or 3.2% Juniors did not give an answer for this question. All the groups answered very consistently, except one-quarter of the Seniors, gave the incorrect response. The Pearson statistic was significant as the correct answer really stood out and the majority of individuals overall, as well as in each of the four groups studied, answered with the correct response.

+Q 23 - Location of Cross-Bite. All the orthodontists determined that this question did not apply to this case since no cross-bite existed.

Overall, 140 or 81.9% indicated that this question did not apply to this case, including 43 or 78.2% Freshmen, 49 or 90.7% Sophomores, 28 or 90.3% Juniors, and 20 or 64.5% Seniors. A total of 7 or 4.1% thought this patient had an anterior cross-bite, while 23 or 13.5% located a posterior cross-bite. This included 3 or 5.4% Freshmen, 1 or 1.8% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors for the former, and 9 or 16.4% Freshmen, 3 or 5.6% Sophomores, 1 or 3.2% Juniors, and 10 or 32.3% Seniors for the latter. The Pearson statistic was significant as the correct answer really stood out and the majority of participants overall, as well as in each group, responded to this question correctly.

+Q 24 - Presence of Maxillary Transverse Deficiency. All of the orthodontists diagnosed that no maxillary transverse deficiency was present in this case.

One-hundred-thirty-four or 78.4% overall recognized that no maxillary transverse deficiency existed, which included 40 or 72.7% Freshmen, 46 or 85.2% Sophomores, 25 or 80.6% Juniors, and 23 or 74.2% Seniors. A total of 36 or 21.1% believed this deficiency was present, specifically 15 or 27.3% Freshmen, 7 or 13% Sophomores, 6 or 19.3% Juniors, and 8 or 25.8% Seniors. Only 1 or 1.8% Sophomores did not give any answer to this question. This result was similar to the result from the two previous questions regarding the presence and location of a cross-bite.

+Q 25 - Presence of Spacing. Ninety percent of the orthodontists diagnosed that no spacing was present in the arches, while 10% decided that spacing was present.

Overall, 144 or 84.2% determined that no spacing existed in the maxillary or mandibular arches, which included 42 or 76.4% Freshmen, 47 or 87% Sophomores, 27 or 87.1% Juniors, and 28 or 90.3% Seniors, which indicated a trend, for as the level of education increased, so did the percentage in each group who responded

correctly. A total of 26 or 15.2% believed that spacing was evident, specifically 13 or 23.6% Freshmen, 6 or 11.1% Sophomores, 4 or 12.9% Juniors, and 3 or 9.7% Seniors. Only 1 or 1.8% Sophomores gave no answer to this question. This question was rather consistently answered by all four groups surveyed.

+Q 26 - Presence of Crowding. All the orthodontists concurred that crowding was present in this case.

Overall, 160 of the 171 participants or 93.6% recognized that crowding existed in this case, and included 49 or 89.1% Freshmen, 52 or 96.3% Sophomores, 30 or 96.8% Juniors, and 29 or 93.5% Seniors. Only a total of 11 or 6.4% found no crowding present, and consisted of 6 or 10.9% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors. This question was answered correctly in a very consistent manner, therefore, it was not a good determinator of ability as it was too easy.

+Q 27 - Amount of Crowding - Maxilla. Eighty percent of the orthodontists concluded that the amount of crowding present in the maxillary arch was moderate, and 20% decided the crowding was slight.

A total of 95 or 55.6% determined the amount of crowding in the maxillary arch was moderate, including 26 or 47.3% Freshmen, 29 or 53.7% Sophomores, 16 or 51.6% Juniors, and 24 or 77.4% Seniors. Fifty-four or 31.6% overall felt the crowding was slight, specifically, 19 or 34.5% Freshmen, 19 or 35.2% Sophomores, 10 or 32.3% Juniors, and 6 or 19.3% Seniors. In all, 11 or 6.4% of the students thought it was severe, while another 11 or 6.4% located no crowding in the maxillary arch at all. This was composed of 5 or 9.1% Freshmen, 3 or 5.6% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors for the former, and 5 or 9.1% Freshmen, 3 or 5.6% Sophomores, and 3 or 9.7% Juniors for the latter. The Seniors responded

correctly with the largest percentage of the four groups, 77.4%, and was the only group where none of the participants answered that no crowding was present.

+Q 28 - Amount of Crowding - Mandible. Eighty percent of the orthodontists identified that the crowding present in the mandibular arch was moderate, and 20% decided the crowding was slight.

Overall, 88 or 51.5% diagnosed that the crowding in the mandibular arch was moderate, and included 27 or 49.1% Freshmen, 27 or 50% Sophomores, 16 or 51.6% Juniors, and 18 or 58.1% Seniors. This indicated a trend, for as the level of education increased, so did the percentage of students in each group, who answered correctly. The next most popular answer was a slight amount of crowding and was selected by a total of 50 or 29.2%, specifically, 15 or 27.3% Freshmen, 19 or 35.2% Sophomores, 7 or 22.6% Juniors, and 9 or 29% Seniors. Twenty-nine or 17% overall thought it was severe, and included 11 or 20% Freshmen, 6 or 11.1% Sophomores, 8 or 25.8% Juniors, and 4 or 12.9% Seniors. Only 2 or 3.6% Freshmen and 2 or 3.7% Sophomores found no crowding in this arch.

On average, just over half of the respondents determined the crowding was moderate, while nearly 30% felt it was only slight, and 17% believed it was severe. Even though this question was answered in an increasingly correct manner by the students from the Freshman through the Senior years, it seems that the results should have been more consistent.

+Q 29 - Treatment for the Crowding. All the orthodontists concurred that the crowding present in this case required treatment.

A total of 159 or 93% responded that treatment was necessary for the crowding exhibited by this patient. This included 49 or 89.1% Freshmen, 50 or 92.6% Sophomores, 29 or 93.5% Juniors, and all 31 or 100% Seniors, which indicated a

trend, for as the educational level increased, so did the percentage of participants who answered correctly in each group. Only 10 or 5.8% felt no treatment was required, specifically, 4 or 7.3% Freshmen, 4 or 7.4% Sophomores, and 2 or 6.4% Juniors. Only 2 or 3.6% Freshmen gave no answer to this question. Since this question was answered correctly in such a consistent manner, it was not a good determinator of ability, as it was much too easy.

+Q 30 - Co-incidence of Midlines. All the orthodontists agreed that the midlines were co-incident in this patient.

Overall, 145 or 84.8% determined that this patient's midlines were co-incident, specifically, 44 or 80% Freshmen, 47 or 87% Sophomores, 27 or 87.1% Juniors, and 27 or 87.1% Seniors. A total of 24 or 14% decided the midlines were not co-incident, including 11 or 20% Freshmen, 6 or 11.1% Sophomores, 4 or 12.9% Juniors, and 3 or 9.7% Seniors. One or 1.8% Sophomores and 1 or 3.2% Seniors gave no answer to this question. On the whole, this question was answered quite consistently by the majority of individuals in this study, therefore, it was not a good determinator of ability as it was too easy.

+Q 31 - Presence of Dental Conditions: A) missing teeth, B) supernumerary teeth, C) impacted teeth, D) malformed teeth, or E) none of the above. All the orthodontists concurred that there were no unusual dental conditions present in this patient.

A total of 140 of the 171 participants or 81.9% observed no unusual dental conditions in this case, which included 40 or 72.7% Freshmen, 44 or 81.5% Sophomores, 26 or 83.9% Juniors, and 30 or 96.8% Seniors, which indicated a trend, for as the level of education increased, so did the percentage who responded correctly. Overall, 5 or 2.9% answered that teeth were congenitally missing, while 4 or 2.3%

thought supernumerary teeth were present. This included 4 or 7.3% Freshmen and 1 or 1.8% Sophomores for the former, and 2 or 3.6% Freshmen and 3 or 6.4% Juniors for the latter. A total of 13 or 7.6% located impacted teeth and 9 or 5.3% noticed malformed teeth, specifically, 4 or 7.3% Freshmen, 6 or 11.1% Sophomores, 2 or 6.4% Juniors, and 1 or 3.2% Seniors for the former, and 5 or 9.1% Freshmen, 3 or 5.6% Sophomores, and 1 or 3.2% Juniors for the latter. The majority of respondents did very well in correctly answering this question.

+Q 32 - Gingival Health. Ninety percent of the orthodontists determined that the gingiva in this case was healthy, while 10% thought it was not healthy.

Overall, 122 or 71.3% considered this patient's gingiva to be healthy, including 41 or 74.5% Freshmen, 34 or 63% Sophomores, 23 or 74.2% Juniors, and 24 or 77.4% Seniors. A total of 44 or 25.7% found the tissue to be unhealthy, specifically, 13 or 23.6% Freshmen, 20 or 37% Sophomores, 7 or 22.6% Juniors, and 4 or 12.9% Seniors. Only 3 or 9.7% Seniors gave no answer to this question. The Pearson statistic was significant as the correct answer stood out and the majority of individuals overall, as well as in each of the four groups, answered this question correctly.

+Q 33 - Presence of Periodontal Conditions: A) recession of the gum tissue, B) defects in the gum tissue, C) bone loss, or D) none of the above. All the orthodontists agreed that no unusual periodontal conditions existed in this case.

Overall, 140 or 81.9% diagnosed that no unusual periodontal problems were present, which included 42 or 76.4% Freshmen, 44 or 81.5% Sophomores, 24 or 77.4% Juniors, and 30 or 96.8% Seniors. A total of 8 or 4.7% found gingival recession, while 15 or 8.8% believed gingival defects were evident. This included 6 or 10.9% Freshmen, 1 or 1.8% Sophomores, and 1 or 3.2% Juniors for the former, and 4 or 7.3% Freshmen, 7 or 13% Sophomores, and 4 or 12.9% Seniors for the latter.

Only 2 or 1.2%, specifically 1 or 1.8% Freshmen and 1 or 1.8% Sophomores, felt bone loss was present. The Senior students answered this question very consistently with 97%, while the other groups responded with an average of 78%.

+Q 34 - Need for Orthodontic Treatment. All the orthodontists agreed that this patient required orthodontic treatment.

Overall, 163 or 95.3% of the participants determined that this patient should have orthodontic treatment, and included 51 or 92.7% Freshmen, 52 or 96.3% Sophomores, 30 or 96.8% Juniors, and 30 or 96.8% Seniors. Only 6 or 3.5%, specifically 2 or 3.6% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors felt no treatment was necessary. Just 1 or 1.8% Freshmen gave no answer to this question. All four groups surveyed for this study answered this question in a very consistent manner, therefore, it was not a good determinator of ability as it was far too easy to answer correctly.

+Q 35 - Provider for Orthodontic Treatment: A) A general dentist who treats limited aspects of orthodontics, B) A general dentist who treats all aspects of orthodontics, C) A general dentist who only practices orthodontics, D) A pedodontist, E) An orthodontist. All the orthodontists concurred that an orthodontist should provide treatment in this case.

Overall, 100 or 58.5% determined that an orthodontist should provide treatment for this patient, specifically, 28 or 50.9% Freshmen, 29 or 53.7% Sophomores, 21 or 67.7% Juniors, and 22 or 71% Seniors, which indicated a trend. A total of 16 or 9.4% chose A, while B was selected by 30 or 17.5%. This included 9 or 16.4% Freshmen, 1 or 1.8% Sophomores, 2 or 6.4% Juniors, and 4 or 12.9% Seniors for the former, and 10 or 18.2% Freshmen, 15 or 27.8% Sophomores, 3 or 9.7% Juniors, and 2 or 6.4% Seniors for the latter. Overall, 5 or 2.9% decided on C and another 5 or 2.9%

chose D, including 2 or 3.6% Freshmen, 1 or 1.8% Sophomores, and 2 or 6.4% Juniors for answer C, and 3 or 5.4% Freshmen and 2 or 6.4% Juniors for answer D. A total of 15 or 8.8% responded with multiple answers to this question, and consisted of: 3 or 5.4% Freshmen - 1 AE, 1 BCE, and 1 BCDE; 8 or 14.8% Sophomores - 5 BCE, 2 BE and 1 AE; 1 or 3.2% Juniors - 1 BE; and 3 or 9.7% Seniors - 1 AE, 1 CE and 1 ABCE.

Even though the respondents demonstrated a trend in selecting the correct answer, an average of only 58.5% did so. The Pearson statistic was significant as the correct answer stood out and the majority of participants overall, as well as in each group surveyed, responded to this question correctly.

+Q 36 - Necessity for Extractions: Eighty percent of the orthodontists indicated extractions were not necessary to treat this patient, while 20% decided extractions were needed.

Overall, 113 or 66.1% indicated that no extractions were required, and included 36 or 65.4% Freshmen, 40 or 74.1% Sophomores, 18 or 58.1% Juniors, and 19 or 61.3% Seniors. A total of 56 or 32.7% felt extractions were necessary and was comprised of 18 or 32.7% Freshmen, 14 or 25.9% Sophomores, 13 or 41.9% Juniors, and 11 or 35.5% Seniors. Only 1 or 3.2% Freshmen did not give an answer to this question. A higher percentage of students overall regarded this to be an extraction case than did the orthodontists, with the Junior students selecting this option with the greatest frequency among the four groups, with 41.9%

+Q 37 - Diagnostic Records: Models. Ninety percent of the orthodontists determined that they relied on the models in a large part, while 10% relied on them in a small part to diagnose this case.

Overall, 150 or 87.7% of the respondents needed the models in a large part

including 47 or 85.5% Freshmen, 46 or 85.2% Sophomores, 30 or 96.8% Juniors, and 27 or 87.1% Seniors. A total of 11 or 6.4% used them in a small part, specifically, 4 or 7.3% Freshmen, 5 or 9.3% Sophomores, and 2 or 6.4% Seniors. Only 9 or 5.3% thought they totally used the models to diagnose this case, including 3 or 5.4% Freshmen, 3 or 5.6% Sophomores, 1 or 3.2% Seniors, and 2 or 6.4% Seniors, while only 1 or 1.8% Freshmen found they did not need them at all. This question was very consistently answered by the majority of participants in this study, therefore, it was not a good determinator of ability as it was very easy.

+Q 38 - Diagnostic Records: Photographs. Seventy percent of the orthodontists decided they relied on the photographs in a large part, while 30% relied on them in a small part to diagnose this case.

Overall, 88 or 51.5% stated they needed the photographs in a large part, which included 29 or 52.7% Freshmen, 24 or 44.4% Sophomores, 18 or 58.1% Juniors, and 17 or 54.8% Seniors. A total of 75 or 43.9% believed they required them in a small part, specifically, 22 or 40% Freshmen, 29 or 53.7% Sophomores, 12 or 38.7% Juniors, and 12 or 38.7% Seniors. Only 7 or 4.1%, including 3 or 5.4% Freshmen, 1 or 1.8% Sophomores, 1 or 3.2% Juniors, and 2 or 6.4% Seniors indicated they used them totally to diagnose this case, while just 1 or 1.8% Freshmen did not use them at all. Just a little over half of the respondents reached the conclusion that they needed the photographs in a large part, while 70% of the orthodontists decided this.

+Q 39 - Diagnostic Records: X-Rays. Fifty percent of the orthodontists determined they needed the radiograph in a large part, while the other 50% decided they needed it in a small part in order to diagnose this case.

Overall, 92 or 53.8% of the participants stated they relied on the radiograph in a small part, while a total of 58 or 33.9% felt they used it in a large part. This included

33 or 60% Freshmen, 30 or 55.6% Sophomores, 15 or 48.4% Juniors, and 14 or 45.2% Seniors for the former and 11 or 20% Freshmen, 21 or 38.9% Sophomores, 14 or 45.2% Juniors, and 12 or 38.7% Seniors for the latter. Overall, only 9 or 5.3% needed the radiograph totally to diagnose this case, specifically, 5 or 9.1% Freshmen, 2 or 3.7% Sophomores, 1 or 3.2% Juniors, and 1 or 3.2% Seniors. A total of 12 or 7% found they did not need it at all, including 6 or 10.9% Freshmen, 1 or 1.8% Sophomores, 1 or 3.2% Juniors, and 4 or 12.9% Seniors. Since the experts were evenly divided on the answer to this question, it was not a good indicator by which to measure the participants' ability.

A list of the number of significant responses by question for Cases 1 - 7 are listed on Table 47.

Table 47 --Number of Significant Responses
By Question for Cases 1-7

Question Number	Number of Sig Responses ($p < 0.05$)	Question Number	Number of Sig Responses ($p < 0.05$)
1	5	21	2
2	6	22	2
3	3	23	5
4	2	24	0
5	2	25	0
6	1	26	2
7	2	27	3
8	2	28	4
9	4	29	2
10	5	30	1
11	5	31	2
12	7	32	3
13	4	33	2
14	4	34	1
15	2	35	5
16	2	36	1
17	2	37	0
18	3	38	1
19	1	39	1
20	1		

DISCUSSION

Didactic Assessment

The outcome test consisted of ten questions and was utilized during the first month of the spring semester, to examine the Case Western Reserve University dental students' didactic knowledge. The identical test had been administered the first week of the fall semester at the University of Tennessee in 1992 and 1993, and those results were compared to the ones from the present study.

At the University of Tennessee, the Knowledge Base in 1992 was as follows: Freshmen 31.37%, Sophomores, 37.46%, Juniors 44.07%, and Seniors 49.71% (Figure 9), while the Knowledge Base in 1993 was Freshmen 31.5%, Sophomores 39.63%, Juniors 44.8% and Seniors 47.59% (Figure 10).

It was interesting to note that there were no differences between the scores from the first and second year students at CWRU, who both achieved 30%, even though at the time of the test, the Sophomores had completed their Freshman Facial Growth and Development course, but a difference did exist with the results from the Sophomores in Tennessee, who had an average score of approximately 38.5%. The third year students presented with 42% correct which was similar to the score from the University of Tennessee, however, the fourth year students at CWRU had a higher score, 59%, than those from Tennessee with 48.6%. Therefore, the differences in the test results between the two universities appear to be from the Sophomore and Senior groups. The lower score from the Sophomores at CWRU may be due to their either not possessing

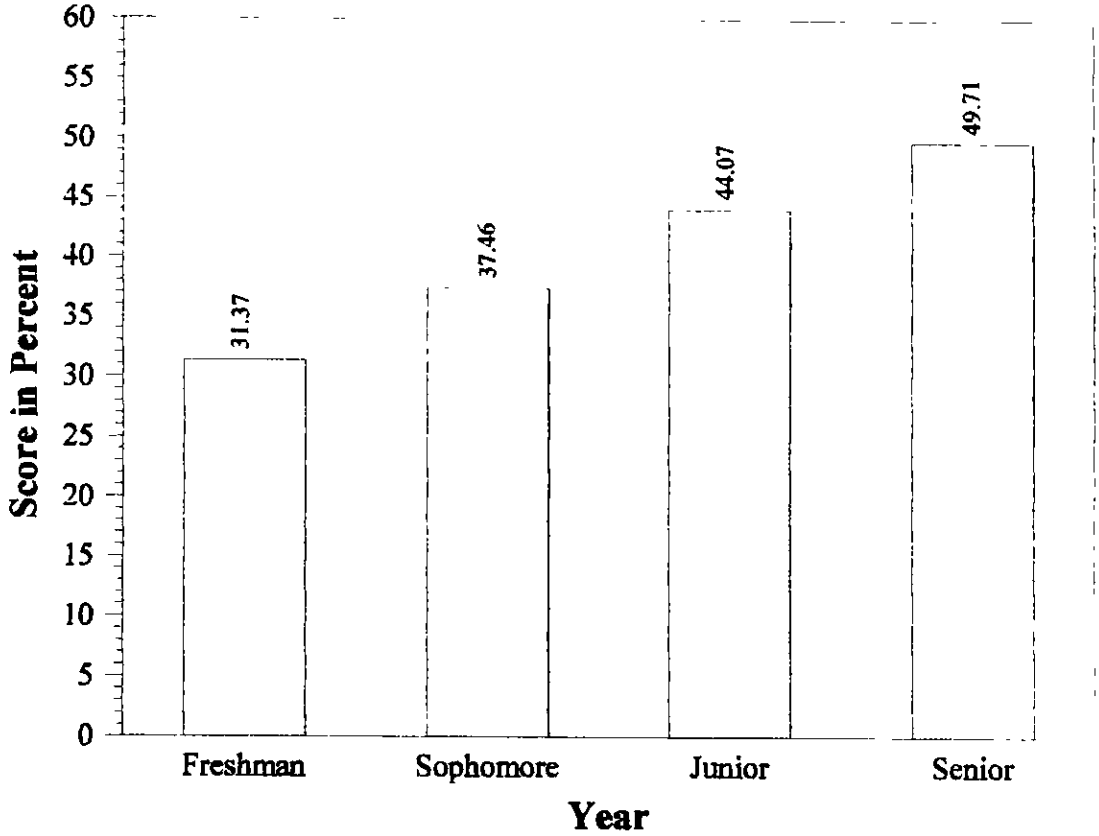


Figure 9 University of Tennessee
Didactic Knowledge Base - 1992

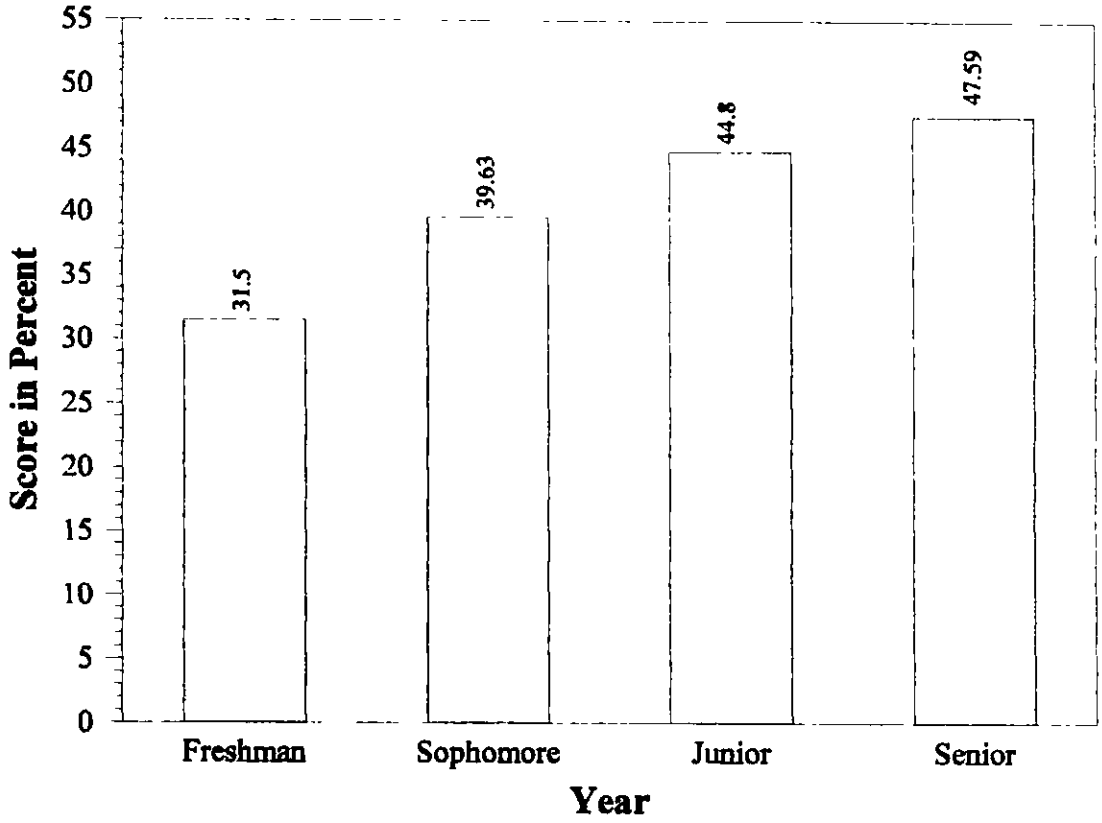


Figure 10 University of Tennessee
Didactic Knowledge Base - 1993

any additional information than the Freshman students, or perhaps they may not have tried as hard as they should have. While the Seniors from the University of Tennessee had an average score of about 48.6%, the Seniors from Cleveland achieved a score of 59% correct (Behrents 1993 and 1994).

Even though the tests were administered at different times of the year, I believe the amount of knowledge possessed by the students was rather comparable, except for the Senior group. They had recently been examined in orthodontics from a section of the National Boards Exam, Part II. Therefore, they were much more familiar with the questions used in the outcome test than were the Seniors in Tennessee, or for that matter, any of the other participants in these two studies.

The predoctoral curriculum at CWRU compares with most other schools and reflects the AADS guidelines. The curriculum at the University of Tennessee, which was the subject of Behrents' outcomes assessment test (1994) was similar and the course descriptions in its catalog reflect the same training at each class level.

The need for outcomes assessment of undergraduate dental education, and methods of constructing adequate test instruments, have been discussed by several authors (Adair 1990; Behrents 1993 and 1994; Casamassimo 1990; Cullen 1990; Cummings et al., 1988; Graber 1967; Hanes 1990; Jacobs 1988; Nieberg and Sinclair 1988; Romberg 1990).

Curriculum

The first through fourth year dental students at the CWRU School of Dentistry were tested in January and February 1994, after completing the first semester of that year in school. In order to compare the test results of students in each class, a description of educational courses completed by each group at the time of the test follows. According to the curriculum for the first semester, Freshmen took lectures in

dental anatomy, biochemistry (macromolecular basis of oral disease), physical evaluation, dental health ecology, biostatistics, periodontics and preventive periodontics, gross anatomy, radiology, prosthodontics, and skills development in evaluating dental literature. Clinics and laboratories included periodontics, gross anatomy, radiology and admitting, and prosthodontics (C.W.R.U. School of Dentistry 1994).

Second year students received in the second semester as Freshmen, and their first semester as Sophomores, lectures in periodontics, microbiology and infection surgery, infectious diseases, partial denture design, basic procedures in restorative dentistry and oral diagnosis. Lab and clinic courses included dental histology lab, periodontics clinic, radiology and admitting clinic, partial denture lab, restorative dentistry lab, and prosthodontics lab.

The third year students received in their second semester as Sophomores and first semester as Juniors, lectures in oral pathology, physiopharmacology, endodontics, dental auxiliary management, dental and facial morphology, orthodontics, restorative dentistry, oral diagnosis, medical emergencies, periodontics, operative dentistry, pediatric dentistry and applied nutrition, geriatric dentistry, principles of medicine, and removable prosthodontics. Labs and clinics included basic procedures in restorative dentistry, periodontics clinic, infections disease lab, partial denture lab, oral diagnosis and continuing care clinic, orthodontics lab, and admitting clinic. More than half of the scheduled hours for first and second semester Juniors and Seniors are in the clinics.

Fourth year students had received at the time this test was administered, as second semester Juniors and first semester Seniors, lectures in clinical neuroscience, fixed prosthodontics, oral surgery, operative dentistry, pediatric dentistry and applied nutrition, issues and trends in dentistry, hospital dentistry, oral cancer diagnosis and

treatment, implant dentistry, periodontic case studies, occupational safety and health, jurisprudence, practice administration, clinical oral pathology, therapeutic pharmacology, and case presentations. In addition to dental clinic hours, labs and clinics included oral surgery and orthodontics.

Second semester Seniors spend most of their time in the dental clinics, with lectures in practice administration, case presentation, and seminars on special topics. Every Senior is expected to have one limited treatment orthodontics case in the clinic, but in practice, there may not always be enough cases in the clinic. Alternatively, Seniors may actively participate by assisting residents in the orthodontics program with selected cases.

Specific course work that has implications for this study included, besides the general clinical experience and clinical orthodontics, for Freshmen, facial growth and development comprising normal growth and development of the human face. Sophomores take dentofacial morphology with lectures and demonstrations of the ontogenesis of occlusion in the face of the growing child demonstrated with motion pictures and serial cephalometric roentgenograms; Bolton standards are applied, and differentiation from normal variability with emphasis on facial form, mixed dentition, case analyses, and responsibilities of the practicing dentist are discussed. Orthodontic lectures and laboratories begin in the second half of the second year, through the first semester of the Junior year, with orthodontic clinical experiences in the third and fourth years.

These course descriptions, from the CWRU School of Dentistry Catalog (1994), very specifically detail the requirements of the undergraduate dental curriculum, including courses related to diagnosis and recognition of malocclusion. The option for clinical experience in orthodontics by completion of supervised orthodontics assists are

clearly explained in supplemental memoranda by the department, along with the criteria for evaluation and credit (Hans, September 8, 1994).

The curriculum reflects guidelines of the American Association of Dental Schools for orthodontics instruction of undergraduates, including educational goals and objectives, sequence of instruction, topics in growth and development, topics for preclinical instruction, and clinical experience and treatment, and these specifically include diagnosis of malocclusion. These standards were developed by The American Dental Association Commission on Accreditation of Dental and Dental Auxiliary Educational Programs in 1978, and were published in 1979 (ADA-AAD, Journal of Dental Education Special Report, 44:4:1980).

These guidelines are based on the premise that the general dentists must be able to recognize and identify orthodontic problems, and to do so must understand the etiology and treatment of occlusal disharmonies and orofacial deformities. The guidelines recommend that the predoctoral curriculum should include basic components of orthodontics, and that application of the need for appropriate referral to specialists be taught. The predoctoral curriculum should structure instruction in orthodontics so that the student will be able to recognize, describe, classify and differentiate occlusal problems of children and adults. The curriculum should include at level 1 growth and development; at level 2, preclinical orthodontics, including applied growth and development, diagnostic methods, and biomechanics and techniques; and at level 3, clinical experience, including uncomplicated orthodontic treatment, as well as referral and interaction with specialists. The specifics of these courses are further described in the guidelines (ADA-AAD 1980, Gottlieb et al. 1991, Jacobs 1977 and 1988).

Clinical Assessment

This section of the discussion examined how well each group of students,

Freshmen (FR), Sophomores (SO), Juniors (JR) and Seniors (SR) performed on the clinical test by looking at the answers to each of the 39 questions asked about each case of malocclusion presented. When a trend was evident, the performance for each group increased as academic year increased. A reversal indicated that overall fewer than half of the students correctly answered the question. A very subtle question for a given case was one in which the diagnosis was more difficult and required a close comparison of all diagnostic tools provided. Twenty-four questions had over 50% of the subjects in all four groups giving correct responses (Table 48), so in general, only in the results of the remaining 15 questions was there enough variance among groups to distinguish significant results. For certain questions applied to certain cases, the answers of the orthodontists varied widely, so student results for these instances were discarded since these would not provide good measures for study.

Appendices E and F described the 75 criteria for malocclusion which were used to select the 39 test questions applied to the cases, and to select the cases for evaluation. This list was presented to several orthodontists, who were each asked to select the 20 most important items, and the results were used to compile the questionnaire. The cases were selected to demonstrate those aspects identified as being the most critical for the general dentist to recognize.

All the questions from each of the seven cases were studied and 24 "base questions" were identified. These were the questions that the majority of the students in each of the four groups answered correctly for the seven cases, when compared to the responses from the reference group of orthodontists. The complete group consisted of a majority of Freshman, Sophomore, Junior and Senior students who answered each question correctly for the seven cases as shown in Table 48. All of these questions that four or more complete groups answered accurately were not necessarily good

Table 48 --Number of Complete Groups For Seven Cases With Correct Responses

Question	Number of Complete Groups	Topic
1	3	Facial Profile
2	3	Mandibular Position
3	3	Treatment for Mandibular Position
4	3	Treatment for Facial Profile
*5	5	Appearance of the Lips
*6	5	Treatment for Labial Appearance
*7	7	Stage of Dentition
*8	5	Appropriate Dentition
9	1	Cuspid Relationship-Right Side
10	3	Cuspid Relationship-Left Side
*11	4	Treatment for Cuspid Relationship
12	3	Molar Relationship-Right Side
13	3	Molar Relationship-Left Side
*14	6	Treatment for Molar Relationship
*15	7	Presence of Overbite
*16	4	Amount of Overbite
*17	5	Treatment for Overbite
*18	7	Presence of Open-Bite
*19	6	Presence of Overjet
20	3	Amount of Overjet
*21	4	Treatment for Overjet
*22	6	Presence of Cross-Bite
*23	6	Location of Cross-Bite
*24	6	Presence of Maxillary Transverse Deficiency
*25	6	Presence of Spacing
*26	5	Presence of Crowding
27	2	Crowding in Maxillary Arch
28	1	Crowding in Mandibular Arch
*29	5	Treatment for Crowding
*30	5	Co-incidence of Midlines
31	3	Dental Conditions
*32	7	Gingival Health
*33	7	Periodontal Conditions
*34	7	Orthodontic Treatment
35	3	Provider for Orthodontic Treatment
*36	5	Extractions
*37	7	Models for Diagnosis
38	2	Photographs for Diagnosis
39	2	Radiograph for Diagnosis

[* = Base Question]

determinators of ability. This will be discussed later. The base questions appearing in each case are listed in Appendix J, Tables 52-58.

Dental group means on all 39 questions for the seven cases were as follows: for FR 64.9%, for SO 69.5%, for JR 69.8% and for SR 70.4%. The Freshman group representing general knowledge before dental education begins was the lowest, with a jump in results from the Freshman to the Sophomore groups, some improvement from the Sophomore to Junior year and improvement, but very little, from the Junior to the Senior group. These results are displayed in Table 49.

Table 49 --Dental Group Means On All 39 Questions for the Seven Cases [In Percent]

Freshman	64 9
Sophomore	69.5
Junior	69 8
Senior	70 3

An example of a typical upward and a typical downward trend from the mean case scores for dental groups by question are demonstrated in Figure 11.

Generally, there was a trend overall from the Freshman to Sophomore groups, but not much difference from the Sophomore to Junior groups and from the Junior to Senior groups, but there were some questions that depicted somewhat of a downward trend.

There were a total of eight questions where in the Senior year the score decreased from that in the Junior year. The increasing trend as shown by question 6 was more common than the decreasing trend as illustrated by question 12. These results are described in Table 50, which presents the mean case scores for dental

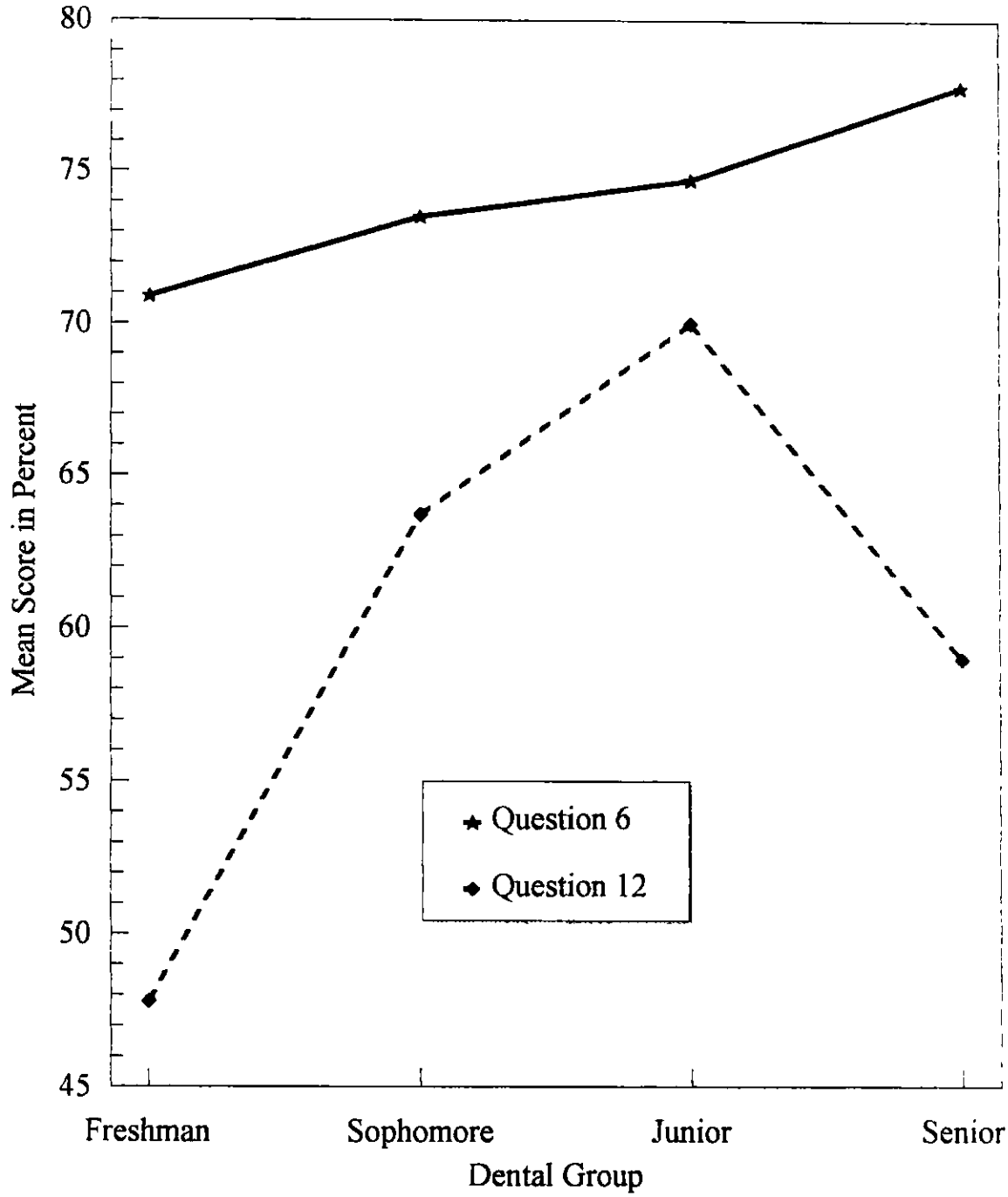


Figure 11. Examples of an Upward and Downward Trend From the Mean Case Scores for Dental Groups by Question

Table 50 --Mean Case Scores for Dental Groups By Question [In Percent]

Question	Freshman	Sophomore	Junior	Senior
1	60 8	64 3	68 7	63 1
2	61 3	60 1	59 4	58 5
3	61 8	68 5	65 0	59 0
4	64 1	65 6	64 0	60 4
5	66.0	73 3	70.0	72 8
6	70 9	73 5	74 7	77 8
7	81 0	92 3	89 8	85 7
8	73 5	74 6	76 9	70 5
9	28 6	37 6	45 6	39 2
10	46.9	59 8	59 4	54 4
11	51 9	52.6	53 5	59 4
12	47 8	63.7	70.0	59 0
13	50.4	63 5	62.7	59 4
14	70 1	80 4	69.6	80 6
15	85.7	85 7	90.8	90 3
16	59 0	65 1	69 1	68 2
17	64.1	70 0	75 1	74 7
18	78.4	85 7	83 8	89 9
19	79 0	81 7	75 6	78 8
20	45 2	49 5	50 7	50 7
21	57 4	63 2	65 4	66 3
22	77 7	86 5	79.7	82 0
23	72 7	80 4	71 9	72 3
24	73 2	73 5	78 3	78 3
25	68 6	72 5	72.8	76 0
26	75 0	73 0	75 6	80 2
27	55 6	62 2	63 6	65 0
28	41 6	39 4	33 6	53 4
29	70.9	73 2	76 9	76 9
30	67 0	75 9	66 4	73 7
31	53 3	63 0	68.7	70 0
32	74 0	75 7	72.3	75 1
33	82.9	81 0	79.7	82 9
34	90 9	88 4	91 7	96 3
35	52.7	47 9	61.7	67 7
36	68 8	72 2	70.1	69 6
37	79.7	86.8	87.1	86 2
38	62.9	62 2	67.2	65 4
39	60 5	66 1	65.4	51 2

groups by question.

These 8 questions are the areas of special concern for Senior students: 1-facial profile; 3-treatment of mandibular position; 7-stage of dentition; 8-appropriate dentition; 9-cuspid relationship on the right side; 10-cuspid relationship on the left side; 12-molar relationship on the right side; and 39-panoramic radiograph for diagnosis.

The trend, especially for the Freshman and Senior groups, seems reasonable and was expected. The first and fourth placements were good. These results did not behave in any way out of the ordinary. Also, the Sophomore and Junior groups placed second and third the expected number of times and the progression appears to be good. These results are described in Table 51, Number of Correct Questions by Group and Placement.

Table 51.--Number of Correct Questions By Group and Placement

	Freshman	Sophomore	Junior	Senior
First	2	13	12	16
Second	4	7	15	9
Third	11	15	5	9
Fourth	22	4	7	5

Summary of Responses to the 39 Questions

Question 1, Facial Profile, was identified by the majority of students for obvious Class I and Class II profiles, however, when the case was more subtle or when the patient displayed a prominent chin, the students became distracted and confused and were unable to correctly identify the skeletal relationship. Overall, they did not do as well in diagnosing a pre-adolescent patient. For Case 1, 60% overall and

only half of the FR and SO students identified the convex profile, but a trend was evident as the students answered in an increasingly correct manner as the level of education increased. For Case 2, 71% identified the convex profile and a trend was evident, but for Case 3, the FR, JR and SR answered correctly with just over 60%, but SO had 87% correct. For Case 4, 57% overall recognized the convex profile, but 34% labeled it a straight profile, and fewer than half the SO and SR students answered correctly. This was a more subtle case to correctly diagnose as the patient had a prominent chin. For Case 5, over 74% of FR, SO and JR correctly identified the straight profile, but only 45% of SR were correct. Overall, 77% answered Case 6 correctly recognizing the straight profile, yet for Case 7 only 40% correctly identified the straight profile. However, the same percentage identified it as being concave, since this was a subtle presentation with a prominent chin displayed by the patient. Therefore, this indicated a reversal.

For Question 2, Mandibular Position, generally, the students were able to recognize a mandible in an obvious retruded or straight position, however, they could not separate the skeletal position of the lower jaw from a prominent menton area, and thus were not able to draw the correct conclusion. Also, when dealing with a younger patient, they did not identify the problem as well as with a teenage patient. Overall, 57% correctly identified the retruded mandible for Case 1, yet 39% thought it was straight. For Case 2 a trend was evident as 75% overall correctly identified the retruded mandible. In Cases, 3, 5, and 6, the straight position of the mandible was obvious and over 62% answered correctly. For Case 4, 48% identified the retruded mandible correctly, but another 48% were misled by the prominent chin and answered incorrectly, showing a reversal; the majority of FR and JR were correct, but more FR and JR answered incorrectly. Only 42% of SR and 23% of JR correctly identified the

straight mandible for Case 7, and only 35% overall answered correctly, as the patient's prominent chin confused the diagnosis.

Question 3, Treatment for the Mandibular Position, when the mandible was in an obviously ideal or straight position, a few more students responded that no treatment was necessary than answered that the mandible was straight. Therefore, they understood that they should withhold treatment when no problem was evident. However, when the students identified a skeletal problem was present, generally fewer students wished to treat the discrepancy. For Cases 1 and 2, the need for treatment for a retruded mandible was obvious, yet in both cases fewer than half the students recommended treatment of this skeletal problem. For Cases 3 and 6, 83% overall would not treat the straight mandible. Cases 4 and 7 presented more subtle situations, yet a majority for each case answered correctly. For Case 5, 73% overall would not treat the straight mandible, yet 61% of SR responded incorrectly, since many misdiagnosed the mandibular position..

For Question 4, Treatment for the Facial Profile, when the profile was ideal and was an obvious Class I, generally more students chose not to treat the patient. But when the students identified that a problem existed, fewer were willing to treat the patient for this skeletal discrepancy. Over 66% chose to treat the convex profile for Case 1, and 53% for Case 2, both obvious convex facial profiles requiring treatment. While a slight majority of FR and SO, and about half of the JR answered correctly, most SR answered incorrectly for Case 2. For Cases 3, 5, and 6, straight profiles obviously did not require treatment, and the majority of each group answered correctly. For Case 4, 49% overall chose to treat the convex profile, a subtle question, indicating a reversal. For Case 7, less than half the students decided not to treat the straight profile, indicating a reversal, failing to correctly identify that no treatment was needed

for this subtle case.

Question 5 asked about the Appearance of the Lips, and in Case 1, 53% overall determined the lips were tense, yet only 50% of the experts agreed, so this case was disregarded for analysis of results. The majority of students decided the lips in Cases, 2, 3, 5, 6, and 7 appeared normal. For Case 4, only 48% overall correctly identified the tense lips, therefore, this indicated a reversal. Fewer than half of FR and SO answered correctly, but only 25% of JR were correct, however, two-thirds of SR answered correctly, showing that only the SR could correctly recognize a tense appearance of the lips.

Question 6, Treatment for the Appearance of the Lips, was an easy question to answer for Cases 2, 3, 5, 6, and 7 with normal lips, and a high percentage answered each case correctly. For Case 1, only 50% overall would treat, although 68% identified a problem. For Case 4, only 39% would treat the tense lips, indicating a reversal, even though 52% overall identified a problem. When the lips were normal, students responded appropriately, but even when a problem was correctly identified, fewer students recognized the need for treatment.

For Question 7, Stage of Dentition, the great majority overall answered correctly for Cases 1, 2, 4, 5, 6, and 7. For Case 3, 30% failed to recognize the unerupted permanent maxillary cuspids, so responded incorrectly. In general, students were able to recognize the stage of dentition, but missed the impacted maxillary cuspids, possibly because they did not study the patient's records carefully.

Question 8 asked if the Dentition was Appropriate for the Age and Gender of the patient, and the great majority of students answered correctly for Cases 1, 2, 4, 5 and 6. For Case 3, 56% overall decided the dentition was inappropriate, a more subtle case, but for this case, over 63% of the FR, SO and JR answered correctly, yet only

29% of the SR saw that the dentition was not suitable for this patient, as they missed the retained primary teeth. For Case 7, only 16% overall, and only 29% of SR, were able to correctly identify an advanced stage of permanent dentition in relation to age and gender. Overall, half the participants did not understand the concepts of retained primary teeth and an advanced stage of permanent dentition.

Question 9, Cuspid Relationship (right side), in general had poor results. Case 1 received variable answers from the experts, so this was not considered a good question for analysis. For Case 2, only 30% overall recognized the Class II relationship, therefore, indicating a reversal. For Case 3, the JR had the highest percentage of correct answers to this more subtle end-to-end relationship with 23%, and only 6% of SO answered correctly. For Case 4, 70% overall identified the Class I relationship and a trend was noted from the FR through the SR groups. For Case 5, only 32% overall recognized the Class I relationship, indicating a reversal. Only 39% of JR and SR correctly identified this relationship. For Case 6, only 36% overall recognized the end-to-end relationship, indicating a reversal. Only a majority of JR answered correctly, followed by SO, SR and FR (25%). For Case 7, overall, less than half of the students correctly identified a Class II relationship. In only one of the two cases with Class I, did the groups perform well, and less than one-third could identify an end-to-end relationship. Therefore, since most of these were very obvious cuspid relationships, no matter what the diagnosis, the large majority was unable to diagnose correctly, indicating a need to devote much more attention to this area of instruction.

Question 10, Cuspid Relationship (left side), had mixed results among the orthodontists for Case 1, so this result was discarded for purposes of discussion. Only 38% overall correctly diagnosed the Class II relationship for Case 2, indicating a

reversal; the SO had the highest percentage correct with 44%, with FR having only 31% correct. For Cases 3 and 4, over 70% overall correctly identified Class I relationships. For Case 5, 52% recognized the more subtle Class I relationship (or Super Class I), but about half the FR, SO and JR responded correctly, while only a third of SR answered as such. For Case 6, 67% recognized the Class I relationship. For Case 7, only 16% overall correctly identified the end-to-end relationship, indicating a reversal. Forty-two percent of SO answered correctly, but the other groups, including SR, responded with about 11% correct. Therefore, it appears that the majority of students could recognize an ideal Class I cuspid relationship, but not a more subtle one, and had difficulty differentiating between and identifying Class II and end-to-end relationships, indicating a need for more instruction in this area.

Question 11, Treatment for the Cuspid Relationship had mixed results, as students who had difficulty diagnosing the cuspid relationship in subtle cases could not accurately make treatment decisions. For Case 1, the orthodontists' results were too widely varied for comparison. For Case 2, 66% of students overall decided the Class II relationship required treatment, with more SO and SR responding correctly than FR and JR. Only 43% overall determined the cuspid relationship for Case 3 required treatment. Therefore, a reversal was indicated. For Case 4, overall 69% recognized the Class I relationship did not require treatment, and a trend was noted. For Case 5, only 28% decided the Class I relationship did not require treatment, and the incorrect responses to this very subtle case showed a reversal. The SO had the most correct answers. The left side exhibited a super Class I relationship which confused the majority of students in all groups.

For Case 6, 59% overall recommended treatment, with the large majority of SR answering correctly, but only about half of the FR, SO and JR did so. Case 7 had the

lowest percentage correct among the SR (55%) and the highest percent by SO (67%), with 63% overall recommending treatment.

Question 12, Molar Relationship (right side), was easy for the majority to identify a Class I relationship when the opposing side was also Class I. Most could identify Class II, but all groups had difficulty diagnosing an end-to-end relationship, especially a subtle one, confusing it with Class I. Half the JR and SR and the great majority of FR and SO could not identify an obvious end-to-end relationship. For Case 1, only 28% overall diagnosed the end-to-end relationship, a subtle question, which showed a reversal. The JR had the highest percentage correct, but the SR had the lowest. Case 2 also indicated a reversal, as only 47% overall recognized the Class II relationship, with only a slight majority of SO and JR correct, and under half of the SR correct, with many respondents confusing it with an end-to-end relationship. For Case 3 and Case 4, a large majority of all groups correctly diagnosed the Class I relationships. For Case 5, 64% answered correctly, with a bare majority of FR, and a larger majority of SO and JR correctly identifying the Class I relationship, however, fewer than half the SR were correct, possibly not understanding a subdivision case. In Case 6, only 27% overall correctly diagnosed the end-to-end relationship, showing a reversal, with more JR and SR being correct, but there were fewer FR and SO correct. For Case 7, over 70% overall correctly diagnosed the Class II relationship.

Question 13, Molar Relationship (left side). The students showed difficulty in distinguishing an end-to-end relationship. For Case 1, only 20% and for Case 7, only 22% overall correctly diagnosed the end-to-end relationships in these subtle cases, which indicated reversals. Most students saw Case 1 as a Class I relationship, with 29% FR correct, but only 6% SR correct, while for Case 7, more JR and Sr were correct than FR and SO. For Case 2, just over half recognized the Class II relationship

and, while a majority of SO and JR were correct, fewer than half the FR and SR answered correctly, with SR confusing it with end-to-end. Case 3 and Case 6 had about 90% correctly diagnosing Class I. Case 4 had 74% identifying Class I correctly and a trend was noted. Case 5 represented a Class III relationship and a majority of SO and JR were correct, but fewer than half of the Sr and FR answered accurately.

Question 14, need for Treatment of the Molar Relationship, was answered correctly by a majority of students for all cases, but where students correctly identified problems with the molar relationship, a smaller percentage were willing to treat it. Most accurately diagnosed that no treatment was needed for a Class I relationship, yet in a Class I end-to-end subdivision, more of them recognized a problem than were willing to treat, most likely feeling it was not severe, yet a positive trend was noted in this instance from FR to SR. In the Class II and end-to-end cases, even though overall, students did well in diagnosing that treatment was necessary, more recognized a problem than would treat it. For Case 1, 63% overall decided to treat the end-to-end molar relationship, with 77% of the SR correct, but the JR with only 39%. For Case 2, SO had the highest score correct with 83%, but just about half of the SR, FR and JR were correct. Over 91% responded correctly to Case 3, and Case 4 had 79% correct overall, both cases of Class I not requiring treatment. Case 5 had a large majority of correct responses, over 82%, relating well with the diagnostic questions on molar relationship. For Case 6, a trend was evident and 64% overall decided to treat this subdivision case. For Case 7, 81% overall chose to treat this subdivision case of Class II - end-to-end.

Question 15, Presence of Overbite, was easily diagnosed by a majority of students when it was excessive or moderate, but fewer students recognized an acceptable overbite (77%) and only 64% were able to recognize that no overbite existed

in the presence of an open bite. For Case 1, overall 64% correctly found that no overbite was present and a trend was evident. For Cases 2, 3, 4, 6, and 7 over 90% correctly identified the presence of an overbite. For case 5, 77% correctly identified the overbite.

Question 16, Amount of Overbite, was easy to diagnose for all groups when excessive, but they had more difficulty with a moderate amount of overbite. In cases of acceptable overbite, while a majority answered correctly, far more should have recognized this. In Case 1, only 43% overall determined that no overbite existed, indicating a reversal. In Case 2, 81% overall and Case 7, 87% overall correctly identified the excessive overbite. In Case 3, only 36% overall recognized the moderate overbite, indicating a reversal with this more subtle determination. In Case 4, the orthodontists were evenly divided so this was not a good question to study. In Case 5, over 74% overall recognized an acceptable overbite. In Case 6, only 37% overall recognized the moderate overbite, indicating a reversal for this more subtle problem, and while half the SO were correct, only 29% of the JR and SR were correct.

For Question 17, Treatment of Overbite, when an excessive amount of overbite was present, the great majority did well in recommending treatment. Also, when the overbite was acceptable, the large majority recognized that no treatment was needed. However, when the overbite was moderate, it was difficult for the students not only to make that determination, but also to know when treatment was needed. When an open bite was present, the students were confused with the application of the "overbite" terminology. In Case 1, only 43% overall answered they would treat the overbite, indicating a reversal, with SR having the least correct, 36%. In Cases 2, 4, and 7 about 90% recognized the need for treatment of an excessive overbite, and a trend was noted in Case 2, with all the SR answering correctly for Case 7. For Case 3, 67%

overall decided to treat the moderate overbite, a subtle determination. Case 6 also had a moderate overbite and was more subtle to diagnose, with only 32% overall correct. In this case the occlusal plane was more even and overall this dentition appeared more normal. For Case 5, 80% overall decided the acceptable overbite did not require treatment.

Question 18, Presence of Open Bite, was recognized by a majority of students, as was the absence of open bite, except in cases where teeth were still erupting, where over one-third misdiagnosed the absence of an open bite. In Case 5, 63% overall correctly answered there was no open bite. The highest percentage correct were the SO with 70%, however, the SR had only 55% correct, and over one-third thought an open bite was present. In Case 1, 81% overall correctly diagnosed the open bite. In Cases 2, 3, 4, 6, and 7 the great majority, over 80%, correctly stated no open bite was present. In Cases 3 and 7, the FR had the lowest percentage correct and in Case 4 the JR had the lowest percentage correct.

For Question 19, Presence of Overjet, students could understand and diagnose overjet except when the appearance and inclination of the maxillary incisors distracted them. In Case 1, 90% overall recognized the overjet. In Case 2, 83% identified the overjet, but the SR had the lowest percentage correct, with 74%. In Case 3, the overjet was correctly noted by 66% overall, and the JR had the lowest percentage correct, 52%. In Case 4, 95% overall recognized overjet, including all of the JR. In Cases 5 and 6, 81% identified overjet. In Case 7, 59% recognized overjet, with just under half of the JR and SR responding correctly, while 61% of the SO and 71% of the FR did so, and 40% answered no overjet was present.

Question 20, Amount of Overjet, was evaluated correctly by the majority of students for obvious cases of acceptable or excessive overjet. However, when cases

were more subtle, only 22% to 44% of the individuals correctly classified the problem. They were unable to accurately evaluate a case that displayed moderate overjet, and did not pay attention to the flaring of the maxillary lateral incisors, but instead focused only on the upright or retroclined central incisors to make their diagnosis. In Case 1, 78% overall determined the overjet was excessive, and ranged from 69% FR to 87% SR correct. In Case 2, only 41% decided the overjet was moderate, indicating a reversal for this subtle determination. In Case 3, 65% overall decided the overjet was acceptable, but the SR scored the lowest, 59%, and the SO the highest with 69%. In Case 4, only 44% overall thought the overjet was moderate, indicating a reversal for this subtle question. The SR scored the lowest with 39%. Case 5 showed a trend, as 67% overall found the overjet to be acceptable. Case 6 was answered correctly by only 22% who determined the overjet was moderate, which indicated a reversal, and this was a very subtle question. The answers ranged from 30% of the SO to only 6% of the SR. For Case 7, most students in each group evaluated this as being acceptable or having no overjet, and only 22% correctly identified the amount of overjet, indicating a reversal in this more subtle question.

Question 21, Treatment of the Overjet, was answered correctly for obvious problems, or when no problem was present, but when the problem was a more subtle case of moderate overjet, only 40% wanted to treat, indicating difficulty in diagnosing more complex cases. Case 1, 89% overall decided to treat overjet. In Case 2, 56% overall decided to treat, and though more students identified a problem, fewer students decided to treat. In Case 3, a good number realized no treatment was necessary (73%) for this acceptable overjet. In Case 4, 70% overall decided to treat, with the SR being the highest at 84%. In Case 5, overall 74% decided no treatment was required. In Case 6, very few students, only 29%, decided to treat, indicating a reversal and

misdiagnosing the amount of overjet. For Case 7, the students also had problems, as only 45% overall decided to treat, but a trend was evident as the percentage of correct answers increased from the FR through the SR years.

Question 22, Presence of a Cross-Bite, was misdiagnosed by half the students when present, but the majority correctly responded when no cross-bite was evident. In Case 1, 66% overall identified the cross-bite, from 56% FR to 81% SR. In Cases 2, 3, 4, 6, and 7 no cross-bite was present, and the great majority answered correctly, over 85% overall, in each case. In Case 5, only 46% overall identified the cross-bites, indicating a reversal, ranging from 31% FR to 58% SR, and these results indicate that this concept needs to be stressed more in training.

Question 23, Location of the Cross-Bite, presented difficulties in Case 5, where only 45% overall were correct in identifying both an anterior and a posterior cross-bite, indicating a reversal for this more subtle determination. The large majority answered correctly when a cross-bite was not present. For Case 1, with a posterior cross-bite, 67% overall answered correctly with results ranging from 55% of the JR to 77% of the SR.

Question 24, Presence of a Maxillary Transverse Deficiency, applied to only one case, that is Case 1, and only 32% overall were able to identify this problem, indicating a reversal. This is a concept which needs more emphasis in clinical training.

Question 25, Presence of Spacing between the teeth in the upper or lower arches, was answered correctly by the majority of students in the absence of spacing or in very obvious situations, yet when spacing was very subtle, many students were confused. Only 35% overall identified that no spacing was present in Case 2, indicating a reversal, and only 53% for Case 3 found no spacing present. Cases 4, 5, 6, and 7 had no spacing, and at least 80% overall answered correctly with trends being

noted in Cases 5, 6, and 7. In Case 1, 86% overall detected that spacing was present.

Question 26, Presence of Crowding in the dentition of the upper or lower arches, was detected by the majority in the obvious cases. However, when dealing with a younger patient, the students were not able to anticipate the crowding that would exist in the future after the permanent teeth had erupted. Also, they did not report crowding existed when it was only minimal. In Case 1, only 38% overall identified crowding, indicating a reversal for this more subtle determination. In Case 2, just under 50% recognized crowding, indicating a reversal, but the SR had the highest percentage correct, with 68%. In Cases 3 through 7, the crowding was very obvious, and over 75% overall answered correctly.

Question 27, Amount of Crowding in the maxillary arch, the students were able to recognize when no crowding was present. Yet when crowding was slight or moderate, just over half the students could accurately identify the amount. When questioned about future space requirements for unerupted teeth, they either did not diagnose the unerupted teeth or underestimated the actual amount of crowding that would eventually exist. For Case 1, 81% overall noted no crowding, and indicated a trend. For Case 2, 64% noticed no crowding. For Case 3, only 48% overall recognized a moderate amount of crowding in this arch. A reversal was indicated for this subtle determination. For Case 4, only 37% overall noted moderate crowding, indicating a reversal, but as the level of education increased, so did the scores, setting a trend. In Case 5, since the experts were evenly divided as to the amount of crowding present, it was not a good question to study. In Case 6, only 52% overall recognized slight crowding, which ranged from 26% of the SR to 61% of the SO. For Case 7, only 56% overall identified moderate crowding, from 47% of the FR to 77% of the SR.

Question 28, Amount of Crowding in the mandibular arch was difficult for

students when it came to distinguishing between a slight and moderate amount of crowding. Most students were able to identify severe crowding. In Case 1, only 10% recognized the moderate crowding, indicating a reversal for this subtle question, because students did not note the resulting future lack of space from unerupted teeth. Only 44% overall correctly identified slight crowding in Case 2, indicating a reversal, with 68% of the SR being correct, but most of the other students did not consider the anterior crowding to be significant. In Case 3 only 37% overall recognized moderate crowding, indicating a reversal to this subtle question, but the SR had the most correct, 42%. It appears the majority did not accurately evaluate the constriction in the anterior section of this arch. In case 4, 60% determined the crowding was severe. For Cases 5, 6, and 7, 54%, 35% and 52% respectively, diagnosed the crowding was moderate, however, most of the other students felt it was only slight.

Question 29, need for Treatment of the Crowding, was easily recognized by the majority of students when indicated, except when dealing with a younger patient, where future problems with permanent dentition were not considered. In Case 1, only 26% overall determined treatment was necessary, indicating a reversal, in this case of potential crowding from unerupted dentition. In Case 2, 66% overall determined no treatment was needed. In Case 3, 84% overall decided treatment was obviously indicated. In Case 4, 93% overall answered correctly that treatment was required. In Cases 5, 6, and 7, as well, the majority recognized treatment was needed and the results of Case 7 indicated a trend.

In Question 30, Co-Incidence of the Dental Midlines, the problems were easy to identify, yet the students had difficulty from not basing their diagnoses on the intraoral frontal photograph which accurately demonstrated this relationship, and instead were paying too much attention to the models. In Case 1, 67% overall diagnosed that the

midlines were not co-incident, from 60% of the FR to 82% of the SR. Overall, 87% correctly answered Case 2. In Case 3, 83% overall recognized midlines were not co-incident. In Case 4, only 42% overall determined the midlines were co-incident, indicating a reversal, due to lack of attention to the intraoral photograph, as well as for Case 5, only 47% overall identified the midlines as not co-incident, indicating a reversal, but the majority of the SR were correct. For Cases 6 and 7, over 85% overall made the correct determination.

Question 31, Presence of Dental Conditions, asked for congenitally missing teeth, supernumerary teeth, impacted teeth (other than 3rd molars), malformed teeth, or none of the above. When no unusual dental conditions were present, the majority answered correctly. However, congenitally missing teeth or impacted teeth were missed by the majority. In Case 1, only 43% overall recognized that there were no unusual conditions, indicating a reversal, yet a trend emerged from 40% of the FR to 55% of the SR. Most of the other students responded that teeth were missing, either from misinterpreting the radiograph or identifying teeth that had not yet erupted. In Case 2, only 40% identified a congenitally missing mandibular left second premolar, but a trend was noted, although the question showed a reversal, and 68% of SR answered correctly. In Case 3, only 42% overall diagnosed the maxillary cuspids were impacted, indicating a reversal in this more subtle determination. Case 4 was correctly answered by 79% overall and no unusual conditions were present. Cases 5, 6, and 7 had no unusual conditions.

Question 32, Gingival Health, was answered correctly by an average of over 83% in six cases of healthy tissue, however, Case 4, the one instance of obvious unhealthy tissue, was answered correctly by only 22%, indicating a reversal. The tissue in the photographs was not examined by the students thoroughly enough to make

the correct diagnosis.

Question 33, Presence of Periodontal Conditions, asked for the presence of recession of gingival tissue, defects in gingival tissue, bone loss, or none of the above. No periodontal conditions were present in any of the seven cases, so students were not actually tested and no inferences can be drawn from the results.

Question 34, Need for Orthodontic Treatment. Since all the cases obviously required treatment, this was not a good test question, especially since the subjects were aware that the test was sponsored by the Department of Orthodontics.

Question 35, Provider for Orthodontic Care, asked the subjects to recommend treatment by a general dentist who treats limited aspects of orthodontics, a general dentist who treats all aspects of orthodontics, a general dentist who practices only orthodontics, a pedodontist, or an orthodontist. When students considered the patient too young for comprehensive treatment (Phase II), a larger majority overall indicated that a specialist should handle the case. However, in general, when dealing with teenage patients, an average of 40% determined that a general practitioner could handle the case. For Case 1, 68% overall suggested an orthodontist, from 61% of the SO to 81% of the SR. In Case 2, 57% overall would have treatment by an orthodontist, from 43% of the SO to 84% of the SR. In Case 3, 54% overall would refer to an orthodontist, from 43% of the SO to 74% of the SR. For Case 4, scores of those correctly recommending the orthodontist ranged from 52% of the SR to 65% of the JR. For Case 5, overall 59% decided that an orthodontist should treat and a trend emerged. For Case 6, the scores ranged from 30% of the SO to 39% of the JR, but only 35% overall determined an orthodontist should treat, representing a reversal. For Case 7, overall 59% responded an orthodontist should treat, and a trend was noted.

In Question 36, the Need for Extractions to provide orthodontic treatment for

the subject, when the majority of experts determined no extractions were needed, the students performed well, but when the orthodontists indicated extractions were required, the students were unable to diagnose as easily. In Case 1, the experts were divided so it was not a good test. In Case 2, overall 72% of the students determined extractions were not necessary, from 65% of the FR and the SR to 82% of the SO. In Case 3, just over half of the FR, SO and SR responded accurately, but more JR were correct in recommending extractions, which came to 61% overall. In Case 4, 56% overall indicated no extractions were needed. In Case 5, 57% overall indicated no extractions were necessary. In Case 6, overall 81% stated no extractions were required, including 94% of the SR. In Case 7, scores ranged from 58% for the JR to 74% for the SO for this non-extraction case.

Questions 37, 38 and 39 asked the subjects to what degree they relied on each of the diagnostic aids in answering the questions. Question 37, Use of Models, a large majority utilized the models in a large part and in a very consistent manner. In Question 38, Use of Photographs, in general, a majority of students utilized them in a large part, but 40% relied on them in only a small part. For Case 3, only 40% overall used the photographs in a small part to diagnose this case, indicating a reversal. For Question 39, Use of the Panoramic Radiograph for diagnosis, most of the students responded they needed the radiograph in a small part to diagnose each case. It appears either they did not evaluate this on a case-by-case basis, or in general, they did not use it enough in diagnosing. For Case 1 and Case 3, only 44% overall required the radiograph in a large part, indicating a reversal. For Case 2 and Case 7, the experts were divided. For Cases 4, 5, and 6, a bare majority, 53% to 60% used the radiograph in a small part to diagnose the cases.

Education of General Dentists

Education of general dentists in recognizing malocclusion in children is critical, not only to prepare the practitioner to treat simple cases, but also to enable the dentist to diagnose cases and make timely referrals to the specialist. The issues debated in the literature include the appropriate orthodontic instruction in the undergraduate curriculum. (ADA Guidelines 1980; Proceedings of the Orthodontic Educational Development Symposium 1994; Andreasen 1968; Dugoni and Chambers 1981; Graber 1967; Hanes 1990; Hannett 1963; Jacobs 1977 and 1988; Lerian 1968; McDuffie 1985; Moyers 1963; Nieberg and Sinclair 1988; Pender 1982.)

One shortcoming in the C.W.R.U. dental curriculum pointed out by the present study was that students had difficulty differentiating skeletal and dental problems. For instance, where an excessive amount of overbite or crowding was present, the students recognized the problem and decided to refer for treatment. However, when the problem was moderate, the students did not recognize the need for treatment as readily. This has implications for their future practice as general dentists which requires adequate clinical knowledge of when to refer, where to refer, and what to treat. Criteria for malocclusion should be taught at the undergraduate level so that general dentists can recognize the problem, assess the severity and complexity of the problem in relation to the age and gender of the patient, and understand skeletal vs. dental problems. The curriculum must prepare the dentist to understand mixed dentition analysis, congenitally missing teeth, impacted teeth, tooth development, and normal chronological development. The curriculum should include recognition of periodontal problems such as muco-gingival problems, and the planes of space: anterior-posterior, transverse, vertical and perimeter. The general dentist must understand the benefits of early treatment.

The differences of opinion regarding which cases are appropriately treated by the family dentist are debated by several authors, who all agree on the shortcomings of undergraduate education in orthodontics. (Argent 1990; Association of Pedodontic Diplomates 1983; Bader and Kaplan 1983; Brown et al 1982; Carapezza 1985; Elderton et al 1983 and 1984; Gecker 1969; Howell 1986; Koroluk et al 1988; Linge 1987; Lowe 1987; Lubit 1983; Manasse and Dooley 1980; Miller 1973; Miranda 1980; Moorrees and Gron 1966; Norton et al 1971; Nowack 1983; Panel Discussion 1994; Prahl-Andersen et al 1979; Rickles 1975; Sachs 1971; Salzmann 1969 and 1970; J.R. Smith 1987; Trapani 1977; and Wasson 1983.)

Benefits of Early Treatment

At the age when the patient is in the early mixed dentition, the facial structures are in a period of rapid development and growth sites are very active. Orthodontics needs to be performed at this phase of development so that advantage may be taken of the growth by attempting to redirect it favorably. For example, skeletal and dental relationships and muscular problems may be modified or corrected, and the remaining permanent teeth may be able to erupt into more favorable positions in relation to the opposing teeth.

Also, at an early age, better results may be achieved regarding correction of an open bite, overbite, overjet, cross-bite and/or crowding. Early treatment may alleviate the need for extractions and a compromised result if treatment would be postponed until all the permanent teeth have erupted. In addition, the benefits of timely comprehensive orthodontic treatment are a more functional occlusion, a more pleasing aesthetic result, better periodontal health, and improved self-esteem.

The importance of early diagnosis and referral for orthodontic treatment for optimal timing and results is discussed by several authors. (Battagel 1985; Borell

1982; Carapezza 1979; Cuozzo 1987; Gottlieb et al 1990; Hahn 1963; Heikinheimo et al 1987; Hilding 1979; Hill 1992; Jacobson 1979; Kilmon 1983; Kossowan 1987; Pietila et al 1992; Prahl-Andersen 1978; Turpin 1993; Vego and Murphy 1982.)

The following is an explanation for Figure 12. The highest mean percent for any group of students was approximately 74.6%, and the lowest was about 58%. The orthodontists' mean percents were between 89.7% and 94.9%.

Questions for which each student group scored low (less than 50% correct), which possibly affected the overall scores, are listed by case, then by the group which scored highest to the group scoring lowest. Also, listed are the questions for which students in all the groups scored less than 50%.

CASE 1

SR Highest score from the four groups, no questions in particular stood out

JR Q 11. decided against treating the cuspid relationship

Q 14. decided against treating the molar relationship

Q 16. were unable to diagnose that no amount of overbite was present, most were probably confused by the terminology

Q 31. identified unusual dental conditions that did not exist

FR Q 1. could not diagnose the convex facial profile

Q 6. decided against treating the tense labial appearance

Q 16. were unable to diagnose that no overbite was present, confused by terminology

Q 31. identified unusual dental conditions where none existed

SO Lowest score from the four groups

Q 1. could not diagnose the convex facial profile

Q 2. could not diagnose the retruded mandibular position

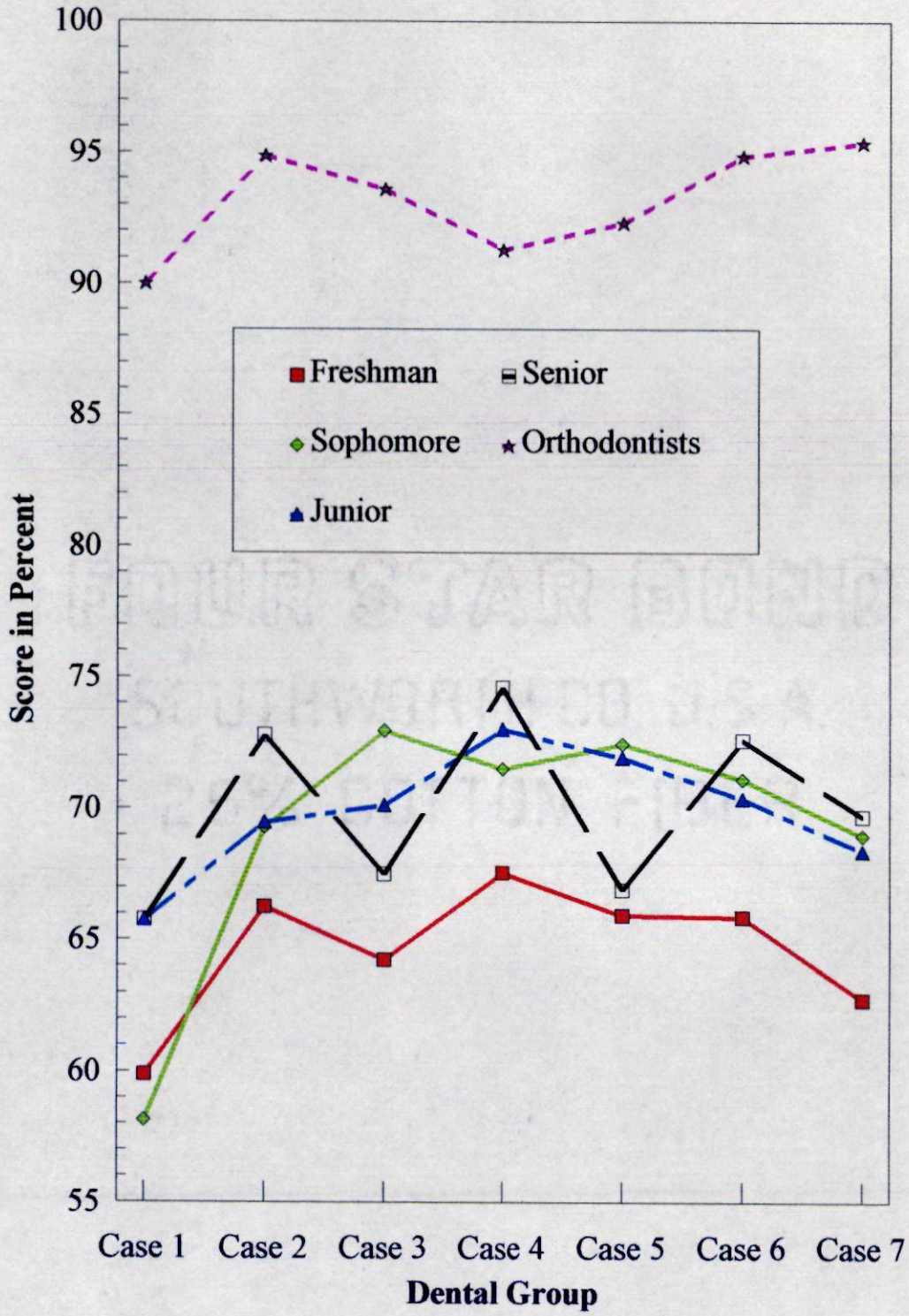


Figure 12. Comparison of Means for Cases 1-7 By Group

Q 4. did not wish to treat the facial profile

Q 5. did not identify the tense appearance of the lips

Q 6. decided against treating the tense labial appearance

Q 11. decided against treating the cuspid relationship

Q 16. were unable to diagnose that no overbite was present, most were probably confused by the terminology

Q 31. identified unusual dental conditions where none existed

Q 38. decided they did not require the photographs in a large part in order to diagnose this case

Questions for which all the groups scored low:

Q 12. could not identify the end-to-end molar relationship on the right side

Q 13.could not identify the end-to-end molar relationship on the left side

Q 17. did not believe the overbite required treatment, most were probably confused by the terminology

Q 24. unable to identify the maxillary transverse deficiency

Q 26. unable to diagnose that crowding would exist when the permanent teeth erupt

Q 28. did not identify the moderate maxillary crowding, as the majority believed no crowding existed

Q 29. did not determine that the crowding would require treatment, as the majority thought no crowding was present

CASE 2 TREND

SR Highest score from the four groups

Q 12. were not able to diagnose the Class II molar relationship on the

right side

Q 13. were not able to diagnose the Class II molar relationship on the left side

JR Q 28. did not identify the slight amount of crowding in the mandibular arch

Q 31. did not diagnose the congenitally missing mandibular left second premolar

SO Q 21. decided not to treat the moderate amount of overjet

Q 26. not able to identify that crowding existed

Q 28. did not identify the slight amount of crowding in the mandibular arch

Q 31. did not diagnose the congenitally absent mandibular left second molar

Q 35. did not feel an orthodontic specialist needed to treat this patient

FR Lowest score of all four groups

Q 12. were not able to diagnose the Class II molar relationship on the right side

Q 13. were not able to diagnose the Class II molar relationship on the left side

Q 28. did not identify the slight amount of crowding in the mandibular arch

Q 31. did not diagnose the congenitally missing mandibular left second premolar

Questions for which all the groups scored low:

Q 3. did not believe the retruded mandibular position required any

treatment

Q 9. could not identify the Class II cuspid relationship on the right or

Q 10. on the left side

Q 20. not able to diagnose the moderate amount of overjet present

Q 25. not able to identify that no spacing was present in the arches

Q 27. could not recognize that no crowding existed in the maxillary arch

CASE 3

SO Highest score among the four groups

Q 11. did not believe treatment for the cuspid relationship was needed

Q 27. did not identify the amount of maxillary crowding as moderate, they did not know the space requirement for the maxillary cuspids

Q 35. decided an orthodontic specialist was not needed to treat this case

Q 39. felt they did not need the panoramic radiograph in a large part to diagnose this case

JR No questions in particular

SR Q 8. decided the dentition was appropriate for this patient's age and gender even though impacted maxillary cuspids were present

Q 11. did not believe treatment for the cuspid relationship was needed

Q 27. did not identify the amount of maxillary crowding as moderate, they did not know the space requirement for the maxillary cuspids

Q 39. felt they did not need the panoramic radiograph in a large part to diagnose this case

FR Lowest score from the four groups

Q 10. did not identify Class I cuspid relationship on the left side

Q 27. did not identify the amount of maxillary crowding as moderate,

they did not know the pace requirement for the maxillary cuspids

Q 35. decided an orthodontic specialist was not needed to treat this case

Q 39. felt they did not need the panoramic radiograph in a large part to diagnose this case

Questions for which all the groups scored low:

Q 9. were not able to diagnose the end-to-end cuspid relationship on the right side

Q 16. could not identify the amount of overbite as being moderate

Q 28. did not identify the amount of mandibular crowding as moderate, they did not recognize the constricted anterior section of this arch

Q 31. did not recognize the impacted maxillary permanent cuspids

Q 38. felt they did not require the photographs in only a small part in order to diagnose this case

CASE 4 TREND

SR Highest score from the four groups

Q 1. did not recognize the facial profile as convex since they were focusing on the patient's prominent chin

Q 2. could not identify the retruded mandibular position as they were distracted by the prominent chin

Q 30. did not recognize that the dental midlines were co-incident, as they did not base their decision on the intraoral frontal photograph

Q 39. felt they did not use the panoramic radiograph in only a small part in order to diagnose this case

JR Q 4. did not believe treatment for the convex profile was required

Q 5. did not identify the appearance of the lips as being tense

Q 6. did not believe the labial appearance required treatment

Q 27. could not recognize the maxillary crowding as being moderate

Q 30. did not recognize that the dental midlines were co-incident, as they did not base their decision on the intraoral frontal photograph

SO Q 1. did not recognize the facial profile as convex, since they were focusing on the patient's prominent chin

Q 2. could not identify the retruded mandibular position, as they were distracted by the prominent chin

Q 4. did not believe treatment for the convex profile was required

Q 5. did not identify the appearance of the lips as being tense

Q 6. did not believe the labial appearance required treatment

Q 27. could not recognize the maxillary crowding as being moderate

Q 36. did not identify that extractions were definitely needed to treat this patient orthodontically

Q 38. did not feel they required the photographs in a large part in order to diagnose this case

FR Lowest score from the four groups

Q 5. did not identify the appearance of the lips as tense

Q 6. did not believe the labial appearance required treatment

Q 27. could not recognize the maxillary crowding as being moderate

Q 30. did not recognize that the dental midlines were co-incident, as they did not base their decision on the intraoral frontal photograph

Q 38. did not feel they required the photographs in a large part in order to diagnose this case

Questions on which all four groups scored low:

Q 20. did not identify the amount of overjet present as being moderate

CASE 5

SO Highest score from all four groups

Q 23. did not diagnose the presence of both an anterior and a posterior cross-bite

Q 30. were unable to diagnose that the dental midlines were not co-incident, as they did not rely on the intraoral frontal photograph for their diagnosis

Q 38. did not feel they needed the photographs in a large part in order to diagnose this case

JR Q 22. were not able to identify the presence of a cross-bite in this case

Q 23. did not diagnose the presence of both an anterior and a posterior cross-bite

Q 28. did not recognize that a moderate amount of mandibular crowding existed

Q 30. were unable to diagnose that the dental midlines were not co-incident, as they did not rely on the intraoral frontal photograph for their diagnosis

SR Q 1. did not diagnose the obviously straight facial profile

Q 2. did not identify the apparent straight mandibular position

Q 3. decided the mandibular position required treatment when it did not

Q 10. could not diagnose the Class I cuspid relationship on the left side

Q 12. could not identify the Class I molar relationship on the right side

Q 13. did not recognize the Class III molar relationship on the left side

Q 23. did not diagnose the presence of both an anterior and a posterior

cross-bite

Q 36. felt extractions would be necessary to orthodontically treat this case

Q 38. did not feel they needed the photographs in a large part in order to diagnose this case.

Q 39. decided they did not need the panoramic radiograph in only a small part in order to diagnose this case

FR Lowest score of the four groups

Q 10. could not diagnose the Class I cuspid relationship on the left side

Q 13. did not recognize the Class III molar relationship on the left side

Q 22. were not able to identify the presence of a cross-bite in this case

Q 28. did not recognize that a moderate amount of mandibular crowding existed

Q 30. were unable to diagnose that the dental midlines were not co-incident, as they did not rely on the intraoral frontal photograph for their diagnosis

Q 35. did not feel a specialist in orthodontics was needed to treat this patient

Questions on which all four groups scored low:

Q 9. were not able to identify the Class I cuspid relationship on the right side

Q 11. did not believe that no treatment for the cuspid relationship was needed

Q 31. did not recognize the congenitally missing mandibular right third molar

CASE 6

SR Highest score from all four groups

Q 9. were unable to diagnose the end-to-end cuspid relationship on the right side

Q 12. could not identify the end-to-end molar relationship on the right side

Q 27. did not believe only a slight amount of crowding was present in the maxillary arch

Q 39. did not feel they needed the panoramic radiograph in only a small part to diagnose this case

SO Q 9. were unable to diagnose the end-to-end cuspid relationship on the right side

Q 12. could not identify the end-to-end molar relationship on the right side

Q 28. could not identify that a moderate amount of crowding was present in the mandibular arch

JR Q 28. could not identify that a moderate amount of crowding was present in the mandibular arch

Q 39. did not feel they needed the panoramic radiograph in only a small part to diagnose this case

FR Lowest score among the four groups

Q 9. were unable to diagnose the end-to-end cuspid relationship on the right side

Q 12. could not identify the end-to-end molar relationship on the right side

Q 28. could not identify that a moderate amount of crowding was present in the mandibular arch

Questions for which all four groups scored low:

Q 16. could not identify the amount of overbite present as moderate

Q 17. decided not to treat the amount of overbite present

Q 20. were not able to recognize that the amount of overjet present was moderate, but felt it was acceptable

Q 21. believed treatment of the overjet was not needed

Q 35. (the large majority) decided a specialist in orthodontics was not needed to treat this case

CASE 7

SR Highest score from the four groups

Q 19. did not identify any overjet as they focused on the maxillary central incisors (which were extremely upright, if not retroclined) and were confused

SO Q 9. could not diagnose the Class II cuspid relationship on the right side

Q 21. did not believe the overjet required any treatment, as they thought it did not exist or was acceptable

Q 28. did not identify the mandibular crowding as being moderate

Q 38. did not feel they used the photographs in a large part to diagnose this case.

JR Q 3. decided treatment for straight the mandibular position was needed

Q 4.decided treatment for the straight profile was necessary

Q 9. could not diagnose the Class II cuspid relationship on the right side

Q 19. did not identify any overjet, as they focused on the maxillary

central incisors (which were extremely upright, if not retroclined) and were confused

Q 21. did not believe the overjet required any treatment, as they thought it did not exist or was acceptable

FR Lowest score among all four groups

Q 3. decided treatment for the straight mandibular position was needed

Q 4. decided treatment for the straight profile was needed

Q 9. could not diagnose the Class II cuspid relationship on the right side

Q 21. did not believe the overjet required any treatment, as they thought it did not exist or was acceptable

Q 27. did not identify the maxillary crowding as being moderate

Q 28. did not identify the mandibular crowding as being moderate

Questions on which all four groups scored low:

Q 1. could not identify the facial profile as being straight, but focused on the prominent chin area

Q 2. could not recognize the straight mandibular position due to their emphasis on the prominent chin

Q 8. could not identify that the dentition was advanced for this patient's age and gender

Q 10. did not diagnose the end-to-end cuspid relationship on the left side

Q 13. were unable to diagnose the end-to-end molar relationships on the left side

Q 20. could not identify the moderate amount of overjet, as they did not consider the flaring of the maxillary lateral incisors

Figure 5 vividly demonstrated that, in the overall scheme of things, the orthodontists who have had extensive specialized training beyond dental school, scored much higher than any of the four student groups. The Freshmen clearly scored the lowest. The Sophomores and Juniors scored in a consistent, steady manner. The Seniors' scores fluctuated much more. The Sophomores' and Juniors' results on the clinical test correlated with the level of their training. The Seniors cannot and are not asked to apply didactic knowledge to clinical situations. They may feel that, because they will not be actually treating orthodontic cases in their practices, they should spend less clinical time on those problems. The shortcomings demonstrated by the study are in the area of clinical education in recognition of problems, their severity, complexity and the need for treatment.

Summary of Statistical Analysis

A Chi square analysis was performed on every question for each of the seven cases. The frequencies, percentages, and Pearson statistic were used to analyze the answers from the 171 students. The answers of the students were analyzed in comparison with the experts (orthodontists) and the four groups of students were compared to each other. These comparisons showed which questions were good discriminators between those who possessed the required knowledge and those who did not .

The ANOVA analysis showed differences in performance among all five groups, and showed the vast difference in performance between the students and the experts, as well as relatively smaller differences between each student group.

The Newman-Keuls comparison of means, and the Means, Standard Deviations, and Ranges of Test Scores were applied also to the orthodontists (group 5). The results showed clearly that the reference group was different from the other four

groups. Overall, the student Newman-Keuls test demonstrated that results for group 1 through 4 were identical to those as when group 5 was included.

The statistical methods of analysis showed that this was a reliable test instrument. The correlations were used to study internal consistencies by looking at associations between test questions. Correlations address how well each item fit with all the other items on the test, and for this study, the correlations showed that paired questions went well together.

The item analysis provided estimates of the reliability of the test. A high standardized item co-efficient alpha indicated a good test instrument, which showed how reliable the total scale was and whether there was internal consistency. The means of each question were studied, as answered by all students, and the results demonstrated the reliability of the test.

Limitations and Delimitations of the Study

Some limitations of the present study which should be taken into account in considering the results as regards to the quality of teaching include the small sample size of the orthodontists. The subjects viewed photographs of diagnostic media, rather than examining actual cases. The study has not and was not designed to answer why the knowledge base does or does not increase significantly over four years of education. While it can pinpoint specific areas in which the general dentists, that is, the graduating Seniors, are not adequately prepared to diagnose, it does not reveal why, or suggest ways to remedy the problems. The study does not explain why for certain questions or cases the Seniors did not perform as well as other groups, or why results for Seniors were inconsistent over all cases and questions. The study does not explain why results for Juniors were worse for some cases and questions than for Sophomores, the reverse of the expectation, as education level increased. The study

shows that, when a certain percentage of students correctly identified the presence of a problem, a lower percentage would refer the patient to an orthodontist. However, it does not suggest reasons why, nor does it explain why students often did not use the diagnostic media appropriately or put enough weight on each diagnostic tool. The study does not explain why students did not consistently apply demonstrated didactic knowledge in clinical situations.

SUMMARY AND CONCLUSIONS

The purpose of the present study was to design a test instrument to assess the outcome of predoctoral orthodontic dental education at the School of Dentistry, Case Western Reserve University in Cleveland, Ohio. This test measured the clinical abilities of predoctoral dental students in the diagnosis of malocclusion in children, as well as their didactic abilities in answering selected questions from recent national board examinations in orthodontics. Seven cases were selected from the practice of a board certified orthodontist which demonstrated different types of malocclusion. These cases were presented to undergraduate dental students at C.W.R.U. who were asked to make diagnoses and recommendations for treatment. The administration of national board examination questions was used to measure the objective classroom education in the subject. Together these tests were used to assess outcomes of the predoctoral dental curriculum in imparting knowledge of orthodontic diagnosis required of the general dentist in practice with children.

1. The percentage of C.W.R.U. students that answered correctly on the didactic section were: Freshmen 30%, Sophomores 30%, Juniors 42% and Seniors 59%.

2. This showed that their didactic knowledge nearly doubled over the four years of dental school. Therefore, this didactic test is a good instrument for outcomes assessment of dental education.

3. The clinical test is a reliable instrument to assess outcomes of dental education, as it relates to diagnosis of malocclusions in children. The correlations demonstrated internal consistency.

4. Statistical analysis demonstrated the reliability of the test. The questions discriminated well between those who had the required knowledge and

those who did not. The test was able to pinpoint areas where each group of students had difficulty, especially where the Seniors, who would shortly become general dental practitioners, were not able to diagnose and make referral decisions correctly. The clinical test provided valid results regarding the increase in the students' knowledge, based over the four years of their education.

5. The students could only diagnose, in general, very obvious problems. Their decisions to treat were not accurate because their diagnoses were not accurate. When the students considered a patient too young for comprehensive treatment, a larger majority decided that a specialist should treat the case. However, when dealing with teenage patients, an average of 40% indicated that a general dentist should treat the case.

6. In general, students overall in the four groups were not able to assess the severity of a problem. Even when a majority of students identified a problem correctly, a much lower percentage decided to refer.

7. The students did not demonstrate the ability to use the diagnostic media appropriately, and often did not put proper emphasis or weight on each aspect of diagnosis. They mainly relied on the models and did not use the photographs or radiograph in cases where they were clearly necessary.

8. Students also showed a lack of ability in recognizing underlying skeletal and dental problems. They did not recognize subtle cases affecting the facial profile, mandibular position, appearance of the lips, stage of dentition, appropriate dentition for the age and gender of the patient, cuspid relationship, and molar relationship.

9. The students had difficulty recognizing subtle cases of spacing and crowding, severity of the overbite, amount of overjet and presence and location of crossbites.

10. Some obvious problems which students could not recognize included: presence of a maxillary transverse deficiency, dental conditions and gingival health.

11. The C.W.R.U.curriculum descriptions show that less than 5% of the undergraduates' time is spent on orthodontics. The graduating Seniors did not demonstrate the clinical skills to recognize malocclusion in children, and did not know when to refer such cases to an orthodontist.

12. Juniors and Seniors are not asked to apply didactic knowledge in clinical situations as part of their training and, therefore, did not demonstrate that ability.

13. Most Seniors may feel that, since they will not be performing orthodontic treatment as general dentists, they do not need to spend

clinical time on those aspects. The preceptors in the clinic must teach total patient care, including the necessity of recognizing and assessing problems and making referrals for early, optimal treatment.

14. Unless the general dentist is taught to recognize malocclusion in children and the benefits of early treatment, there will be no referrals to the orthodontist. The undergraduate curriculum should give the graduating Senior the ability to know when to refer, where to refer, and what to treat.

Conclusion

The didactic and clinical test instruments were valid tools to assess the outcome of undergraduate dental education in recognizing malocclusion in children. The general dentists, that is, the graduating Seniors, did not demonstrate the ability to apply didactic knowledge to clinical situations. The curriculum must give more attention to the understanding of skeletal vs. dental problems, mixed dentition analysis, early periodontal problems, and the benefits of referral to the specialist for early treatment.

APPENDIX A

Consent Form

APPENDIX A

CONSENT FORM

SUBJECT NAME: **DATE:** _____

TITLE OF STUDY: Recognition of Malocclusion - An Education Outcomes Assessment

PRINCIPAL INVESTIGATOR: **Brenda B. Brightman, D.D.S.**
Mark G. Hans, D.D.S., M.S.D.
Gary R. Wolf, D.D.S., M.S.D.
Hinsdale Bernard, Ph.D.

PURPOSE OF STUDY:

Dr. Brightman has informed me that she is conducting research with the long term objectives of determining how the level of education a dental professional has received affects his or her ability to accurately diagnose malocclusions in children.

I understand that this study will have no benefit to me, but will help develop certain parameters which will help to obtain a better understanding of the problems of diagnosing malocclusions in children.

DESCRIPTION OF THE STUDY:

I understand that the procedures used in the study are the following:

I understand that the investigator will select seven cases from the practice of a board certified orthodontist to demonstrate different types of malocclusion.

I understand that models, photographs, and radiographs of each patient will be shown to me and that I will be asked to make a diagnosis and recommendation regarding referral for orthodontic treatment in each case.

I understand that my response will be kept confidential and that my response will be used only for statistical analysis, along with the responses of other subjects.

I understand that my response will be used to make recommendations regarding the improvement of the education of general dentists in diagnosing malocclusions in children.

I understand that the results will be used for statistical analysis only, not as a critique of individual participants.

I have read the above information and understand that risks involved in participating in this study.

SIGNATURE_____ **DATE:** _____

APPENDIX B

List of Orthodontists (10) - Gold Standard

APPENDIX B: LIST OF ORTHODONTISTS AND NUMBER OF YEARS IN PRACTICE - THE GOLD STANDARD

	Orthodontist	Years in Practice	Board Certified
1.	Jeffrey Arnold, D.D.S., M.S.D.	5	
2.	Joseph Belhobek, D.D.S., M.S.D.	20	
3.	Charles Boester, D.D.S., M.S.D.	22	
4.	B. Holly Broadbent, Jr., D.D.S.	39	
5.	Howard Kossoff, D.D.S., M.S.D.	19	Yes
6.	Sanford Neuger, D.D.S., M.S.	36	Yes
7.	Arthur Phelps, D.D.S., M.S.	43	Yes
8.	Richard Valentine, D.D.S., M.S.D.	26	
9.	Dennis Ward, D.D.S., M.S.D.	11	Yes
10.	Gary R. Wolf, D.D.S., M.S.D.	13	Yes
Total years in practice:		234	
Average years in practice:		23.4	

APPENDIX C

Outcome Test, Orthodontics

APPENDIX C

CASE WESTERN RESERVE UNIVERSITY
School of Dentistry
1994

Outcome Test
Orthodontics

Name_____

1. A major disadvantage of treatment using cervical headgear is:

   a. impaction of maxillary canines
   b. extrusion of maxillary incisors
   c. extrusion of maxillary molars
   d. potential deformity of the neck
   e. psychologic trauma due to appearance

2. At birth, which of the following structures is nearest the size it will eventually attain in adulthood?

   a. mandible
   b. cranial vault
   c. cranial base
   d. middle face
   e. nasal capsule

3, Frankfort-horizontal is a reference plane constructed by the joining of the following landmarks:

   a. porion and sella
   b. porion and nasion
   c. porion and orbitale
   d. nasion and sella

4. If a child's teeth do not form, this would primarily affect the growth of the:

   a. maxilla
   b. mandible
   c. whole face
   d. alveolar bone

5. Rectangular wire is used in an edgewise orthodontic appliance in order to:

   a. reduce the amount of force on the premolars
   b. prevent gingival irritation
   c. maximize strength of the appliance
   d. facilitate fabrication
   e. prevent undesired buccal or lingual tooth movement

6. Which of the following is related to occipital anchorage?

   a. intra-oral force
   b. tipping a tooth
   c. extra-oral force
   d. bodily movement of a tooth

7. Fractured maxillary anterior teeth occur most often in children with:
   a. maxillary retrusion
   b. Class I malocclusion
   c. Class II, Division 1 malocclusion
   d. Class II, Division 2 malocclusion
   e. Class III malocclusion

8. A radiograph of a child, aged four years, reveals no evidence of calcification of mandibular second premolars. This means that:

   a. these teeth may develop later
   b. the child will probably never develop second premolars
   c. it is too early in life to make any final predictions concerning the development of any permanent teeth
   d. extraction of deciduous second molars should be performed to allow the permanent first molars to drift forward

9. Examination of a mixed dentition malocclusion reveals an abnormal resorption pattern in primary teeth, delayed eruption of permanent teeth, incompletely formed roots of permanent teeth and a large tongue. Which of the following etiologic factors is the probable cause of the condition?

   a. Addison's disease
   b. hypothyroidism
   c. hyperthyroidism
   d. von Recklinghausen disease
   e. history of severe febrile disease

10. Cephalometrics is used in orthodontics to:

   a. treat malocclusions
   b. study growth changes
   c. aid in diagnosis and case analysis
   d. only (a) and (b) above
   e. only (b) and (c) above
   f. all of the above

KEY TO THE OUTCOME TEST

1. A major disadvantage of treatment using cervical headgear is:
   (C) extrusion of maxillary molars

2. At birth, which of the following structures is nearest the size it will eventually attain in adulthood?
   (B) cranial vault

3. Frankfort-horizontal is a reference plane constructed by the joining of the following landmarks:
   (C) porion and orbitale

4. If a child's teeth do not form, this would primarily affect the growth of the:
   (D) alveolar bone

5. Rectangular wire is used in an edgewise orthodontic appliance in order to:
   (E) prevent undesired buccal or lingual tooth movement

6. Which of the following is related to occipital anchorage?
   (C) extra-oral force

7. Fractured maxillary anterior teeth occur most often in children with:
   (C) Class II, Division 1 malocclusion

8. A radiograph of a child, aged four years, reveals no evidence of calcification of mandibular second premolars. This means that:
   (A) these teeth may develop later

9. Examination of a mixed dentition malocclusion reveals an abnormal resorption pattern in primary teeth, delayed eruption of permanent teeth, incompletely formed roots of permanent teeth and a large tongue. Which of the following etiologic factors is the probable cause of the condition?
   (B) hypothyroidism

10. Cephalometrics is used in orthodontics to:
    (E) study growth changes and aid in diagnosis and case analysis

APPENDIX D

Questionnaire

APPENDIX D

Case Western Reserve University
School of Dentistry
Questionnaire
1994

1. Is this subject's facial profile:

   a. Class I (straight)
   b. Class II (convex)
   c. Class III (concave)
   d. Bimaxillary protrusive
   e. Other

2. Is the alignment of the lower jaw:

   a. retruded
   b. straight
   c. prominent

3. Do you believe the position of the lower jaw needs to be treated?

   a. Yes b. No

4. Do you believe this profile needs to be treated?

   a. Yes b. No

5. Do the subject's lips appear to be:

   a. Normal (relaxed)
   b. Tense
   c. Flaccid

6. Do you believe the appearance of the lips needs to be treated?

   a. Yes b. No

7. In which stage of dentition is this subject?

   a. Primary (baby teeth)
   b. Mixed
   c. Permanent

8. Is the dentition appropriate for this subject's age?

   a. Yes b. No

9. What is this subject's canine relationship?

Right side:

a. Class I (normal)
b. End-to-End
c. Class II
d. Class III

10. What is this subject's canine relationship?

Left side:

a. Class I (normal)
b. End-to-End
c. Class II
d. Class III

11. Do you believe this canine relationship needs to be treated?

a. Yes b. No

12. What is this subject's molar relationship?

Right side:

a. Class I (normal)
b. End-to-End
c. Class II
d. Class III

13. What is this subject's molar relationship?

Left side:

a. Class I (normal)
b. End-to-End
c. Class II
d. Class III

14. Do you believe this molar relationship needs to be treated?

a. Yes b. No

15. Does this subject have an overbite? (Vertical overlapping of the upper front teeth with the lower front teeth)

    a. Yes b. No

16. If so, is it:

    a. Acceptable
    b. Moderate
    c. Excessive

17. Do you believe this overbite needs to be treated?

    a. Yes b. No

18. Does this subject have an open bite? (Absence of vertical overlapping of teeth)

    a. Yes b. No

19. Does this subject have an overjet? (The horizontal relationship of the upper front teeth to the lower front teeth)

    a. Yes b. No

20. If so, is it:

    a. Acceptable
    b. Moderate
    c. Excessive

21. Do you believe this overjet needs to be treated?

    a. Yes b. No

22. Does this subject have a cross-bite? (One or more of the upper teeth inside of the lower teeth)

    a. Yes b. No

23. If so, is it:

    a. In the anterior of the mouth
       and/or
    b. In the posterior of the mouth

24. Is there a maxillary transverse deficiency present? (Constriction of the upper jaw)

    a. Yes b. No

25. Is there any spacing between the teeth in the upper or lower arches?

    a. Yes b. No

26. Is there any crowding of the teeth in the upper or lower arches?

    a. Yes b. No

27. In the upper arch crowding is:

    a. Slight
    b. Moderate
    c. Severe
    d. Not present

28. In the lower arch crowding is:

    a. Slight
    b. Moderate
    c. Severe
    d. Not present

29. If present, do you believe the crowding needs to be treated?

    a. Yes b. No

30. Are the dental midlines co-incident?

    a. Yes b. No

31. Are any of the following conditions present? (you may choose more than one)

    a. Missing teeth
    b. Extra teeth
    c. Impacted teeth (other than 3rd molars - wisdom teeth)
    d. Malformed teeth
    e. None of the above

32. Does the gum tissue appear to be healthy?

    a. Yes b. No

33. Are any of the following conditions present? (you may choose more than one)

a. Recession of the gum tissue
b. Defects in the gum tissue
c. Bone loss
d. None of the above

34. Do you think this subject needs orthodontic treatment?

a. Yes b. No

35. If so, who do you think should provide orthodontic treatment for this subject? (you may choose more than one)

a. A general dentistwho treats limited aspects of orthodontics
b. A general dentist who treats all aspects of orthodontics
c. A general dentist who only practices orthodontics
d. A pedodontist (childrens' dentist)
e. An orthodontist (specialist in orthodontics)
f. Other

36. Do you think extractions need to be performed in order to orthodontically treat this case?

a. Yes b. No.

37. In reaching your conclusions to diagnose this case, to what degree did you rely on the following diagnostic aid:

Models

a. Totally
b. In large part
c. In small part
d. Not at all

38. In reaching your conclusions to diagnose this case, to what degree did you rely on the following diagnostic aid:

Photographs

a. Totally
b. In large part
c. In small part
d. Not at all

39. In reaching your conclusions to diagnose this case, to what degree did you rely on the following diagnostic aid:

X-Rays

a. Totally
b. In large part
c. In small part
d. Not at all

APPENDIX E

Criteria of Malocclusion

APPENDIX E

In terms of the recognition of malocclusion, please select the 20 criteria you consider most important

|_| Activity of muscles of mastication
|_| Angle of mandible
|_| Ankylosed or retained primary teeth
|_| Anterior open bite
|_| A-P dental symmetry
|_| Arch form
|_| Arch length discrepancies
|_| Amount of incisor and gingiva showing at rest
|_| Amount of incisor and gingiva showing when smiling
|_| Bolton template analysis
|_| Bolton tooth size analysis
|_| Buccal arch symmetry
|_| Buccal mucosa
|_| Canting of lips
|_| Canting of occlusal plane
|_| Cephalometric analysis
|_| Chief complaint
|_| Chin button
|_| Cooperation or compliance
|_| Cross-bite (Ant. or Post.)
|_| Curve of Spee
|_| Dental classification
|_| Dental deflections (contact points)
|_| Dental health (caries)
|_| Dental history (extractions, trauma, etc.)
|_| Dental spacing
|_| Eruption pattern
|_| Facial depth
|_| Facial form
|_| Facial heights (U : L)
|_| Facial profile
|_| Facial symmetry
|_| Family history (skeletal/dental malocclusions)
|_| Floor of mouth
|_| Freeway space
|_| Frenum size & position
|_| Functional shift
|_| Gingival health
|_| Growth pattern
|_| Habits
|_| Hand-wrist film
|_| Head form
|_| Impacted teeth
|_| Incisor position (U or L)
|_| Inter-labial gap
|_| Length of upper lip
|_| Lip prominence
|_| Malformed teeth
|_| Maxillary molar rotations
|_| Medical history
|_| Mentalis strain
|_| Midline diastema
|_| Midline discrepancy
|_| Missing teeth
|_| Mucogingival status
|_| Nasolabial angle
|_| Oral hygiene
|_| Overbite
|_| Overjet
|_| Path of closure
|_| Perioral musculature
|_| Range of motion
|_| Respiration (nose or mouth)
|_| Salivary glands
|_| Size of nose
|_| Signs of TMJ
|_| Size of Airway
|_| Skeletal classification
|_| Skin
|_| Space analysis
|_| Stage of dentition
|_| Speech
|_| Supernumerary teeth
|_| Swallowing pattern
|_| Tongue size
|_| Tonicity of Lips
|_| Tonsils and adenoids
|_| Transposed teeth
|_| Transverse deficiency
|_| Type of occlusion (cuspid guidance, group function, other)
|_| Uvula
|_| Vault form

APPENDIX F

Orthodontists' Criteria for Recognition of Malocclusion

APPENDIX F

Orthodontists' Criteria for Recognition of Malocclusion

No. of Responses	Criteria for Recognition of Malocclusion
9	Skeletal Classification
8	Facial Profile
8	Arch Length Discrepancies
7	Impacted Teeth
7	Overbite
6	Anterior Open Bite
6	Cross-Bite
6	Dental Classification
6	Space Analysis
5	Facial Symmetry
5	Missing Teeth
4	Ankylosed or Retained Primary Teeth
4	Angle of the Mandible
4	Habits
4	Incisor Position
4	Functional Shift
4	Supernumerary Teeth
3	A-P Symmetry
3	Amount of Incisor and Gingiva Showing When Smiling
3	Chief Complaint
3	Gingival Health
3	Dental Spacing
3	Lip Prominence
3	Midline Discrepancy
3	Mucogingival Status
3	Midline Diastema
3	Mentalis Strain
3	Transverse Discrepancy
3	Signs of TMJ
2	Arch Form (Symmetry)
2	Cephalometric Analysis
2	Curve of Spee
2	Cooperation or Compliance
2	Medical History
2	Nasolabial Angle
2	Oral Hygiene

Orthodontists' Criteria for Recognition of Malocclusion (Cont.)

No. of Responses	Criteria for Recognition of Malocclusion
2	Stage of Dentition
2	Swallowing Pattern
2	Transposed Teeth
2	Type of Occlusion
1	Activity of Muscles of Mastication
1	Amount of Incisor and Gingiva Showing at Rest
1	Bolton Template Analysis
1	Dental Health
1	Dental Deflections (contact points)
1	Facial Form
1	Frenum Size and Position
1	Growth Pattern
1	Horizontal Tooth Malpositions
1	Interlabial Gap
1	Maxillary Molar Rotations
1	Path of Closure
1	Perioral Musculature
1	Range of Motion
1	Respiration
1	Tonicity of Lips
1	Tonsils and Adenoids
1	Vault Form
1	Vertical Tooth Malpositions

APPENDIX G

Case Descriptions - 7 Cases

APPENDIX G: CASE DESCRIPTIONS OF THE SEVEN CASES OF MALOCCLUSION

CASE ONE - 8 YEARS, 9 MONTHS CAUCASIAN FEMALE

Class II skeletal with a retruded mandible in the mixed dentition and an anterior open bite. Additionally, a posterior cross-bite with a maxillary transverse deficiency, end-to-end molar relationship with moderate mandibular crowding and excessive overjet are present. Dental midlines are not co-incident and the lips appear tense when closed.

CASE TWO - 11 YEARS, 8 MONTHS, CAUCASIAN MALE

Class II skeletal with a retruded mandible in the mixed dentition with end-to-end cuspid and molar relationships. There is slight mandibular crowding with excessive overbite and moderate overjet and a congenitally missing mandibular left second premolar. The lips appear normal and relaxed when closed.

CASE THREE - 15 YEARS, 1 MONTH CAUCASIAN FEMALE

Class I skeletal in the mixed dentition with retained maxillary primary cuspids and impacted permanent maxillary cuspids. The cuspid relationship is end-to-end on the right side and Class I on the left side and the molar relationship is Class I. There is moderate maxillary and mandibular crowding and a moderate overbite. The dental midlines are not co-incident.

CASE FOUR - 12 YEARS, 11 MONTHS CAUCASIAN MALE

Class II skeletal with a retruded mandible in the permanent dentition with Class I cuspid and molar relationships. There is moderate maxillary and severe mandibular crowding with moderate overbite and overjet. There is gingival inflammation and, when closed, the lips are tense.

CASE FIVE - 12 YEARS, 5 MONTHS CAUCASIAN FEMALE

Class I skeletal in the permanent dentition with a bilateral Class I cuspid relationship, a Class I molar relationship on the right side, and a Class III molar relationship on the left side. There is moderate crowding in both arches and anterior and posterior cross-bites. The midlines are not co-incident and the mandibular right third molar is congenitally missing.

CASE SIX - 14 YEARS, 6 MONTHS CAUCASIAN FEMALE

Class I skeletal relationship in the permanent dentition with an end-to-end cuspid and molar relationship on the right side and a Class I cuspid and molar relationship on the left side. There is a moderate overbite and overjet and slight maxillary and moderate mandibular crowding. The dental midlines are not co-incident.

CASE SEVEN - 11 YEARS, 5 MONTHS CAUCASIAN MALE

Class I skeletal in the permanent dentition which is advanced for his age with Class II cuspid and molar relationships on the right side and end-to-end cuspid and molar relationships on the left side. There is an excessive overbite and a moderate overjet with moderate maxillary and mandibular crowding.

APPENDIX H

Correlation Coefficients for Pairs of Questions

Table 25.--Correlation Coefficients For Pairs of Questions

CASE ONE ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
1-2	0.2791**	7.79
1-4	0.3906**	15.26
1-5	0.2582**	6.67
1-24	0.2692**	7.25
2-3	0.3970**	15.76
2-4	0.2102*	4.42
2-14	0.2269**	5.15
3-4	0.4671**	21.82
3-14	0.1988*	3.95
3-24	0.2619**	6.86
4-5	0.2230*	4.97
4-24	0.2814**	7.92
4-29	0.2021*	4.08
5-22	0.1984*	3.94
5-23	0.1988*	3.95
5-27	0.2055*	4.22
6-14	0.1979*	3.92
7-8	0.3508**	12.31
9-10	0.4005**	16.04
9-11	-0.5685**	32.32
9-14	-0.2177*	4.74
10-31	0.2071*	4.29
11-14	0.2675**	7.16
11-29	0.2313*	5.35
12-13	0.5466**	29.88
12-34	-0.2123*	4.51
14-29	0.2617**	6.85
14-33	-0.2642**	6.98
15-16	0.6017**	36.20
15-17	-0.2344*	5.49
15-18	0.4326**	18.71
15-28	-0.1966*	3.87
16-18	0.3322**	11.04
17-37	-0.2217*	4.92

Table 25 cont.--Correlation Coefficients For Pairs of Questions

CASE ONE ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
18-33	-0.2065*	4.26
19-20	0.5374**	28.88
19-21	0.3179**	10.11
20-21	0.2209*	4.88
20-27	0.2212*	4.89
20-28	-0.2015*	4.06
21-33	0.2435*	5.93
22-23	0.8438**	71.20
22-34	0.2108*	4.44
23-24	0.2135*	4.56
23-34	0.2191*	4.80
24-27	-0.2547**	6.49
24-29	0.2620**	6.86
25-28	-0.2033*	4.13
26-27	-0.3038**	9.23
26-29	0.4761**	22.67
27-28	-0.2415*	5.83
27-29	-0.2664**	7.10
27-39	-0.2045*	4.18
28-29	0.2515**	6.33
31-32	0.2091*	4.37
31-33	0.2281*	5.20
32-33	0.2920**	8.53
34-35	0.2277*	5.18
34-39	-0.1972*	3.89
36-37	0.2184*	4.77

Table 26.--Correlation Coefficients For Pairs of Questions

CASE TWO ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
1-2	0.4972**	24.72
1-3	0.3586**	12.86
1-4	0.3572**	12.76
1-14	0.2378*	5.65
1-16	0.3783**	14.31
1-17	0.2849**	8.12
1-21	0.2218*	4.92
1-35	0.2375*	5.64
2-3	0.4913**	24.14
2-4	0.3410**	11.63
2-5	-0.2017*	4.07
2-21	0.3026**	9.16
3-4	0.5657**	32.00
3-8	0.2057*	4.23
3-9	0.2018*	4.07
3-12	0.3300**	10.89
3-14	0.3079**	9.48
3-21	0.2451*	6.01
4-6	-0.2109*	4.45
4-21	0.2472*	6.11
5-6	0.5592**	31.27
5-7	0.2036*	4.15
5-21	-0.1990*	3.96
5-27	0.2447*	5.99
6-27	0.2617**	6.85
7-14	0.2341*	5.48
7-27	0.3138**	9.85
7-28	-0.2013*	4.05
8-11	-0.2128*	4.53
8-14	0.2070*	4.28
8-15	0.3417**	11.68
8-24	0.2868**	8.23
8-31	-0.2063*	4.26
8-35	-0.2719**	7.39

Table 26 cont.--Correlation Coefficients For Pairs of Questions

CASE TWO ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
9-10	0.7497**	56.21
9-11	0.2588**	6.70
9-12	0.3658**	13.38
9-13	0.2019*	4.08
9-14	0.2247*	5.05
10-11	0.3499**	12.24
10-12	0.2828**	8.00
10-13	0.2102*	4.42
10-14	0.2649**	7.02
10-19	0.1979*	3.92
11-14	0.2009*	4.04
12-13	0.7231**	52.29
12-14	0.4721**	22.29
13-14	0.4884**	23.85
13-26	-0.2163*	4.68
13-28	-0.2131*	4.54
14-23	0.2143*	4.59
14-27	0.2244*	5.04
15-16	0.2137*	4.57
15-17	0.3048**	9.29
15-19	0.2946**	8.68
15-21	0.2185*	4.77
15-24	0.3115**	9.70
16-17	0.4535**	20.57
16-35	0.2370*	5.62
17-18	0.2059*	4.24
17-35	0.2505**	6.28
18-30	0.1976*	3.90
18-32	0.2850**	8.12
19-20	0.3527**	12.44
19-21	0.4909**	24.10
20-21	0.3524**	12.42
21-24	0.2140*	4.58
22-23	0.5833**	34.02
22-24	0.2496**	6.23
23-24	0.3217**	10.35
23-38	0.2817**	7.94
26-27	-0.3096**	9.58

Table 26 cont.--Correlation Coefficients For Pairs of Questions

CASE TWO ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
26-28	0.5591**	31.26
26-31	0.2313*	5.35
28-37	0.3316**	11.00
30-33	0.2287*	5.23
31-34	0.2129*	4.53
32-33	0.3249**	10.56
32-38	0.2046*	4.19
33-34	0.2107*	4.44
34-35	0.4606**	21.22
35-36	-0.1971*	3.88
37-38	0.4646**	21.59
37-39	0.3098**	9.60
38-39	0.2909**	8.46

Table 27.--Correlation Coefficients For Pairs of Questions

CASE THREE ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
1-2	0.3576**	12.79
1-3	0.2919**	8.52
1-4	0.3979**	15.83
1-11	-0.3208**	10.29
1-12	0.2591**	6.71
1-13	0.3006**	9.04
1-14	0.2551**	6.51
1-17	-0.2364*	5.59
1-20	0.2009*	4.04
1-21	0.2479*	6.15
1-22	0.3007**	9.42
2-3	0.3110**	9.67
2-10	0.3509**	12.31
2-12	0.2477*	6.14
2-14	0.1995*	3.98
2-23	0.2511**	6.31
2-30	0.2433*	5.92
3-4	0.3846**	14.79
3-6	0.2860**	8.18
3-11	-0.2029*	4.12
3-12	0.2665**	7.10
3-14	0.2455*	6.03
3-17	-0.2204*	4.86
3-22	0.1992*	3.97
4-6	0.2860**	8.18
4-12	0.3480**	12.11
4-14	0.2491*	6.21
4-17	-0.2669**	7.12
4-21	0.2867**	8.22
4-26	0.2061*	4.25
5-6	0.5529**	30.57
5-14	0.2073*	4.30
5-16	0.2264*	5.13
5-23	0.2385*	5.69

Table 27 cont.--Correlation Coefficients For Pairs of Questions

CASE THREE ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
6-12	0.2948**	8.69
6-14	0.3868**	14.96
7-8	0.5772**	33.32
8-31	0.2186*	4.78
8-36	0.2562**	6.56
9-14	-0.2731**	7.46
9-30	-0.2234*	4.99
10-11	-0.4263**	18.17
10-13	0.2664**	7.10
10-30	0.2379*	5.66
11-13	-0.2298*	5.28
11-14	-0.2716**	7.38
11-22	-0.3862**	14.92
11-23	-0.2149*	4.62
11-24	-0.2046*	4.19
12-13	0.4497**	20.22
12-14	0.5879**	34.56
12-23	0.2119*	4.49
13-14	0.4885**	23.86
13-32	0.2088*	4.36
15-17	0.2413*	5.82
15-34	0.2369*	5.61
17-27	0.2152*	4.63
17-35	0.2654**	7.04
19-20	0.4566**	20.87
20-21	0.4659**	21.71
20-22	0.2006*	4.02
21-37	0.2206*	4.87
22-23	0.5803**	33.67
23-28	0.2457*	6.04
23-29	0.1979*	3.92
25-28	0.2059*	4.24
26-27	0.2412*	5.82
26-29	0.5667**	32.11
26-36	0.2454*	6.02
27-28	0.3104**	9.63
27-29	0.2033*	4.13
28-29	0.3052**	9.31

Table 27 cont.--Correlation Coefficients For Pairs of Questions

CASE THREE ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
29-32	0.2324*	5.40
29-34	0.2013*	4.05
29-36	0.2276*	5.18
31-36	0.2873**	8.25
32-33	0.4541**	20.62
34-35	0.2391*	5.72
36-39	0.2025*	4.10

Table 28.--Correlation Coefficients For Pairs of Questions

CASE FOUR ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
1-2	0.3788**	14.35
1-4	0.4697**	22.06
1-6	0.2957**	8.74
1-15	0.2007*	4.03
1-23	0.2690**	7.24
2-3	-0.4497**	20.22
2-4	0.3447**	11.88
2-18	-0.1989*	3.96
3-4	-0.4820**	23.23
3-7	0.2005*	4.02
3-9	0.2349*	5.52
3-11	0.2944**	8.67
3-12	0.2280*	5.20
4-6	0.3984**	15.87
4-9	-0.2032*	4.13
4-11	-0.2268*	5.14
4-17	0.2484*	6.17
5-6	0.3451**	11.91
5-18	0.2149*	4.62
6-17	0.2512**	6.31
6-21	0.2891**	8.36
7-8	0.2731**	7.41
7-9	0.2003*	4.01
7-15	0.2641**	6.97
7-19	0.2402*	5.77
7-26	0.2195*	4.82
7-31	0.2138*	4.57
7-34	0.2003*	4.01
8-15	0.2250*	5.06
8-17	0.2088*	4.36
8-34	0.2489*	6.20
9-10	0.5250**	27.56
9-11	0.7240**	52.42
10-11	0.4752**	22.58

Table 28 cont.--Correlation Coefficients For Pairs of Questions

CASE FOUR ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
10-20	0.2229*	4.97
10-23	0.3236**	10.47
11-14	0.2122*	4.50
11-28	0.2220*	4.93
12-13	0.6548**	42.88
12-14	0.6389**	40.82
13-14	0.7664**	58.74
14-39	0.2185*	4.77
15-17	0.2641**	6.97
15-19	0.3198**	10.23
15-21	0.2147*	4.61
15-34	0.3735**	13.95
16-17	0.6072**	36.87
16-19	0.3877**	15.03
16-26	0.2565**	6.58
16-34	0.2001*	4.00
17-18	0.4018**	16.14
17-19	0.3217**	10.35
17-21	0.3132**	9.81
17-29	0.2562**	6.56
17-34	0.2922**	8.54
18-20	0.2774**	7.70
19-21	0.2996**	8.98
19-23	0.2290*	5.24
19-26	0.2761**	7.62
19-29	0.2428*	5.90
19-31	0.2637**	6.95
19-34	0.4800**	23.04
23-27	-0.2070*	4.28
23-30	0.2117*	4.48
23-34	0.2092*	4.38
23-37	0.2402*	5.77
25-28	0.2019*	4.08
25-33	0.2420*	5.86
26-29	0.2242*	5.03
26-34	0.2001*	4.00
27-28	0.3564**	12.70
27-30	-0.2007*	4.03

Table 28 cont.--Correlation Coefficients For Pairs of Questions

CASE FOUR ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
27-36	0.2597**	6.74
28-33	0.2161*	4.67
28-36	0.4261**	18.16
29-34	0.4054**	16.43
31-37	0.2438*	5.94
32-33	-0.3551**	12.61

Table 29.--Correlation Coefficients For Pairs of Questions

CASE FIVE ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
1-2	0.4902**	24.03
1-3	0.4693**	22.02
1-4	0.4159**	17.30
1-12	0.1997*	3.99
1-21	0.3181**	10.12
1-32	0.3218**	10.36
2-3	0.5030**	25.30
2-4	0.3344**	11.18
2-12	0.2113*	4.46
2-32	0.2457*	6.04
2-37	-0.2124*	4.51
3-4	0.5278**	27.86
3-9	0.2765**	7.65
3-10	0.3080**	9.49
3-11	0.2616**	6.84
3-12	0.2283*	5.21
3-35	-0.2168*	4.70
3-36	0.2763**	7.63
3-38	0.2288*	5.23
3-39	0.1977*	3.91
5-6	0.5622**	31.61
5-21	0.2431*	5.91
6-33	0.2363*	5.58
6-39	-0.2117*	4.48
7-14	0.2273*	5.17
8-24	0.3960**	15.68
8-31	-0.2428*	5.90
8-34	0.2830**	8.01
9-10	0.3431**	11.77
9-11	0.5450**	29.70
9-21	0.2907**	8.45
10-11	0.4244**	18.01
10-12	0.3385**	11.46
11-14	-0.2465*	6.08

Table 29 cont.--Correlation Coefficients For Pairs of Questions

CASE FIVE ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
11-21	0.2188*	4.79
12-13	0.2309*	5.33
13-14	0.3329**	11.08
13-20	0.2162*	4.67
13-21	0.2715**	7.37
14-19	0.3084**	9.51
14-24	0.2312*	5.35
15-16	0.2858**	8.17
15-18	0.2783**	7.75
15-19	0.5465**	29.87
15-20	0.2741**	7.51
15-24	0.2001*	4.00
15-31	-0.3088**	9.54
16-17	0.4308**	18.56
16-19	0.3223**	10.39
16-20	0.5014**	25.14
16-21	0.2656**	7.05
17-20	0.2019*	4.08
17-21	0.3645**	13.29
19-20	0.3219**	10.36
19-24	0.2225*	4.95
19-31	-0.2166*	4.69
20-21	0.6154**	37.87
22-23	-0.8116**	65.87
24-31	-0.2179*	4.75
26-27	0.2731**	7.46
26-29	0.1989*	3.96
27-28	0.3243**	10.52
27-29	0.3074**	9.45
28-29	0.2655**	7.05
28-31	-0.2048*	4.19
28-34	0.2540**	6.45
29-34	0.4552**	20.72
29-37	0.2079*	4.32
31-37	-0.2063*	4.26
32-33	0.2300*	5.29
32-39	0.2058*	4.24
35-39	-0.2192*	4.80

Table 30.--Correlation Coefficients For Pairs of Questions

CASE SIX ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
1-2	0.5394**	29.10
1-3	0.4865**	23.67
1-4	0.5431**	29.50
1-32	0.2781**	7.73
2-3	0.4924**	24.25
2-4	0.4439**	19.70
2-32	0.2129*	4.53
3-4	0.5970**	35.64
3-9	-0.2102*	4.42
4-36	0.2199*	4.48
5-6	0.5042**	25.42
5-7	0.2369*	5.61
6-7	0.2036*	4.15
7-8	0.2814**	7.92
7-19	0.2036*	4.15
7-26	0.2204*	4.86
8-10	0.2055*	4.22
8-32	0.2553**	6.52
9-11	0.2073*	4.30
9-12	0.4477**	20.04
9-32	-0.1966*	3.87
10-11	-0.2262*	5.12
10-13	0.2727**	7.44
10-18	0.2700**	7.29
10-22	0.2230*	4.97
11-14	0.5221**	27.26
11-27	-0.2850**	8.12
11-28	0.2134*	4.55
11-29	0.1969*	3.88
11-34	0.2414*	5.83
12-26	0.2604**	6.78
12-33	-0.2099*	4.41
13-22	0.2749**	7.56
13-23	0.2523**	6.37

Table 30 cont.--Correlation Coefficients For Pairs of Questions

CASE SIX ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
13-37	0.2250*	5.06
14-16	0.2144*	4.60
14-28	0.2150*	4.62
14-32	0.2830**	8.01
14-34	0.2663**	7.09
14-35	0.2066*	4.27
14-36	0.2236*	5.00
15-16	0.2098*	4.40
15-19	0.2204*	4.86
15-22	0.2667**	7.11
15-26	0.2101*	4.41
16-17	0.4603**	21.19
16-31	0.2216*	4.91
16-39	0.2039*	4.16
17-20	0.3375**	11.39
17-21	0.2730**	7.45
18-20	-0.2244*	5.04
18-21	-0.3007**	9.04
18-33	0.1988*	3.95
19-20	0.2157*	4.65
19-21	0.2755**	7.59
20-21	0.6301**	39.70
22-23	0.6624**	43.88
23-25	0.3079**	9.48
23-38	0.2078*	4.32
25-38	0.2147*	4.61
26-27	0.3001**	9.01
26-29	0.3682**	13.56
27-28	-0.2422*	5.87
28-29	0.3110**	9.67
28-33	-0.3242**	10.51
29-30	0.1988*	3.95
29-34	0.3119**	9.73
31-33	0.2437*	5.94
31-39	0.2218*	4.92
32-33	0.2960**	8.76
32-34	0.2578**	6.65
33-35	0.2312*	5.35
34-36	0.2030*	4.12
37-38	0.3002**	9.01

Table 31.--Correlation Coefficients For Pairs of Questions

CASE SEVEN ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
1-2	0.6168**	38.04
1-3	0.4597**	21.13
1-4	0.4827**	23.30
1-8	-0.2304*	5.31
1-13	-0.2044*	4.18
1-19	-0.1984*	3.94
2-3	0.5654**	31.97
2-4	0.4102**	16.83
2-8	-0.2547**	6.49
2-13	-0.2104*	4.43
3-4	0.6152**	37.85
3-6	0.2126*	4.52
3-8	-0.2132*	4.55
3-11	-0.2255*	5.09
4-5	0.2277*	5.18
4-6	0.2952**	8.71
5-6	0.5989**	35.87
5-11	-0.2315*	5.36
5-19	-0.2214*	4.90
6-7	0.2521**	6.36
6-11	-0.2303*	5.30
6-24	0.2412*	5.82
6-30	0.2521**	6.36
7-22	0.2717**	7.38
7-26	0.2209*	4.88
8-13	0.2196*	4.82
8-21	0.2030*	4.12
8-22	-0.1980*	3.92
9-11	0.4037**	16.30
9-12	0.2459*	6.05
9-24	0.2201*	4.84
9-31	0.2390*	5.71
11-14	0.3567**	12.72
12-14	0.4439**	19.70

Table 31 cont.--Correlation Coefficients For Pairs of Questions

CASE SEVEN ** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Question Pair	Correlation Co-efficient	Percent Explained Variance
12-33	0.2054*	4.22
15-16	0.3390**	11.49
15-17	0.2445*	5.98
15-24	0.2543**	6.47
15-26	0.3281**	10.76
15-30	0.3156**	9.96
15-31	0.2840**	8.07
15-34	0.3923**	15.39
15-37	0.2214*	4.90
16-17	0.6467**	41.82
16-31	0.3039**	9.24
17-18	0.2425*	5.88
19-20	0.2161*	4.67
19-22	0.2043*	4.17
20-21	0.3927**	15.42
20-22	-0.2818**	7.94
20-31	-0.2596**	6.74
22-23	0.6053**	36.64
23-34	0.2552**	6.51
23-37	0.2402*	5.77
24-36	0.3135**	9.83
25-29	0.2577**	6.64
26-27	0.1972*	3.89
26-29	0.3945**	15.56
26-30	0.2209*	4.88
26-34	0.2805**	7.87
27-28	0.2145*	4.60
27-29	0.2150*	4.62
27-32	0.2400*	5.76
29-34	0.2644**	6.99
31-34	0.2552**	6.51
32-33	0.2725**	7.43
33-34	0.2552**	6.51
34-35	0.2067*	4.27
34-37	0.3090**	11.49
35-37	0.2633**	6.93
37-38	0.3140**	9.86
37-39	0.2400*	5.76

Table 32.--Correlation Coefficients
For Specific Question Pairs

Question Pair	Case One	Case Two	Case Three	Case Four	Case Five
1-4	0.39**	0.36**	0.40**	0.47**	0.42**
2-3	0.40**	0.49**	0.31**	-0.45**	0.50**
5-6	0.16	0.56**	0.55**	0.35**	0.56**
7-8	0.35**	0.09	0.58**	0.27**	0.10
9-11	-0.57**	0.26**	0.20	0.72**	0.55**
10-11	0.05	0.35**	0.43**	0.48**	0.42**
12-14	0.04	0.47**	0.59**	0.64**	-0.13
13-14	0.05	0.49**	0.49**	0.77**	0.33**
15-17	-0.23	0.30**	0.24*	0.26**	0.04
16-17	-0.12	0.45**	0.16	0.61**	0.43**
15-18	0.43**	0.05	0.02	0.13	0.28**
19-21	0.32**	0.49**	0.15	0.30**	0.02
20-21	0.22**	0.35**	0.47**	0.05	0.62**
22-23	0.84**	0.58**	0.58**	0.16	-0.81**
26-27	-0.30**	-0.31**	0.24*	0.19	0.27**
26-28	0.18	0.56**	0.19	0.05	0.17
26-29	0.47**	-0.04	0.57**	0.22*	0.20*
27-29	-0.27**	0.18	0.20*	0.07	0.31**
28-29	0.25**	0.08	0.31**	0.15	0.27

** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

Table 32 cont.--Correlation Coefficients
For Specific Question Pairs

Question Pair	Case Six	Case Seven
1-4	0.54**	0.48**
2-3	0.49**	0.57**
5-6	0.50**	0.60**
7-8	0.28**	-0.12
9-11	0.21*	0.40**
10-11	-0.23	0.15
12-14	0.12	0.44**
13-14	0.06	0.05
15-17	0.09	0.24*
16-17	0.46**	0.65**
15-18	0.01	0.09
19-21	0.28**	0.16
20-21	0.63**	0.39**
22-23	0.66**	0.61**
26-27	0.30**	0.20*
26-28	0.14	0.17
26-29	0.37**	0.39**
27-29	0.12	0.22*
28-29	0.31**	0.15

** = Significant at the p = 0.001 level
* = Significant at the p = 0.01 level

APPENDIX I

Frequencies of Responses to Individual Questions by Orthodontists and Undergraduate Dental Students

TABLE 33a.--Frequencies of Responses to Individual Questions by Orthodontists in Percent **[Case 1, n = 10]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1		100.0						
2	100.0							
3	100.0							
4	100.0							
5	20.0	50.0	30.0					
6	90.0	10.0						
7		100.0						
8	90.0	10.0						
9	40.0	20.0	20.0			20.0		
10	30.0	20.0	30.0			20.0		
11	30.0	30.0				40.0		
12	10.0	90.0						
13	10.0	90.0						
14	100.0							
15		100.0						
16						100.0		
17	100.0							
18	100.0							
19	100.0							
20			100.0					
21	100.0							
22	100.0							
23		100.0						
24	70.0	30.0						
25	90.0	10.0						
26	100.0							
27				100.0				
28		100.0						
29	100.0							
30		100.0						
31					100.0			
32	100.0							
33				100.0				
34	100.0							
35					100.0			
36	50.0	50.0						
37		80.0	20.0					
38		80.0	20.0					
39		60.0	40.0					

TABLE 33b.--Frequencies of Responses to Individual Questions by Freshmen in Percent **[Case 1, n = 55]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	23.6	49.1	20.0	7.3				
2	65.4	27.3	7.3					
3	56.4	43.6						
4	80.0	20.0						
5	38.2	52.7	9.1					
6	43.6	56.4						
7	9.1	87.3	3.6					
8	83.6	16.4						
9	30.9	14.5	36.4	16.4		1.8		
10	32.7	14.5	35.5	16.4		1.8		
11	58.2	40.0	1.8					
12	25.4	29.1	25.4	20.0				
13	41.8	29.1	16.4	12.7				
14	70.9	29.1						
15	47.3	52.7						
16	23.6	14.5	25.4			34.5		1.8
17	43.6	41.8						14.5
18	74.5	25.4						
19	81.8	14.5	3.6					
20	7.3	12.7	69.1					10.9
21	76.4	14.5	1.8					7.3
22	56.4	43.6						
23	3.6	60.0				36.4		
24	34.5	65.4						
25	89.1	10.9						
26	41.8	58.2						
27	10.9	9.1		74.5				5.4
28	25.4	16.4	3.6	52.7				1.8
29	29.1	34.5				36.4		
30	36.4	60.0						3.6
31	27.3	3.6	14.5	5.4	40.0		9.1	
32	81.8	18.2						
33	5.4	9.1	1.8	83.6				
34	90.9	7.3						1.8
35	9.1	5.4		14.5	63.6		3.6	3.6
36	32.7	65.4						1.8
37	7.3	72.7	20.0					
38	3.6	60.0	34.5					1.8
39	3.6	45.5	40.0	9.1				1.8

TABLE 33c.--Frequencies of Responses to Individual Questions by Sophomores in Percent **[Case 1, n = 54]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	42.6	50.0	5.6		1.8			
2	38.9	57.4	3.7					
3	35.2	64.8						
4	46.3	53.7						
5	46.3	44.4	9.3					
6	35.2	64.8						
7		100.0						
8	83.3	14.8						1.8
9	37.0	5.6	25.9	1.8		29.6		
10	37.0	5.6	25.9	1.8		29.6		
11	31.5	40.7				27.8		
12	24.1	25.9	48.1	1.8				
13	48.1	20.4	29.6	1.8				
14	59.3	40.7						
15	44.4	55.6						
16	42.6		13.0			44.4		
17	44.4	37.0						18.5
18	72.2	27.8						
19	96.3	3.7						
20	5.6	7.4	83.3					3.7
21	98.1	1.8						
22	70.4	29.6						
23		74.1				25.9		
24	20.4	79.6						
25	88.9	11.1						
26	25.9	74.1						
27	13.0	5.6		81.5				
28	22.2	5.6	5.6	66.7				
29	22.2	38.9				38.9		
30	18.5	81.5						
31	27.8	1.8	18.5	5.6	40.7		5.6	
32	77.8	22.2						
33	9.3	11.1		79.6				
34	90.7	7.4	1.8					
35	7.4	9.3	3.7	1.8	61.1		14.8	1.8
36	33.3	66.7						
37	1.8	88.9	9.3					
38		46.3	53.7					
39	3.7	46.3	50.0					

TABLE 33d.--Frequencies of Responses to Individual Questions by Juniors in Percent **[Case 1, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	22.6	74.2		3.2				
2	71.0	25.8	3.2					
3	41.9	58.1						
4	67.7	32.3						
5	19.3	54.8	25.8					
6	58.1	41.9						
7	3.2	93.5	3.2					
8	96.8	3.2						
9	45.2	3.2	32.3	9.7		9.7		
10	45.2	6.4	29.0	9.7		9.7		
11	41.9	48.4				9.7		
12	25.8	38.7	35.5					
13	51.6	16.1	25.8	6.4				
14	38.7	61.3						
15	22.6	74.2						3.2
16	41.9	12.9	3.2			41.9		
17	45.2	38.7						16.1
18	93.5	3.2	3.2					
19	90.3	9.7						
20	6.4	9.7	77.4					6.4
21	96.8	3.2						
22	58.1	41.9						
23	12.9	54.8				32.3		
24	41.9	58.1						
25	74.2	25.8						
26	41.9	54.8						3.2
27	3.2	3.2	3.2	83.9				6.4
28	35.5	9.7		48.4				6.4
29	19.3	58.1	3.2			19.3		
30	38.7	58.1						3.2
31	41.9	3.2	12.9		41.9			
32	74.2	22.6	3.2					
33	6.4	3.2	3.2	87.1				
34	96.8	3.2						
35	6.4	9.7		6.4	74.2			3.2
36	12.9	83.9		3.2				
37	6.4	77.4	12.9	3.2				
38		71.0	25.8	3.2				
39		54.8	38.7	6.4				

TABLE 33e.--Frequencies of Responses to Individual Questions by Seniors in Percent **[Case 1, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	12.9	83.9		3.2				
2	58.1	38.7	3.2					
3	48.4	51.6						
4	71.0	29.0						
5	6.4	64.5	29.0					
6	80.6	16.1						
7	3.2	96.8						
8	90.3	9.7						
9	12.9	12.9	54.8			19.3		
10	19.3	9.7	48.4	3.2		19.3		
11	67.7	22.6				9.7		
12	22.6	16.1	54.8	6.4				
13	61.3	6.4	25.8	6.4				
14	77.4	22.6						
15	9.7	87.1	3.2					
16	29.0	9.7	3.2			54.8		3.2
17	35.5	25.8	6.4					32.3
18	93.5	6.4						
19	93.5	6.4						
20	3.2	3.2	87.1					6.4
21	87.1	12.9						
22	80.6	19.3						
23	3.2	77.4				19.3		
24	35.5	64.5						
25	87.1	9.7						3.2
26	48.4	51.6						
27	3.2	3.2	3.2	90.3				
28	16.1	6.4	19.3	58.1				
29	32.3	41.9				25.8		
30	38.7	61.3						
31	35.5	3.2	6.4		54.8			
32	83.9	16.1						
33	6.4	9.7		67.7	12.9			3.2
34	100.0							
35			3.2	6.4	80.6		9.7	
36	51.6	48.4						
37	3.2	80.6	16.1					
38	3.2	67.7	25.8	3.2				
39	6.4	29.0	61.3	3.2				

TABLE 33f.--Multiple Responses from Groups by Question Number
[Case 1]

Group	Question Number	Number of Students	Answers Chosen
Freshman (n=55)	31	3	A,C
		1	A,C,D
		1	A,B,C,D
	35	1	A,B,C,E
		1	B,C,D,E
Sophomore (n=54)	31	2	A,C
		1	A,D
	35	2	C,E
		2	D,E
		2	B,C,E
		1	A,E
		1	B,E
Junior (n=31)	none		
Senior (n=31)	35	2	B,C,E
		1	C,E

TABLE 34a.-- Frequencies of Responses to Individual Questions by Orthodontists in Percent **[Case 2, n = 10]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1		100.0						
2	100.0							
3	100.0							
4	100.0							
5	100.0							
6	20.0	80.0						
7		100.0						
8	100.0							
9			100.0					
10			100.0					
11	100.0							
12		20.0	80.0					
13		10.0	90.0					
14	100.0							
15	100.0							
16		10.0	90.0					
17	100.0							
18		100.0						
19	100.0							
20		100.0						
21	100.0							
22		100.0						
23						100.0		
24		100.0						
25	20.0	80.0						
26	90.0	10.0						
27				100.0				
28	90.0			10.0				
29	30.0	70.0						
30	90.0	10.0						
31	100.0							
32	100.0							
33				100.0				
34	100.0							
35					100.0			
36	40.0	60.0						
37		90.0	10.0					
38		50.0	50.0					
39		50.0	50.0					

TABLE 34b.--Frequencies of Responses to Individual Questions by Freshmen in Percent [Case 2, n = 55]

Question	A	B	C	D	E	N/A	Multiple	No Ans.
			305					
1	25.4	67.3	5.4					1.8
2	70.9	25.4	1.8					1.8
3	47.3	52.7						
4	58.2	41.8						
5	83.6	9.1	5.4					1.8
6	9.1	87.3	3.6					
7		83.6	16.4					
8	89.1	10.9						
9	47.3	21.8	23.6	5.4				1.8
10	41.8	21.8	30.9	5.4				
11	54.5	45.5						
12	40.0	20.0	32.7	5.4				1.8
13	32.7	25.4	38.2	3.6				
14	60.0	39.2	1.8					
15	96.4	3.6						
16	3.6	12.7	81.8					1.8
17	87.3	12.7						
18	16.4	83.6						
19	85.5	14.5						
20	20.0	34.5	36.4					9.1
21	65.4	27.3						7 3
22	5.4	92.7						1.8
23	3.6	16.4				80.0		
24	12.7	85.4						1.8
25	69.1	30.9						
26	52.7	47.3						
27	25.4	7.3	7.3	56.4				3 6
28	49.1	14.5	1.8	32.7				1.8
29	49.1	27.3	1.8					14 5
30	87.3	12.7						
31	27.3	3.6	20.0	9.1	27.3		12.7	
32	89.1	5.4		1.8				3.6
33	3.6	1.8	1.8	92.7				
34	85.5	12.7			1.8			
35	16.4	10.9	3.6		56.4		5.4	7 3
36	29.1	65.4	1.8					3.6
37	1.8	74.5	21.8	1.8				
38	7.3	45.5	43.6	3.6				
39	5.4	38.2	41.8	14.5				

TABLE 34c.--Frequencies of Responses to Individual Questions by Sophomores in Percent **[Case 2, n = 54]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	25.9	70.4	1.8	1.8				
2	74.1	25.9						
3	50.0	50.0						
4	57.4	42.6						
5	92.6	7.4						
6	9.3	90.7						
7	1.8	92.6	5.6					
8	74.1	25.9						
9	22.2	38.9	33.3	1.8				3.7
10	25.9	24.1	44.4	1.8				3.7
11	79.6	18.5	1.8					
12	18.5	18.5	61.1					1.8
13	7.4	20.4	70.4					1.8
14	83.3	16.7						
15	94.4	1.8	3.7					
16	1.8	29.6	68.5					
17	88.9	7.4	3.7					
18	7.4	90.7	1.8					
19	83.3	16.7						
20	25.9	38.9	24.1					11.1
21	48.1	50.0						1.8
22	3.7	94.4	1.8					
23	1.8	9.3				87.0		1.8
24	14.8	81.5	1.8		1.8			
25	63.0	37.0						
26	35.2	59.3	1.8	3.7				
27	14.4	5.6		72.2				7.4
28	29.6	9.3	1.8	51.8				7.4
29	31.5	29.6						38.1
30	85.2	1.3						1.8
31	35.2	5.6	7.4	7.4	25.9		18.5	
32	88.9	11.4						
33	3.7	7.4	3.7	81.5	1.8			1.8
34	66.7	33.3						
35	9.3	20.4	1.8	1.8	42.6		9.3	14 8
36	16.7	81.5						1.8
37	5.6	79.6	14.8					
38		46.3	53.7					
39	11.1	44.4	42.6	1.8				

TABLE 34d.--Frequencies of Responses to Individual Questions by Juniors in Percent **[Case 2, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	22.6	71.0	6.4					
2	74.2	25.8						
3	35.5	64.5						
4	48.4	51.6						
5	87.1	6.4	6.4					
6	9.7	87.1	3.2					
7		87.1	12.9					
8	80.6	19.3						
9	35.6	32.2	32.2					
10	38.7	22.6	38.7					
11	51.6	48.4						
12	19.4	29.0	51.6					
13	22.6	22.6	51.6					3.2
14	54.8	45.2						
15	93.5	6.4						
16		16.1	83.9					
17	90.3	9.7						
18	12.9	87.1						
19	83.9	16.1						
20	19.3	48.4	22.6					9.7
21	54.8	35.5						9.7
22	3.2	96.8						
23	6.4	6.4				87.1		
24	12.9	87.1						
25	61.3	38.7						
26	51.6	48.4						
27	29.0		3.2	64.5				3.2
28	35.5	16.1		45.2				3.2
29	19.3	64.5						16.1
30	83.9	16.1						
31	45.2		12.9		41.9			
32	90.3	9.7						
33	3.2	3.2	3.2	83.9	6.4			
34	90.3	6.4						3.2
35	19.3	9.7	6.4	6.4	58.1			
36	25.8	74.2						
37	6.4	80.6	9.7	3.2				
38	6.4	58.1	35.5					
39	6.4	61.3	29.0	3.2				

TABLE 34e.--Frequencies of Responses to Individual Questions by Seniors in Percent **[Case 2, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	19.3	80.6						
2	83.9	16.1						
3	38.7	61.3						
4	38.7	61.3						
5	74.2	9.7	16.1					
6	6.4	93.5						
7	3.2	74.2	22.6					
8	58.1	41.9						
9	19.3	45.2	35.5					
10	32.3	32.3	35.5					
11	77.4	19.4		3.2				
12	6.4	48.4	45.2					
13	9.7	45.2	45.2					
14	61.3	22.6	16.1					
15	83.9		16.1					
16		3.2	96.8					
17	100.0							
18	3.2	96.8						
19	74.2	25.8						
20	35.5	48.4	16.1					
21	54.8	45.2						
22	3.2	96.8						
23	6.4					93.6		
24	19.3	80.6						
25	64.5	35.5						
26	67.7	32.3						
27	22.6		9.7	64.5				3.2
28	67.7	6.4	6.4	16.1				3.2
29	38.7	54.8						6.4
30	93.5	6.4						
31	67.7		3.2		25.8		3.2	
32	100.0							
33		3.2		93.5	3.2			
34	100.0							
35		3.2			83.9		12.9	
36	35.5	64.5						
37	3.2	87.1	9.7					
38	3.2	32.3	64.5					
39	3.2	48.4	45.2	3.2				

TABLE 34f.--Multiple Responses from Groups by Question Number
[Case 2]

Group	Question Number	Number of Students	Answers Chosen
Freshman (n=55)	31	5	A,C
		1	A,D
		1	A,C,D
	35	1	A,E
		1	C,E
		1	B,C,D,E
Sophomore (n=54)	31	5	A,C
		2	A,D
		1	A,B
		1	C,D
		1	A,C,D
	35	2	B,E
		2	B,C,E
		1	C,E
Junior (n=31)	none		
Senior (n=31)	31	1	C,D
	35	1	C,E
		1	B,C,E
		1	A,B,C,E
		1	B,C,D,E

TABLE 35a.--Frequencies of Responses to Individual Questions by Orthodontists in Percent **[Case 3, n = 10]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	90.0			10.0				
2		100.0						
3		100.0						
4	10.0	90.0						
5	100.0							
6	10.0	90.0						
7		100.0						
8	10.0	90.0						
9	20.0	80.0						
10	100.0							
11	60.0	40.0						
12	100.0							
13	100.0							
14		100.0						
15	100.0							
16		100.0						
17	100.0							
18		100.0						
19	100.0							
20	100.0							
21		100.0						
22		100.0						
23						100.0		
24		100.0						
25	20.0	80.0						
26	100.0							
27		100.0						
28		100.0						
29	100.0							
30		100.0						
31			90.0		10.0			
32	100.0							
33				100.0				
34	100.0							
35					100.0			
36	70.0	30.0						
37		90.0	10.0					
38		40.0	60.0					
39		60.0	40.0					

TABLE 35b.--Frequencies of Responses to Individual Questions by Freshmen in Percent **[Case 3, n = 55]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	63.6	27.3	5.4	3.6				
2	41.8	52.7	5.4					
3	25.4	74.5						
4	32.7	65.4	1.8					
5	70.9	10.9	18.2					
6	20.0	80.0						
7	3.6	69.1	27.3					
8	38.2	61.8						
9	41.8	12.7	34.5	10.9				
10	49.1	7.3	32.7	10.9				
11	58.2	38.2	3.6					
12	78.2	7.3	12.7	1.8				
13	81.8	1.8	10.9	5.4				
14	18.2	81.8						
15	90.9	9.1						
16	41.8	27.3	27.3					3.6
17	54.5	41.8	1.8					1.8
18	27.3	72.7						
19	65.4	34.5						
20	63.6	14.5	3.6					18.2
21	25.4	63.6						10.9
22	12.7	87.3						
23	9.1	16.4				74.5		
24	38.2	61.8						
25	43.6	56.4						
26	90.9	7.3		1.8				
27	36.4	47.3	9.1	7.3				
28	50.9	38.2	9.1	1.8				
29	89.1	10.9						
30	23.6	76.4						
31	5.4	14.5	29.1	7.3	36.4		7.3	
32	85.5	10.9		3.6				
33	5.4	7.3	3.6	76.4	5.4			1.8
34	92.7	3.6			3.6			
35	20.0	18.2	3.6	1.8	47.3		7.3	1.8
36	60.0	36.4	1.8					1.8
37	3.6	78.2	18.2					
38	10.9	47.3	38.2	3.6				
39	9.1	38.2	41.8	10.9				

TABLE 35c.--Frequencies of Responses to Individual Questions by Sophomores in Percent **[Case 3, n = 54]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	87.0	11.1			1.8			
2	14.8	81.5	3.7					
3	3.7	92.6	3.7					
4	7.4	88.9	3.7					
5	83.3	3.7	13.0					
6	13.0	87.0						
7		72.2	27.8					
8	38.4	61.1						
9	63.0	5.6	18.5	9.3				3.7
10	87.0	7.4	1.8					3.7
11	25.9	70.4						3.7
12	98.1		1.8					
13	98.1			1.8				
14		100.0						
15	88.9	9.3		1.8				
16	24.1	46.3	27.8					1.8
17	59.3	40.7						
18	14.8	83.3		1.8				
19	75.9	22.2	1.8					
20	68.5	20.4	3.7					7.4
21	13.0	83.3						3.7
22	5.6	92.6		1.8				
23	3.7	3.7				92.6		
24	29.6	64.8		1.8				3.7
25	48.1	51.8						
26	92.6	5.6		1.8				
27	40.7	50.0	3.7	5.6				
28	50.0	38.9	1.8	9.3				
29	88.9	11.1						
30	14.8	83.3		1.8				
31	5.6	3.7	50.0	3.7	35.2		1.8	
32	94.4	5.6						
33	5.6	3.7		85.2	5.6			
34	96.3	1.8	1.8					
35		25.9	9.3		42.6		22.2	
36	61.1	37.0	1.8					
37	1.8	88.9	9.3					
38		50.0	50.0					
39	5.6	48.1	42.6	3.7				

TABLE 35d.--Frequencies of Responses to Individual Questions by Juniors in Percent **[Case 3, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	61.3	32.3	6.4					
2	32.3	67.7						
3	12.9	87.1						
4	12.9	87.1						
5	74.2	12.9	12.9					
6	6.4	93.5						
7		64.5	35.5					
8	35.5	64.5						
9	35.5	22.6	22.6	19.3				
10	58.1	6.4	6.4	29.0				
11	61.3	38.7						
12	96.8			3.2				
13	90.3	3.2	3.2	3.2				
14	9.7	90.3						
15	96.8	3.2						
16	12.9	48.4	38.7					
17	83.9	16.1						
18	22.6	77.4						
19	51.6	48.4						
20	67.7	3.2						29.0
21	19.3	77.4						3.2
22	25.8	74.2						
23	9.7	29.0				61.3		
24	25.8	74.2						
25	48.4	51.6						
26	83.9	16.1						
27	35.5	54.8		9.7				
28	48.4	25.8	16.1	9.7				
29	83.9	12.9						3.2
30	19.3	77.4			3.2			
31	9.7	9.7	48.4	6.4	22.6			3.2
32	80.6	12.9			6.4			
33	3.2	9.7		80.6	6.4			
34	100.0							
35	9.7	19.3	6.4		64.5			
36	71.0	29.0						
37	3.2	90.3	6.4					
38	6.4	58.1	35.5					
39	9.7	54.8	32.3	3.2				

TABLE 35e.--Frequencies of Responses to Individual Questions by Seniors in Percent **[Case 3, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	64.5	16.1	9.7	9.7				
2	12.9	80.6	6.4					
3	22.6	77.4						
4	45.2	54.8						
5	71.0	25.8	3.2					
6	16.1	80.6	3.2					
7	3.2	61.3	35.5					
8	71.0	29.0						
9	83.9	9.7	3.2	3.2				
10	100.0							
11	29.0	64.5	3.2					3.2
12	90.3	6.4		3.2				
13	96.8	3.2						
14	6.4	93.5						
15	93.5	6.4						
16	16.1	19.3	58.1					6.4
17	83.9	16.1						
18	3.2	96.8						
19	64.5	35.5						
20	58.1	32.3						9.7
21	32.3	67.7						
22	12.9	77.4						9.7
23	9.7	6.4				80.6		3.2
24	9.7	90.3						
25	48.4	51.6						
26	71.0	29.0						
27	19.3	38.7	19.3	22.6				
28	29.0	41.9	6.4	22.6				
29	64.5	35.5						
30		100.0						
31	3.2	3.2	41.9	6.4	38.7		6.4	
32	90.3	9.7						
33		9.7		90.3				
34	93.5			3.2	3.2			
35	16.1				74.2		9.7	
36	51.6	45.2			3.2			
37	9.7	83.9	6.4					
38	6.4	61.3	32.3					
39	3.2	35.5	61.3					

TABLE 35f.--Multiple Responses from Groups by Question Number
[Case 3]

Group	Question Number	Number of Students	Answers Chosen
Freshman (n=55)	31	2	C,D
		1	A,C
		1	B,C
	35	1	A,E
		1	B,C,E
		1	A,B,C,E
		1	B,C,D,E
Sophomore (n=54)	31	1	B,C
	35	9	B,C,E
		2	B,E
		1	A,E
Junior (n=31)	none		
Senior (n=31)	31	1	A,C
		1	B,E
	35	1	B,E
		1	C,E
		1	B,C,E

TABLE 36a.--Frequencies of Responses to Individual Questions by Orthodontists in Percent **[Case 4, n = 10]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	20.0	80.0						
2	70.0	30.0						
3	40.0	60.0						
4	70.0	30.0						
5		100.0						
6	70.0	30.0						
7			100.0					
8	100.0							
9	100.0							
10	100.0							
11		100.0						
12	100.0							
13	100.0							
14		100.0						
15	100.0							
16		50.0	50.0					
17	100.0							
18		100.0						
19	100.0							
20		100.0						
21	100.0							
22		100.0						
23						100.0		
24		100.0						
25	10.0	90.0						
26	100.0							
27	30.0	70.0						
28		40.0	60.0					
29	100.0							
30	90.0	10.0						
31					100.0			
32		100.0						
33				100.0				
34	100.0							
35					100.0			
36	90.0	10.0						
37		90.0	10.0					
38		60.0	40.0					
39		40.0	60.0					

TABLE 36b.--Frequencies of Responses to Individual Questions by Freshmen in Percent **[Case 4, n = 55]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	20.0	61.8	9.1	9.1				
2	58.2	34.5	7.3					
3	45.5	52.7	1.8					
4	60.0	40.0						
5	41.8	49.1	9.1					
6	34.5	65.4						
7	3.6	20.0	76.4					
8	85.5	14.5						
9	54.5	3.6	32.7	7.3				1.8
10	54.5	5.4	32.7	7.3				
11	38.2	58.2	1.8					1.8
12	76.4	9.1	1.8	12.7				
13	61.8	14.5	5.4	18.2				
14	29.1	69.1						1.8
15	92.7	5.4						1.8
16	9.1	18.2	70.9					1.8
17	83.6	12.7						3.6
18	9.1	89.1						1.8
19	90.9	9.1						
20	12.7	47.3	36.4					3.6
21	74.5	23.6						1.8
22	3.6	96.4						
23	7.3	10.9				81.8		
24	21.8	78.2						
25	23.6	76.4						
26	90.9	9.1						
27	58.2	25.4	7.3	9.1				
28	5.4	30.9	58.2	5.4				
29	89.1	7.3	3.6					1.8
30	38.2	61.8						
31	5.4	5.4	5.4	12.7	69.1		1.8	
32	81.8	18.2	1.8	1.8				
33	3.6	1.8	1.8	89.1	3.6			
34	94.5	5.4						
35	9.1	16.4	1.8	1.8	63.6		5.4	1.8
36	52.7	47.3						
37	1.8	81.8	14.5	1.8				
38	3.6	49.1	41.8	3.6	1.8			
39	5.4	20.0	61.8	12.7				

TABLE 36c.--Frequencies of Responses to Individual Questions by Sophomores in Percent **[Case 4, n = 54]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	53.7	42.6	3.7					
2	35.2	63.0	1.8					
3	31.5	68.5						
4	35.2	64.8						
5	40.7	48.1	11.1					
6	38.9	53.7	7.4					
7		7.4	92.6					
8	94.4	5.6						
9	74.1		18.5	7.4				
10	87.0		9.3	3.7				
11	25.9	72.2	1.8					
12	85.2		9.3	5.6				
13	70.4		13.0	16.7				
14	18.5	81.5						
15	92.6	7.4						
16	5.6	9.3	83.3					1.8
17	92.6	5.6	1.8					
18	1.8	98.1						
19	94.4	5.6						
20	13.0	44.4	38.9					3.7
21	61.1	37.0						1.8
22		100.0						
23	1.8	7.4				90.7		
24	11.1	83.3						5.6
25	18.5	81.5						
26	92.6	7.4						
27	50.0	27.8	3.7	18.5				
28	7.4	31.5	61.1					
29	96.3	3.7						
30	63.0	35.2	1.8					
31	3.7	1.8	1.8	9.3	83.3			
32	70.4	27.8		1.8				
33	1.8	20.4	5.6	70.4	1.8			
34	96.3	3.7						
35	7.4	16.7	3.7		53.7		16.7	1.8
36	50.0	50.0						
37	1.8	92.6	5.6					
38		50.0	50.0					
39	3.7	25.9	66.7	1.8	1.8			

TABLE 36d.--Frequencies of Responses to Individual Questions by Juniors in Percent **[Case 4, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	9.7	83.9	6.4					
2	61.3	35.5	3.2					
3	9.7	90.3						
4	48.4	51.6						
5	45.2	25.8	29.0					
6	32.3	61.3	6.4					
7	6.4		93.5					
8	90.3	9.7						
9	77.4		16.1	6.4				
10	77.4	6.4	12.9	3.2				
11	25.8	74.2						
12	93.5	3.2		3.2				
13	80.6	6.4	3.2	9.7				
14	19.3	80.6						
15	100.0							
16		12.9	87.1					
17	77.4	22.6						
18	22.6	77.4						
19	100.0							
20	32.3	45.2	22.6					
21	61.3	38.7						
22	3.2	93.5						3.2
23	6.4	6.4				87.1		
24	25.8	74.2						
25	12.9	87.1						
26	96.8	3.2						
27	32.3	48.4	6.4	12.9				
28	6.4	41.9	51.6					
29	90.3	3.2			6.4			
30	25.8	71.0			3.2			
31	3.2	3.2	6.4		87.1			
32	74.2	22.6		3.2				
33	3.2	6.4		87.1	3.2			
34	93.5	3.2			3.2			
35	6.4	22.6	3.2		64.5		3.2	
36	58.1	41.9						
37	9.7	87.1	3.2					
38	6.4	58.1	35.5					
39	6.4	22.6	64.5	6.4				

TABLE 36e.--Frequencies of Responses to Individual Questions by Seniors in Percent **[Case 4, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	48.4	48.4	3.2					
2	38.7	58.1	3.2					
3	38.7	61.3						
4	54.8	45.2						
5	16.1	67.7	16.1					
6	51.6	48.4						
7		3.2	96.8					
8	96.8		3.2					
9	83.9		12.9	3.2				
10	61.3		35.5	3.2				
11	22.6	77.4						
12	93.5			6.4				
13	93.5			6.4				
14	9.7	90.3						
15	100.0							
16		9.7	90.3					
17	100.0							
18	3.2	96.8						
19	96.8	3.2						
20	35.5	38.7	22.6					3.2
21	83.9	16.1						
22	6.4	93.5						
23	6.4	32.3				61.3		
24	16.1	83.9						
25	19.3	80.6						
26	100.0							
27	38.7	61.3						
28	6.4	25.8	67.7					
29	96.8	3.2						
30	25.8	74.2						
31	6.4		3.2	6.4	80.6			3.2
32	80.6	16.1						3.2
33		6.4		87.1	3.2			3.2
34	100.0							
35	25.8	9.7		3.2	51.6		9.7	
36	71.0	29.0						
37	6.4	90.3	3.2					
38	3.2	71.0	25.8					
39	3.2	54.8	38.7	3.2				

TABLE 36f.--Multiple Responses from Groups by Question Number
[Case 4]

Group	Question Number	Number of Students	Answers Chosen
Freshman (n=55)	31	1	C,D
	35	2	B,C,E
		1	B,C,D,E
Sophomore (n=54)	35	6	B,C,E
		2	B,E
		1	C,E
Junior (n=31)	35	1	B,C,E
Senior (n=31)	35	1	A,B,C,D,E
		1	B,C,E
		1	C,E

TABLE 37a.--Frequencies of Responses to Individual Questions by Orthodontists in Percent **[Case 5, n = 10]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	100.0							
2		100.0						
3		100.0						
4		100.0						
5	100.0							
6		100.0						
7			100.0					
8	100.0							
9	100.0							
10	90.0			10.0				
11	40.0	60.0						
12	100.0							
13				100.0				
14	100.0							
15	100.0							
16	100.0							
17		100.0						
18		100.0						
19	100.0							
20	100.0							
21		100.0						
22	100.0							
23							100.0	
24	50.0	50.0						
25		100.0						
26	100.0							
27	50.0	50.0						
28		100.0						
29	100.0							
30	10.0	90.0						
31	60.0				40.0			
32	80.0	20.0						
33				100.0				
34	100.0							
35					100.0			
36	40.0	60.0						
37		80.0	20.0					
38		60.0	40.0					
39		40.0	60.0					

TABLE 37b.--Frequencies of Responses to Individual Questions by Freshmen in Percent **[Case 5, n = 55]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	74.5	21.8	3.6					
2	14.5	70.9	14.5					
3	23.6	74.5	1.8					
4	25.4	72.7	1.8					
5	81.8	14.5	3.6					
6	9.1	90.9						
7	1.8	14.5	83.6					
8	92.7	5.4						1.8
9	16.4	34.5	25.4	23.6				
10	49.1	25.4	18.2	7.3				
11	85.5	14.5						
12	50.9	16.4	14.5	18.2				
13	23.6	12.7	20.0	43.6				
14	76.4	21.8		1.8				
15	81.8	18.2						
16	70.9	20.0	1.8					7.3
17	18.2	78.2						3.6
18	40.0	60.0						
19	80.0	20.0						
20	56.4	29.1	5.4					9.1
21	34.5	58.2			1.8			5.4
22	30.9	69.1						
23	9.1	27.3	1.8				61.8*	
24	21.8	78.2						
25	29.1	70.9						
26	94.5	5.4						
27	52.7	30.9	9.1	7.3				
28	30.9	49.1	16.4	3.6				
29	83.6	14.5						1.8
30	58.2	41.8						
31	7.3	3.6	14.5	10.9	63.6			
32	81.8	18.2						
33	9.1	3.6	1.8	83.6	1.8			
34	92.7	7.3						
35	21.8	9.1	5.4	3.6	49.1		7.3	3.6
36	36.4	60.0	1.8					1.8
37	1.8	85.5	12.7					
38	1.8	58.2	40.0					
39	3.6	20.0	58.2	18.2				

* A + B

TABLE 37c.--Frequencies of Responses to Individual Questions by Sophomores in Percent **[Case 5, n = 54]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	77.8	16.7	3.7	1.8				
2	20.4	74.1	5.6					
3	13.0	85.2	1.8					
4	11.1	88.9						
5	96.3	3.7						
6	3.7	94.4	1.8					
7		1.8	96.3	1.8				
8	94.4	1.8	1.8					1.8
9	22.2	11.1	22.2	25.9				
10	61.1	5.6	7.4	25.9				
11	61.1	38.9						
12	75.9	7.4		16.7				
13	9.3		5.3	85.2				
14	85.2	14.8						
15	74.1	24.1	1.8					
16	66.7	13.0	1.8	1.8				16.7
17	20.4	74.1						5.6
18	29.6	70.4						
19	77.8	20.4	1.8					
20	64.8	18.5	3.7					13.0
21	16.7	77.8						5.6
22	53.7	44.4		1.8				
23	14.8	48.1					35.2*	1.8
24	18.5	77.8	1.8					1.8
25	22.2	77.8						
26	94 4	5.6						
27	68.5	20.4	1.8	9.3				
28	29.6	64.8	5.6					
29	85.2	14.8						
30	51.8	48.1						
31	3.7	3.7	9.3	14.8	66.7			1.8
32	87.0	13.0						
33	3.7	1.8		92.6	1.8			
34	92.6	7.4						
35	3.7	25.9	1.8	1.8	51.8		14.8	
36	38.9	61.1						
37	3.7	87.0	9.3					
38	1.8	44.4	53.7					
39	7.4	29.6	59.3	3.7				

* A + B

TABLE 37d.--Frequencies of Responses to Individual Questions by Juniors in Percent **[Case 5, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	74.2	9.7	16.1					
2	16.1	51.6	32.3					
3	12.9	83.9		3.2				
4	19.3	77.4		3.2				
5	96.8	3.2						
6	6.4	93.5						
7			100.0					
8	90.3	9.7						
9	38.7	35.5	6.4	19.3				
10	54.8	6.4	12.9	25.8				
11	67.7	32.3						
12	83.9		3.2	12.9				
13	16.1	6.4	3.2	74.2				
14	83.9	16.1						
15	80.6	19.3						
16	83.9	7.3						1.8
17	6.4	93.5						
18	35.5	64.5						
19	80.6	16.1						3.2
20	74.2	19.3						6.4
21	9.7	90.3						
22	48.4	51.6						
23	29.0	32.3					38.7*	
24	25.8	74.2						
25	12.9	87.1						
26	77.4	22.6						
27	54.8	32.3		12.9				
28	45.2	45.2	6.4	3.2				
29	96.8	3.2						
30	58.1	41.9						
31	3.2		6.4	6.4	83.9			
32	80.6	16.1		3.2				
33	6.4	6.4		77.4	9.7			
34	90.3	6.4			3.2			
35	3.2	29.0	3.2		64.5			
36	41.9	58.1						
37	6.4	83.9	6.4					3.2
38	6.4	67.7	25.8					
39	12.9	29.0	54.8	3.2				

* A + B

TABLE 37e.--Frequencies of Responses to Individual Questions by Seniors in Percent **[Case 5, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	45.2	32.3	22.6					
2	29.0	35.5	35.5					
3	61.3	38.7						
4	25.8	74.2						
5	93.5	3.2	3.2					
6	6.4	93.5						
7		3.2	96.8					
8	93.5	6.4						
9	38.7	25.8	6.4	29.0				
10	35.5	16.1	12.9	35.5				
11	71.0	29.0						
12	45.2	3.2	3.2	48.4				
13	38.7		9.7	48.4	3.2			
14	83.9	16.1						
15	71.0	29.0						
16	83.9	5.4						3.6
17	19.3	77.4						3.2
18	45.2	54.8						
19	87.1	12.9						
20	83.9	6.4						9.7
21	12.9	80.6						6.4
22	58.1	41.9						
23	38.7	19.3					38.7*	3.2
24	16.1	83.9						
25	6.4	90.3						3.2
26	93.5	6.4						
27	48.4	48.4		3.2				
28	19.3	54.8	22.6	3.2				
29	90.3	9.7						
30	41.9	58.1						
31	6.4		3.2		87.1			3.2
32	58.1	41.9						
33		3.2	3.2	93.5				
34	96.8	3.2						
35	6.4		3.2		80.6		6.4	3.2
36	54.8	45.2						
37	6.4	87.1	3.2	3.2				
38	22.6	35.5	41.9					
39	3.2	51.6	32.3	12.9				

* A + B

TABLE 37f.--Multiple Responses from Groups by Question Number
[Case 5]

Group	Question Number	Number of Students	Answers Chosen
Freshman (n=55)	23	34	A + B
	35	1	A,B,C,E
		1	B,C,D,E
		1	A,C
		1	C,E
Sophomore (n=54)	23	19	A + B
	35	4	B,C,E
		2	C,E
		1	A,E
		1	B,E
Junior (n=31)	23	12	A + B
Senior (n=31)	23	12	A + B
	35	1	A,B,C,D,E
		1	C,E

TABLE 38a.--Frequencies of Responses to Individual Questions by Orthodontists in Percent **[Case 6, n = 10]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	80.0	10.0	10.0					
2	10.0	90.0						
3		100.0						
4		100.0						
5	100.0							
6		100.0						
7			100.0					
8	100.0							
9		100.0						
10	100.0							
11	100.0							
12		100.0						
13	100.0							
14	100.0							
15	100.0							
16	1.0	90.0						
17	70.0	30.0						
18		100.0						
19	100.0							
20	20.0	80.0						
21	80.0	20.0						
22		100.0						
23						100.0		
24		100.0						
25	10.0	90.0						
26	100.0							
27	100.0							
28	10.0	90.0						
29	100.0							
30		100.0						
31					100.0			
32	100.0							
33				100.0				
34	100.0							
35					100.0			
36	30.0	70.0						
37		90.0	10.0					
38		50.0	50.0					
39		40.0	60.0					

TABLE 38b.--Frequencies of Responses to Individual Questions by Freshmen in Percent **[Case 6, n = 55]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	71.0	16.4	9.1	1.8				1.8
2	20.0	74.5	5.4					
3	18.2	81.8						
4	32.7	65.4	1.8					
5	58.2	38.2	3.6					
6	21.8	78.2						
7		9.1	90.9					
8	94.5	5.4						
9	60.0	23.6	9.1	7.3				
10	65.4	12.7	12.7	9.1				
11	56.4	43.6						
12	49.1	12.7	30.9	7.3				
13	80.0	7.3	10.9	1.8				
14	52.7	47.3						
15	90.9	9.1						
16	60.0	32.7	3.6					3.6
17	23.6	72.7						3.6
18	12.7	87.3						
19	78.2	21.8						
20	56.4	23.6	9.1					10.9
21	29.1	65.4						5.4
22	12.7	87.3						
23	14.5	12.7				72.7		
24	20.0	80.0						
25	20.0	80.0						
26	65.4	32.7		1.8				
27	54.5	18.2		27.3				
28	40.0	30.9	7.3	21.8				
29	67.3	21.8	1.8					9.1
30	14.5	85.5						
31	7.3	9.1	3.6	7.3	71.0			1.8
32	87.3	10.9						1.8
33	9.1	5.4		78.2	7.3			
34	87.3	9.1			1.8			1.8
35	21.8	23.6	5.4		38.2		7.3	3.6
36	20.0	80.0						
37	7.3	80.0	12.7					
38	5.4	63.6	29.1	1.8				
39	7.3	20.0	60.0	12.7				

TABLE 38c.--Frequencies of Responses to Individual Questions by Sophomores in Percent **[Case 6, n = 54]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	79.6	16.7	3.7					
2	11.1	81.5	7.4					
3	9.3	90.7						
4	13.0	87.0						
5	66.7	33.3						
6	14.8	81.5	1.8					1.8
7		1.8	98.1					
8	98.1		1.8					
9	18.5	40.7	37.0	3.7				
10	64.8	7.4	24.1	3.7				
11	53.7	46.3						
12	7.4	16.7	75.9					
13	85.2	3.7	11.1					
14	66.7	33.3						
15	94.6	5.6						
16	40.7	50.0	7.4					1.8
17	38.1	59.3						1.8
18	7.4	92.6						
19	83.3	16.7						
20	59.3	29.6	3.7					7.4
21	33.3	59.3						7.4
22	3.7	94.4	1.8					
23	1.8	5.6				92.6		
24	13.0	83.3						3.7
25	14.8	83.3	1.8					
26	74.1	25.9						
27	61.1	9.3	1.8	24.1				3.7
28	59.3	25.9		11.1				3.7
29	59.3	33.3	1.8					5.6
30	16.7	83.3						
31	1.8	1.8	3.7	9.3	83.3			
32	90.7	7.4						1.8
33	9.3	7.4	1.8	75.9	3.7			1.8
34	79.6	18.5						1.8
35	22.2	20.4	3.7		29.6		13.0	11.1
36	20.4	77.8						1.8
37	3.7	85.2	9.3					1.8
38		50.0	50.0					
39	5.6	29.6	61.1	3.7				

TABLE 38d.--Frequencies of Responses to Individual Questions by Juniors in Percent **[Case 6, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	77.4	3.2	19.3					
2	9.7	67.7	22.6					
3	29.0	71.0						
4	22.6	77.4						
5	80.6	19.3						
6	6.4	87.1	3.2	3.2				
7	3.2		96.8					
8	96.8	3.2						
9	22.6	58.1	16.1	3.2				
10	71.0	9.7	12.9	6.4				
11	51.6	48.4						
12	6.4	51.6	35.5	6.4				
13	93.5	3.2	3.2					
14	67.7	32.3						
15	90.3	9.7						
16	64.5	29.0	3.2					3.2
17	35.5	64.5						
18	6.4	93.5						
19	77.4	22.6						
20	64.5	19.3	3.2					12.9
21	29.0	67.7						3.2
22	3.2	96.8						
23		16.1				83.9		
24	9.7	90.3						
25	16.1	83.9						
26	80.6	19.3						
27	54.8	16.1		29.0				
28	77.4	16.1		6.4				
29	74.2	25.8						
30	6.4	90.3			3.2			
31	3.2		6.4		90.3			
32	83.9			16.1				
33	19.3	6.4	3.2	64.5	6.4			
34	74.2	12.9			12.9			
35	19.3	25.8	3.2	9.7	38.7			3.2
36	9.7	74.2	12.9	3.2				
37	6.4	93.5						
38	12.9	58.1	29.0					
39	9.7	41.9	45.2	3.2				

TABLE 38e.--Frequencies of Responses to Individual Questions by Seniors in Percent **[Case 6, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	80.6	16.1	3.2					
2	25.8	71.0	3.2					
3	12.9	83.9	3.2					
4	22.6	77.4						
5	74.2	25.8						
6	19.3	80.6						
7			100.0					
8	96.8	3.2						
9	29.0	29.0	29.0	12.9				
10	71.0		25.8	3.2				
11	80.6	16.1	3.2					
12	6.4	45.2	32.3	16.1				
13	93.5		6.4					
14	77.4	19.3	3.2					
15	96.8	3.2						
16	67.7	29.0	3.2					
17	32.3	67.7						
18		100.0						
19	87.1	12.9						
20	83.9	6.4	6.4					3 2
21	22.6	77.4						
22	6.4	93.5						
23	3.2	6.4				90.3		
24	16.1	83.9						
25	3.2	96.8						
26	87.1	12.9						
27	25.8	48.4		25.8				
28	19.3	77.4		3.2				
29	93.5	6.4						
30	9.7	90.3						
31	3.2		32.3	3.2	61.3			
32	100.0							
33	16.1	32.3		51.6				
34	87.1	12.9						
35	41.9	9.7			32.3		16.1	
36	6.4	93.5						
37		87.1	12.9					
38		64.5	35.5					
39	3.2	48.4	45.2	3.2				

TABLE 38f.--Multiple Responses from Groups by Question Number
[Case 6]

Group	Question Number	Number of Students	Answers Chosen
Freshman (n=55)	35	1	A,E
		1	C,E
		1	A,B,C,E
		1	B,C,D,E
Sophomore (n=54)	35	3	A,B,C,E
		2	B,C,E
		1	A,E
		1	B,E
Junior (n=31)	none		
Senior (n=31)	35	2	A,B,C,D,E
		2	B,E
		1	A,B,C,E

TABLE 39a.--Frequencies of Responses to Individual Questions by Orthodontists in Percent **[Case 7, n = 10]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	90.0		10.0					
2		100.0						
3		100.0						
4		100.0						
5	100.0							
6		100.0						
7			100.0					
8	10.0	90.0						
9			100.0					
10		100.0						
11	100.0							
12			100.0					
13		100.0						
14	100.0							
15	100.0							
16			100.0					
17	100.0							
18		100.0						
19	100.0							
20	20.0	80.0						
21	90.0	10.0						
22		100.0						
23						100.0		
24		100.0						
25	10.0	90.0						
26	100.0							
27	20.0	80.0						
28	20.0	80.0						
29	100.0							
30	100.0							
31					100.0			
32	90.0	10.0						
33				100.0				
34	100.0							
35					100.0			
36	20.0	80.0						
37		90.0	10.0					
38		70.0	30.0					
39		50.0	50.0					

TABLE 39b.--Frequencies of Responses to Individual Questions by Freshmen in Percent **[Case 7, n = 55]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	38.2	27.3	34.5					
2	32.7	36.4	30.9					
3	54.5	45.5						
4	50.9	47.3						1.8
5	65.4	29.1	5.4					
6	18.2	81.8						
7		23.6	76.4					
8	92.7	7.3						
9	45.5	7.3	38.2	9.1				
10	40.0	10.9	41.8	7.3				
11	63.6	36.4						
12	25.4	14.5	54.5	5.4				
13	54.5	18.2	21.8	5.4				
14	80.0	18.2	1.8					
15	94.5	5.4						
16	10.9	10.9	76.4					1.8
17	78.2	21.8						
18	18.2	81.8						
19	70.9	29.1						
20	49.1	21.8	14.5					14.5
21	34.5	54.5						10.9
22	7.3	92.7						
23	5.4	16.4				78.2		
24	27.3	72.7						
25	23.6	76.4						
26	89.1	10.9						
27	34.5	47.3	9.1	9.1				
28	27.3	49.1	20.0	3.6				
29	89.1	7.3						3.6
30	80.0	20.0						
31	7.3	3.6	7.3	9.1	72.7			
32	74.5	23.6		1.8				
33	10.9	7.3	1.8	76.4	3.6			
34	92.7	3.6			1.8			1.8
35	16.4	18.2	3.6	5.4	50.9		5.4	
36	32.7	65.4	1.8					
37	5.4	85.5	7.3	1.8				
38	5.4	52.7	40.0	1.8				
39	9.1	20.0	60.0	10.9				

TABLE 39c.--Frequencies of Responses to Individual Questions by Sophomores in Percent **[Case 7, n = 54]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	42.6	9.3	46.3	1.8				
2	14.8	35.2	50.0					
3	40.7	57.4	1.8					
4	44.4	55.6						
5	81.5	18.5						
6	11.1	87.0	1.8					
7		5.6	94.4					
8	83.3	16.7						
9	42.6		50.0	7.4				
10	37.0	11.1	40.7	11.1				
11	66.7	31.5			1.8			
12	5.6	1.8	83.3	9.3				
13	35.2	14.8	40.7	9.3				
14	87.0	13.0						
15	100.0							
16	3.7	9.3	87.0					
17	92.6	7.4						
18	7.4	92.6						
19	61.1	38.9						
20	59.3	16.7	9.3					14.8
21	40.7	53.7						5.6
22		100.0						
23	1.8	5.6		1.8		90.7		
24	13.0	85.2						1.8
25	11.1	87.0						1.8
26	96.3	3.7						
27	35.2	53.7	5.6	5.6				
28	35.2	50.0	11.1	3.7				
29	92.6	7.4						
30	87.0	11.1						1.8
31	1.8		11.1	5.6	81.5			
32	63.0	37.0						
33	1.8	13.0	1.8	81.5	1.8			
34	96.3	3.7						
35	1.8	27.8	1.8		53.7		14.8	
36	25.9	74.1						
37	5.6	85.2	9.3					
38	1.8	44.4	53.7					
39	3.7	38.9	55.6	1.8				

TABLE 39d.--Frequencies of Responses to Individual Questions by Juniors in Percent **[Case 7, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	38.7	9.7	51.6					
2	12.9	22.6	61.3					3.2
3	51.6	45.2						3.2
4	54.8	41.9						3.2
5	67.7	19.3	9.7					3.2
6	29.0	71.0						
7		3.2	93.5					3.2
8	80.6	19.3						
9	48.4	6.4	45.2					
10	19.3	41.9	32.3	6.4				
11	61.3	35.5						3.2
12	6.4	16.1	74.2	3.2				
13	41.9	32.3	16.1	9.7				
14	71.0	29.0						
15	100.0							
16	3.2		96.8					
17	100.0							
18	6.4	93.5						
19	45.2	54.8						
20	45.2	22.6	3.2					29.0
21	48.4	51.6						
22	6.4	90.3						3.2
23	6.4	3.2				90.3		
24	19.3	80.6						
25	12.9	87.1						
26	96.8	3.2						
27	32.3	51.6	6.4	9.7				
28	22.6	51.6	25.8					
29	93.5	6.4						
30	87.1	12.9						
31		6.4	6.4	3.2	83.9			
32	74.2	22.6		3.2				
33	3.2	12.9		77.4	6.4			
34	96.8	3.2						
35	6.4	9.7	6.4	6.4	67.7		3.2	
36	41.9	58.1						
37	3.2	96.8						
38	3.2	58.1	38.7					
39	3.2	45.2	48.4	3.2				

TABLE 39e.--Frequencies of Responses to Individual Questions by Seniors in Percent **[Case 7, n = 31]**

Question Number	A	B	C	D	E	N/A	Multiple Answers	No Ans. Rec'ed
1	38.7	32.3	22.6	6.4				
2	9.7	41.9	48.4					
3	35.5	64.5						
4	48.4	51.6						
5	64.5	25.8	9.7					
6	35.5	64.5						
7	25.8	74.2						
8	71.0	29.0						
9	29.0	6.4	64.5					
10	29.0	9.7	48.4	12.9				
11	54.8	35.5	9.7					
12	16.1		77.4	6.4				
13	29.0	32.3	38.7					
14	80.6	9.7	9.7					
15	100.0							
16	6.4		93.5					
17	93.5	3.2	3.2					
18	3.2	90.3	6.4					
19	48.4	45.2	6.4					
20	32.3	32.3	3.2					32.3
21	67.6	22.6						9.7
22	25.8	74.2						
23	3.2	32.3				64.5		
24	25.8	74.2						
25	9.7	90.3						
26	93.5	6.4						
27	19.3	77.4	3.2					
28	29.0	58.1	12.9					
29	100.0							
30	87.1	9.7						3.2
31			3.2		96.8			
32	77.4	12.9						9.7
33				96.8	3.2			
34	96.8	3.2						
35	12.9	6.4			71.0		9.7	
36	35.5	61.3						3.2
37	6.4	87.1	6.4					
38	6.4	54.8	38.7					
39	3.2	38.7	45.2	12.9				

TABLE 39f.--Multiple Responses from Groups by Question Number
[Case 7]

Group	Question Number	Number of Students	Answers Chosen
Freshman (n=55)	35	1	A,E
		1	B,C,E
		1	B,C,D,E
Sophomore (n=54)	35	5	B,C,E
		2	B,E
		1	A,E
Junior (n=31)	35	1	B,E
Senior (n=31)	35	1	A,B,C,E
		1	A,E
		1	C,E

APPENDIX J

Base Questions for Cases 1 through 7 for Undergraduate Dental Students

Table 52 --Correct Questions and Base Questions by Complete Group for Case One

Question	Topic
*7	Stage of Dentition
*8	Appropriate Dentition
10	Cuspid Relationship-Left Side
*15	Presence of Overbite
*18	Presence of Open-Bite
*19	Presence of Overjet
20	Amount of Overjet
21	Treatment for Overjet
*22	Presence of Cross-Bite
*23	Location of Cross-Bite
*25	Presence of Spacing
27	Crowding in Maxillary Arch
*30	Coincidence of Midlines
*32	Gingival Health
*33	Periodontal Conditions
*34	Orthodontic Treatment
35	Provider for Orthodontic Treatment
*36	Extractions
37	Models for Diagnosis

[* = Base Question]

Table 53 --Correct Questions and Base Questions by Complete Group for Case Two

Question	Topic
1	Facial Profile
2	Mandibular Position
*5	Apearance of the Lips
*6	Treatment for Labial Appearance
*7	Stage of Dentition
*8	Appropriate Dentition
*11	Treatment for Cuspid Relationship
*14	Treatment for Molar Relationship
*15	Presence of Overbite
*16	Amount of Overbite
*17	Treatment for Overbite
*18	Presence of Open-Bite
*19	Presence of Overjet
*22	Presence of Cross-Bite
*23	Location of Cross-Bite
*24	Presence of Maxillary Transverse Deficiency
*30	Co-incidence of Midlines
*32	Gingival Health
*33	Periodontal Conditions
*34	Orthodontic Treatment
*36	Extractions
*37	Models for Diagnosis
38	Photographs for Diagnosis
39	Radiograph for Diagnosis

[* = Base Question]

Table 54 --Correct Questions and Base Questions by Complete Group for Case Three

Question	Topic
1	Facial Profile
2	Mandibular Position
3	Treatment for Mandibular Position
4	Treatment for Facial Profile
*5	Appearance of the Lips
*6	Treatment for Labial Appearance
*7	Stage of Dentition
12	Molar Relationship-Right Side
13	Molar Relationship-Left Side
*14	Treatment for Molar Relationship
*15	Presence of Overbite
*17	Treatment for Overbite
*18	Presence of Open-Bite
*19	Presence of Overjet
20	Amount of Overjet
*21	Treatment for Overjet
*22	Presence of Cross-Bite
*23	Location of Cross-Bite
*24	Presence of Maxillary Transverse Deficiency
*25	Presence of Spacing
*26	Presence of Crowding
*29	Treatment for Crowding
*30	Co-incidence of Midlines
*32	Gingival Health
*33	Periodontal Conditions
*34	Orthodontic Treatment
*36	Extractions
*37	Models for Diagnosis

[* = Base Question]

Table 55 --Correct Questions and Base Questions by Complete Group for Case Four

Question	Topic
3	Treatment for Mandibular Position
*7	Stage of Dentition
*8	Appropriate Dentition
9	Cuspid Relationship-Right Side
10	Cuspid Relationship-Left Side
*11	Treatment for Cuspid Relationship
12	Molar Relationship-Right Side
13	Molar Relationship-Left Side
*14	Treatment for Molar Relationship
*15	Presence of Overbite
*16	Amount of Overbite
*17	Treatment for Overbite
*18	Presence of Open-Bite
*19	Presence of Overjet
*21	Treatment for Overjet
*22	Presence of Cross-Bite
*23	Location of Cross-Bite
*24	Presence of Maxillary Transverse Deficiency
*25	Presence of Spacing
*26	Presence of Crowding
28	Crowding in Mandibular Arch
*29	Treatment for Crowding
31	Dental Conditions
*32	Gingival Health
*33	Periodontal Conditions
*34	Orthodontic Treatment
35	Extractions
*37	Models for Diagnosis

[* = Base Question]

Table 56 --Correct Questions and Base Questions by Complete Group for Case Five

Question	Topic
4	Treatment for Facial Profile
*5	Appearance of the Lips
*6	Treatment for Labial Appearance
*7	Stage of Dentition
*8	Appropriate Dentition
*14	Treatment for Molar Relationship
*15	Presence of Overbite
*16	Amount of Overbite
*17	Treatment for Overbite
*18	Presence of Open-Bite
*19	Presence of Overjet
20	Amount of Overjet
*21	Treatment for Overjet
*24	Presence of Maxillary Transverse Deficiency
*25	Presence of Spacing
*26	Presence of Crowding
27	Crowding in Maxillary Arch
*29	Treatment for Crowding
*32	Gingival Health
*33	Periodontal Conditions
*34	Orthodontic Treatment
*37	Models for Diagnosis

[* = Base Question]

Table 57 --Correct Questions and Base Questions by Complete Group for Case Six

Question	Topic
1	Facial Profile
2	Mandibular Position
3	Treatment for Mandibular Position
4	Treatment for Profile
*5	Appearance of the Lips
*6	Treatment for Labial Appearance
*7	Stage of Dentition
*8	Appropriate Dentition
10	Cuspid Relationship-Left Side
*11	Treatment for Cuspid Relationship
13	Molar Relationship-Left Side
*14	Treatment for Molar Relationship
*15	Presence of Overbite
*18	Presence of Open-Bite
*19	Presence of Overjet
*22	Presence of Cross-Bite
*23	Location of Cross-Bite
*24	Presence of Maxillary Transverse Deficiency
*25	Presence of Spacing
*26	Presence of Crowding
*29	Treatment for Crowding
*30	Co-incidence of Midlines
31	Dental Conditions
*32	Gingival Health
*33	Periodontal Conditions
*34	Orthodontic Treatment
*36	Extractions
*37	Models for Diagnosis
38	Photographs for Diagnosis

[* = Base Question]

Table 58 --Correct Questions and Base Questions by Complete Group for Case Seven

Question	Topic
*5	Appearance of the Lips
*6	Treatment for Labial Appearance
*7	Stage of Dentition
*11	Treatment for Cuspid Relationship
12	Molar Relationsip-Right Side
*14	Treatment for Molar Relationship
*15	Presence of Over-Bite
*16	Amount of Over-Bite
*17	Treatment for Over-Bite
*18	Presence of Open-Bite
*22	Presence of Cross-Bite
*23	Location of Cross-Bite
*24	Presence of Maxillary Transverse Deficiency
*25	Presence of Spacing
*26	Presence of Crowding
*29	Treatment for Crowding
*30	Co-incidence Midlines
31	Dental Conditions
*32	Gingival Health
*33	Periodontal Conditions
*34	Orthodontic Treatment
35	Provider for Orthodontic Treatment
*36	Extractions
*37	Models for Dianosis
39	Radiograph for Diagnosis

[* = Base Question]

REFERENCES

Ackerman, JL and WR Proffit. 1969. The characteristics of malocclusion: A modern approach to classification and diagnosis. Am J Orthod Dentofacial Orthop 56(5):443-454.

Adair, SM. 1990. Educational outcomes: Their impact on graduate pediatric dentistry education. J Dent Educ 54(37):188-190.

Al-Emran, S and PJ Wisth. 1990. Prevalence of malocclusion and need for orthodontic treatment in Saudi Arabia. Community Dent Oral Epidemiol 18:253-255.

Albino, JE, EA Lewis, and MJ Slakter. 1978. Examiner reliability for two methods of assessing malocclusion. Angle Orthod 48:297-302

Albino, JE et al. 1981. Variables discriminating individuals who seek orthodontic treatment. J Dent Res 60:1661-1667.

Alexander, SA. 1992. Diagnosis and treatment planning in orthodontics. Curr Opin Dent 2(4):9-13.

American Association of Dental Schools. 1980. Curricular Guidelines for Orthodontics. J Dent Educ 44(4):223-225.

American Association of Orthodontists. 1973. American Association of Orthodontists announces results of manpower survey. Am J Orthod Dentofacial Orthop 63 (1):67-71.

Andreasen, GF. 1968. Teaching orthodontics in the dental curriculum. J Dent Educ 32(1):37-41.

Andrews, LF. 1972. The six keys to normal occlusion. Am J Orthod Dentofacial Orthop 62:296-309.

Angle, EH. 1899. Classification of malocclusion. Dental Cosmos 41:350-357.

Argent, D. 1990. General practice orthodontics -- the debate continues. Dent Pract Nov/Dec 7-8.

Asbell, MB. 1990. A brief history of orthodontics. Am J Orthod Dentofacial Orthop Denrofacial Orthop 98:176-183, 206-213.

Association of Pedodontic Diplomates. 1983. Survey of orthodontic services provided by pedodontists. Pediatr Dent 5(3):204-206.

Atchison, KA and LS Luke. 1989. Orthodontic radiographic usage by pediatric dentists. ASDC J Dent Child Jan-Feb 56(1):26-29.

Atchison, KA, LS Luke and SC White. 1991. Contribution of pretreatment radiographs to orthodontists' decision making. Oral Surg Oral Med Oral Pathol 71:238-245.

Bader, JD and AL Kaplan. 1983. Treatment distributions in dental practice. J Dent Educ 47(3):142-148.

Baldwin, DC. 1980. Appearance and aesthetics in oral health. Community Dent Oral Epidemiol 8:244-256.

Bartz, AE. 1976. Basic Statistical Concepts in Education and the Behavioral Sciences. Minneapolis, MN, Burgess Publishing Co.

Battagel, JM. 1985. The case for early assessment: 1. Treatment in General Practice Dental Update. Treatment by specialist. Dental Update. May, 227-236.

Battagel, JM. 1985. The case for early assessment: 1. Treatment in General Practice Dental Update. Treatment by specialist. Dental Update July, 373-376.

Baume, LJ. 1974. Uniform methods for the epidemiologic assessment of malocclusion. Am J Orthod Dentofacial Orthop Sept. 251-171.

Behrents, RG. 1993. College of Dentistry, University of Tenn. Correspondence to Mark Hans, School of Dentistry, Case Western Reserve University, Oct. 25.

Behrents, RG. 1994. The significance of outcomes assessment to orthodontics. Proceedings of the Orthodontic Educational Development Symposium. American Association of Orthodontists 14-23.

Bezroukov, W, TJ Freer et al. 1979. Basic method for recording occlusal traits. Bull World Health Organ 57(6):955-1061.

Bittner, C and H Pancherz. 1990. Facial morphology and malocclusions. Amer J Orthod Dentofacial Orthop April, 308-315.

Bjork, A, A Krebs and B Solow. 1964. A method for epidemiological registration of malocclusion. Acta Odontol Scand 22:27-41.

Borell, G. 1982. Posterior crossbites - recognition, evaluation and treatment. N Y State Dent J Feb. 82-86.

Bowles, RM. 1970. Evaluation of tooth size relationships in various intradental and interdental arch segments. Am J Orthod Dentofacial Orthop April, 415.

Brodie, AG. 1939. Orthodontic history and what it teaches. Angle Orthod 4:85-97.

Brook, PH and WC Shaw. 1989. The development of an index of orthodontic treatment priority. Eur J Orthod 11:309-320.

Brown, ID, CD Stephens and LA Usiskin. 1982. An investigation into factors influencing the amount of orthodontic treatment attempted by the recent graduates of two dental schools. Br J Orthod 9(2):77-83.

Brown, WAB and O Ronning. 1972. The evaluation of malocclusion from study models an examiner variability study. Proc Finn Dent Soc 71:45-52.

Buchanan, IB, WC Shaw et al. 1993. A comparison of the reliability and validity of the PAR index and Summers Occlusal Index. Eur J Orthod 15(1):27-31.

Burgersdijk, RCW et al. 1991. Malocclusion and orthodontic treatment need of 15-74-year old Dutch adults. Community Dent Oral Epidemiol 19:64-67.

Burstone, J. 1967. Lip posture and its significance in treatment planning. Am J Orthod Dentofacial Orthop 262-284.

Bylaws, American Association of Orthodontists, adopted May 1990, amended 1991, 1992, 1993. St. Louis, MO.

Byrne, JJ. 1968. Assessment of malocclusion: Implications for dental prepayment programs. Am J Orthod Dentofacial Orthop Oct:766-768.

Carapezza, LJ. 1990. Objectifying treatment of malocclusion. J Clin Pediatr Dent 15:5-12.

Carapeeza, LJ. 1979. Orthodontic guidelines for specific patient selection. J Clin Pediatr Dent 3(3):235-244.

Carapezza, LJ. 1985. Pediatric orthodontics: Quality and sufficiency of treatment. J Clin Pediatr Dent 9(2):107-188.

Casamassimo, PS. 1990. Assessment of educational outcomes in pediatric dentistry: a site examiner's perspective. J Dent Educ 54(3):191-193.

Case Western Reserve University Bulletin 1994. School of Dentistry, Cleveland, Ohio. pp 2-19.

Casko, JS, KM Eberle and BJ Hoppens. 1989. Treatment of a dental deep bite in a patient with vertical excess and excessive gingival display. Am J Orthod Dentofacial Orthop July, 96:1-7.

Chang, HF, YY Shiau and KC Chen. 1986. The relationship of dental crowding to tooth size, dental arch width and arch depth. Proc Natl Sci Counc Repub China B 10(4): 299-235.

Cisneros, GJ. 1991. Diagnosis and treatment planning in orthodontics. Curr Opin Dent 1:(5)595-597.

Conlin, RT. 1989. Finished cases and their faces. J Clin Orthod 23(11):751-755.

Corruccini, RS. 1989. "Orthodontistry" and dental occlusion in Etruscans. Angle Orthod 59(1):61-64.

Crabb, JJ. and WP Rock. 1986. Orthodontic screening of nine-year-old children. Br J Orthod 13:43-47.

Cullen, CL. 1990. Defining and assessing effective outcomes in undergraduate pediatric dentistry. J Dent Educ 54(3):184-187.

Cummings, SR, W Strull, MC Nevitt and SB Hully. 1988. Designing Clinical Research: An Epidemiologic Approach. Baltimore, MD Williams and Wilkins 30-52.

Cuozzo, JW. 1987. Earlier orthodontic intervention: a view from prehistory. J N J Dent Assoc Autumn, 33-40.

DeSmit, A and L Dermaut. 1984. Soft-tissue profile preference. Am J Orthod Dentofacial Orthop 86:67-73.

Denbo, JA. 1990. Malocclusion. Dent Clin North Am 34(1):103-109.

Dental Law and Rules, Ohio State Dental Board, Columbus, Ohio, Rev. 1978.

Dorsey, J and K Korabik. 1977. Social and psychological motivations for orthodontic treatment. Am J Orthod Dentofacial Orthop 72(4):460.

Downs, WB. 1948. Variations in facial relationships: their significance in treatment and prognosis. Am J Orthod Dentofacial Orthop 34:812-840.

Dugoni, AA, DW Chambers, and WE Roberts. 1981. The role of orthodontics in the predoctoral education of a dentist. Amer J Orthod Dentofacial Orthop 79(5):564-571.

Dung, DJ and RJ Smith. 1988. Cephalometric and clinical diagnoses of open bite tendency. Amer J Orthod Dentofacial Orthop Dec, 94:84-49.

Elasser, WA. 1951. Studies of Dento-facial morphology: 1. a simple instrument for appraising variations. Angle Orthod July, 21:163-171.

Elderton, RJ and JD Clark. 1984. An investigation of treatment provided in the general dental service for patients with Class II Division 1 malocclusions. Br J Orthod 11:2-8.

Elderton, RJ and JD Clark. 1983. Orthodontic treatment in the general dental service assessed by the occlusal index. Br J Orthod 10:178-186.

Elias, AC. 1980. The importance of the nasolabial angle in the diagnosis and treatment of malocclusion. Int J Orthod June, 18(2):7-12.

Espeland, LV and A Stenvik. 1961. Orthodontically treated young adults: awareness of their own dental arrangement. Eur J Orthod 13:7-14.

Espeland, LV, K Ivarsson, A Stenvik. and TA Alstad. 1992. Perception of malocclusion in 11-year-old children: A comparison between personal and parental awareness. Eur J Orthod 14:350-358.

Espeland, LV, A Stenvik. and L Medin. 1993. Concern for dental appearance among young adults in a region with non-specialist orthodontic treatment. Eur J Orthod 15:17-25.

Evans, R and W Shaw. 1987. Preliminary evaluation of an illustrated scale for rating dental attractiveness. Eur J Orthod 9:314-318.

Fields, HW, WF Vann, Jr. and KWL Vig. 1982. Reliability of soft tissue profile analysis in children. Angle Orthod April, 52(2):159-165.

Fine, MB and CLB Lavelle. 1992. Diagnosis of skeletal form on the lateral cephalogram with a finite element-based expert system. Amer J Orthod Dentofacial Orthop April, 318-329.

Fisk, RO. 1960. When malocclusion concerns the public. J Can Dent Assoc July, 26(7):397-412.

Foster, TD and AJW Day. 1973. A survey of malocclusion and the need for orthodontic treatment in a Shropshire school population. Br J Orthod 1(3):73-78.

Foster, TD and DM Menezes. 1976. The assessment of occlusal features for public health planning purposes. Amer J Orthod Dentofacial Orthop Jan, 83-90.

Foster, TD. 1980. Orthodontic surveys - a critical appraisal. Br J Orthod 7:59-63.

Fox, RN et al. 1982. Development and validation of a measure of attitudes toward malocclusion. J Dent Res 61(9):1039-1043.

Freer, TJ and BL Adkins. 1968. New approach to malocclusion and indices. J Dent Res 1111-1117.

Freer, TJ, JM Grewe and RM Little. 1973. Agreement among the subjective severity assessments of ten orthodontists. Angle Orthod 43(2):185-190.

Gecker, LM. 1969. Selected orthodontic procedures by the family dentist in comprehensive care. N Y J Dent 39:84-87.

Ghafari, J, SA Locke and JM Bentley. 1989. Longitudinal evaluation of the Treatment Priority Index (TPI). Amer J Orthod Dentofacial Orthop 96(5):382-389.

Gianelly, A and VS Dietz. 1982. Maxillary arch considerations in diagnosis and treatment planning. J Clin Orthod Mar, 168-172.

Gochman, DS. 1975. The measurement and development of dentally relevant motives. J Public Health Dent 35(3):160-164.

Gosney, MBW. 1986-1987. An investigation into some of the factors influencing the desire for orthodontic treatment. Br J Orthod 13:87-94.

Gottlieb, E. 1984. Preserving the referral-source practice of orthodontics. J Clin Orthod Dec. 870-876.

Gottlieb, EL, A. Nelson and DS Vogels III. 1990. JC study of orthodontic diagnosis and treatment procedures, Part 1. Results and trends. J Clin Orthod 25(3):145-156.

Gottlieb, EL, A. Nelson and DS Vogels III. 1991. JC study of orthodontic diagnosis and treatment procedures, Part 2, Breakdowns of selected variables J Clin Orthod 25(4):223-230

Gottlieb, EL, A. Nelson and DS Vogels III. 1991. JC study of orthodontic diagnosis and treatment procedures, Part 3, More breakdowns of selected variables. J Clin Orthod 25(5):292-300.

Graber, LW. 1980. Dental esthetic self-evaluation and satisfaction. Am J Orthod Dentofacial Orthop 77:163-173.

Graber, TM. 1967. Count-down for dental student orthodontic education. J Dent Educ 31(2):128-137.

Gravely, JF. and DB Johnson. 1973. Angle's classification of malocclusion: an assessment of reliability. Br J Orthod 1(3):79-86.

Grewe, J M and DV Hagan. 1972. Malocclusion indices: A comparative evaluation. Am J Orthod Dentofacial Orthop Mar., 61(3):286-294.

Hahn, GW. 1963. Treatment planning and therapy in the mixed dentition. Am J Orthod Dentofacial Orthop Aug., 49(8):563-567.

Han, UK, KWL Vig, JA Weintraub, PS Vig and CJ Kowalski. 1991. Consistency of orthodontic treatment decisions relative to diagnostic records. Am J Orthod Dentofacial Orthop 100:212-219.

Hanes, CM. 1990. Defining and assessing knowledge and skill outcomes in undergraduate pediatric dentistry education. J Dent Educ 54(3):181-183.

Hannett, HA. 1963. Undergraduate education. Am J Orthod Dentofacial Orthop 507-518.

Hans, MG. 1994. Memorandum to First and Second Year Orthodontic Residents on Predoctoral Student Supervision, CWRU School of Dentistry, September 8.

Hans, MG. 1994. Memorandum to Predoctoral Students on Policy on Credit for Predoctoral Orthodontics by Completing an Orthodontic Assist in the Orthodontic Department, CWRU School of Dentistry, September 8.

Heath, JR. 1991. The nasolabial angle in diagnosis. Aust Dent J Mar, 12:1:55.

Heikinheimo, K. 1978. Need of orthodontic treatment in 7-year-old Finnish children. Community Dent Oral Epidemiol 6:129-134.

Heikinheimo, K, L Salmi and S Myllarneimi. 1987. Long term evaluation of orthodontic diagnoses made at the ages of 7 and 10 years. Eur J Orthod 15:151-159.

Hellman, M. 1943. Diagnosis in orthodontia and the method of technique I use in practice. Angle Orthod 13(1-2):2-14.

Helm, S, S Kreiborg et al. 1975. Estimates of orthodontic treatment need in Danish school children. Community Dent Oral Epidemiol 3:136-142.

Helm, S. 1977. Intra-examiner reliability of epidemiologic registrations of malocclusion. Acta Odontol Scand 35:161-165.

Hermanson, PC and JM Grewe. 1970. Examiner variability of several malocclusion indices. Angle Orthod 40(3):219-235.

Hilding, OH. 1979. Orthodontics: Evaluation and treatment timing. CDS Rev Oct. 33-37.

Hilgers, JJ. 1987. Bioprogressive simplified: Part 1 diagnosis and treatment planning. J Clin Orthod 21(9):618-627.

Hill, PA. 1992. The prevalence and severity of malocclusion and the need for orthodontic treatment in 9-, 12- and 15-year-old Glasgow school children. Br J Orthod 19:187-196.

Hintze, H, A Wenzel and S Williams. 1990. Diagnostic value of clinical examination for the identification of children in need of orthodontic treatment compared with clinical examination and screening pantomography. Eur J Orthod 12:385-388.

Hocevar, RA and MC Stewart. 1992. A study of reference lines for mandibular plane angles. Am J Orthod Dentofacial Orthop 102(6): 519-526.

Holmes, J. B. et al. 1987. An assessment of the treatment priority index over time. Abstract 1100. J Dent Res, 66:244.

Holmes, A. 1992. The prevalence of orthodontic treatment need. Br J Orthod 19:177-182.

Horup, N, B Melsen and S Terp. 1987. Relationship between malocclusion and maintenance of teeth. Community Dent Oral Epidemiol 15:74-78.

Howard, WW. 1988 To the Editor General practitioners and orthodontics. Amer J Orthod Dentofacial Orthop 93(4):356.

Howell, S. 1986. Orthodontics in general practice - a survey. Aust Dent J 31(6):445-451.

Howells, WW. 1969. The use of multivariate techniques in the study of skeletal populations. Am J Phys Anthropol 31:311-314.

Howells, DJ and WC Shaw. 1985. The validity and reliability of ratings of dental and facial attractiveness for epidemiologic use. Am J Orthod Dentofacial Orthop 88:402-408.

Ingervall, B and A Ronnerman. 1975. Index for need of orthodontic treatment. Odontol Rev 26(1):59-82.

Isaacson, RJ, RJ Zapgel et al. 1977. Some effects of mandibular growth on the dental occlusion and profile. Angle Orthod April, 97-106.

Jacobs, RM. 1977. Council on dental education guidelines for teaching orthodontics and the predoctoral level: A commentary. J Dent Educ 41(8):477-478.

Jacobs, RM et al. 1991. Profiling providers of orthodontic services in general dental practice. Am J Orthod Dentofacial Orthop 99(3):269-275.

Jacobs, RM 1988. Ten-year study of strategies for teaching clinical inference in predoctoral orthodontic education. J Dent Educ 52(5):235-244.

Jacobson, A. 1979. Psychology and early orthodontic treatment. Am J Orthod Dentofacial Orthop 76:511-529.

Jarvinsen, S and P Vaataja. 1987. Variability in assessment of need for orthodontic treatment when using certain treatment-need indices. Community Dent Oral Epidemiol 15:245-248.

Jenkins, PM, BS Feldmanand, DR Stirrups. 1985. The effect of social class and dental features on referrals for orthodontic advice and treatment. Br J Orthod 11:185-188.

Jenny, J. 1975. A social perspective on need and demand for orthodontic treatment. Int Dent J 25(4):248-256.

Jerrold, L and LJ Lowenstein. 1990. The midline: diagnosis and treatment. Amer J Orthod Dentofacial Orthop. 97(6):453-462.

Johnston, LE, Jr. 1987. Template analysis. J Clin Orthod 21(9):585-590.

Jones, WB. 1987. Malocclusion and facial types in a group of Saudi Arabian patients referred for orthodontic treatment: a preliminary study. Br J Orthod 14:143-146.

Katz, RB. 1978. Relationships between eight orthodontic indices and an oral self-image satisfaction scale. Am J Orthod Dentofacial Orthop 73:328-334.

Kemper, WA. 1952. Analysis of malocclusion in the mixed dentition. Angle Orthod Oct, 255-260.

Kerosuo, H. 1990. Occlusion in the primary and early mixed dentitions in a group of Tansanian and Finnish children. J Dent for Children July-Aug, 293-298.

Kerosuo, H, T Laine, E Honkala and M Nyyssonen. 1991. Occlusal characteristics in groups of Tanzanian and Finish urban schoolchildren. Angle Orthod 61(1):49-56.

Kilmon, C and ML Helpin. 1983. Recognizing dental malocclusion in children. Pediatr Nurs 205-208.

Kimmel, SS. 1987. Analysis of study models: the development of a classification and problem list as a method of orthodontic diagnosis. J Am Acad Gnathol Orthop 4-7, 18-25.

Kinaan, RK and PH Burke. 1981. Quantitative assessment of the occlusal features. Br J Orthod 1:149-156.

Klima, RJ, JK Wittemann and JE McIver. 1979. Body image, self-concept and the orthodontic patient. Am J Orthod Dentofacial Orthop 75:507-516.

Korkhaus, G. 1928. The frequency of orthodontic anomalies at various ages. Int J Orthod 14:120-135.

Koroluk, LD, JE Jones and DR Avery. 1988. Analysis of orthodontic treatment by pediatric dentists and general pracititioners in Indiana. ASDC J Dent Child 55(2):97-101.

Kossowan, AC. 1987. Diagnosis and orthodontic treatment in the mixed dentition. Int J Orthod 25(1-2)4-5.

Lavergne, J and N Gasson. 1982. Analysis and classification of the rotational growth pattern without implants. Br J Orthod 9:51-56.

Leighton, BC and RD Howard. 1981. Orthodontics the last hundred years. Br Dent J 151:14-18.

Lerian, HJ. 1968. The orthodontic education of the general dentist. Int J Orthod 6(1):20-23.

Lewis, EA, E Albino, JJ Cunat and LA Tedesco. 1982. Reliability and validity of clinical assessments of malocclusion. Am J Orthod Dentofacial Orthop June, 473-477.

Lindsay, SJE and JFW Hodgkins. 1983. Children's perceptions of their own malocclusion. Br J Orthod 10:13-20.

Linge, L. 1987. The role of the general practitioner and the orthodontist in the provision of orthodontic care. Int Dent J 37(2):86-90.

Lowe, AA. 1987. Undergraduate and continuing education in orthodontics: a view into the 1990s. Int Dent J 37:91-97.

Lubit, EC. 1983. Functional orthodontic therapy with the Frankel appliance. J Clin Pediatr Dent 7(4):257-275.

Luffingham, K and M Campbell. 1975. Attitudes to malocclusion amongst the parents of 10-12-year-old children in Glasgow. Br J Orthod 3(2):101-104.

Manasse, RJ and RJ Dooley. 1980. Correlates of the orthodontic aspects of the general dentist's practice. J Dent Educ 44(9):543-546.

Massler, M and JM Frankel. 1951. Prevalence of malocclusion in children aged 14 to 18 years. Am J Orthod Dentofacial Orthop 751-768.

McDuffie, MW. 1985. Predoctoral orthodontic instruction and practice of recent graduates in Florida. J Dent Educ 49(5):324-326.

McKeown, M. 1977. The diagnosis of incipient arch crowding in children. N Z Dent J 94:93-95.

McLain, JB and WR Proffit. 1985. Oral health status in the United States: prevalence of malocclusion. J Dent Educ 49(6):386-396.

Mew, JRC. 1990. Views. Am J Orthod Dentofacial Orthop Feb, 17A-18A.

Miller, H. 1973. Orthodontics and the general practitioner. Int J Orthod 11:17-22.

Miranda, FL, Jr. 1980. Orthodontics in pedodontic practice: a survey of the Southwestern Society of Pedodontists. Pediatr Dent 2(3):217-220.

Mongini, F and W Schmid. 1982. Assessment of the therapeutic position for orthodontic diagnosis and treatment. Am J Orthod Dentofacial Orthop 83:513-518.

Moore, GR. 1948. The orthodontic program of the Michigan State Department of Health with a new classification of occlusion for survey purposes. Am J Orthod Dentofacial Orthop 34:355-361.

Moorees, CFA et al. 1962. Need for collaboration of pediatrician and orthodontist. Pediatrics 29:142-147

Moorrees, CFA and AM Gron. 1966. Principles of orthodontic diagnosis. Angle Orthod July, 258-262.

Morganstern, WM. 1990. Outcome measures in dental education -- we've only just begun. J Dent Educ 54(6):308-10.

Moyers, RE. 1963. Discussion. Undergrad Educ 49(7):519-520.

Murphee, HB. 1961. Studies on the reliability and validity of objective examinations. J Med Educ 36(7):813-818.

Nieberg, LG and PM Sinclair. 1988. A survey of predoctoral orthodontic education. J Dent Educ 52(1):205-207.

Norton, LA, NA Wickwire, RH Biggerstaff, WR Proffit. 1971. Teaching orthodontics for general practice. J Dent Educ 35(11):704-709.

Nowack, AJ. 1983. Survey of orthodontic services provided by pedodontists. Pediatr Dent 5:204-206.

O'Brian, KD, WC Shaw and CT Roberts. 1993. The use of occlusal indices in assessing the provision of orthodontic treatment by the hospital orthodontic service of England and Wales. Br J Orthod 20:25-35.

Orthodontic Dialogue Panel Discussion 1994. American Association of Orthodontists Spring, 6:2:1-4.

Peck, H and S Peck. 1970. A concept of facial esthetics. Angle Orthod Oct, 40(4):284-318.

Pender, N. 1982. Recent graduate opinion on orthodontic training. Br J Orthod 9(2):73-76.

Perry, SS. 1989. Orthodontic diagnosis Part 3: Soft tissue. Funct Orthod Nov, 29-34.

Pertes, RA. 1985. A review of vertical facial types and craniomandibular disorders. N Y State Dent J Nov, 570-578.

Phillips, C, C Tulloch and C Dann IV. 1992. Rating of facial attractiveness. Community Dent Oral Epidemiol 20:214-220.

Pickering, E and P Vig. 1973. The Occlusal Index used to assess orthodontic treatment. Br J Orthod 2(1):147-151.

Pietila, T, I Pietila and P Vaataja. 1992. Early screening for orthodontic treatment. Community Dent Oral Epidemiol 20:208-213.

Popovich, F and GW Thompson. 1971. A longitudinal comparison of the orthodontic treatment priority index and the subjective appraisal of the orthodontist. J Public Health Dent 31:1:2-8.

Prahl-Andersen, B. 1978. The need for orthodontic treatment. Angle Orthod 48:1-9.

Prahl-Andersen, B, H Boersma, FPGM van der Linden and AW Moore. 1979. Perceptions of dentofacial morphology by laypersons, general dentists and orthodontists. J Am Dent Assoc 98:209-212.

Proffit, WR and JL Ackerman. 1973. Rating the characteristics of malocclusion: a systematic approach for planning treatment. Am J Orthod Dentofacial Orthop 61(3):258-269.

Richmond, S, WC Shaw, KD O'Brien, IB Buchanan, R Jones, CD Stephens, CT Roberts and M Andrews. 1992. The development of the PAR Index (Peer Assessment Rating): reliability and variability. Eur J Orthod 14(2):125-139.

Ricketts, RM. 1957. Planning treatment on the basis of the facial pattern and an estimate of its growth. Angle Orthod 14-37.

Rickles, NH. 1975. Expanded roles for the dentist. J Dent Educ 39(9):584-586.

Rieder, RA. 1950. Esthetics and its relation to orthodontic therapy. Am J Orthod July, 168-178.

Robertson, NRE, ML Jones, S Richmond and F May. 1987. The screening and categorization of patients: a case for natural selection? Br J Orthod 14(3):181-186.

Romberg, E. ed. 1990. Outcomes Assessment: A Resource Book. American Assoc of Dental Schools, Washington, DC The Association.

Rondeau, BHM. 1992. AAFO Diagnostic Treatment Chart. Funct Orthod July/Aug, 32-40.

Sachs, NJ. 1971. The general practitioner's obligation in orthodontics: orthodontic essentials of oral health maintenance in general practice. N Y State Dent J 41:6-7.

Salzmann, JA. 1968. Handicapping malocclusion assessment to establish treatment priority. Am J Orthod Dentofacial Orthop 54(10):749-765.

Salzmann, JA. 1967. Malocclusion severity assessment. Am J Orthod Dentofacial Orthop 53:109-119.

Salzmann, JA. 1970. Orthodontics in modern dental practice: Guest editorial, N Y State Dent J 40:48-50.

Salzmann, JA. 1969. Orthodontics in practice and perspective. Am J Orthod Dentofacial Orthop June, 556-565.

Salzmann, JA. 1969. Supervision and guidance of the orthodontic patient by the general dentist. N Y State Dent J Jan, 35:24-28.

Sclare, R. 1945. Orthodontics and the school child: A survey of 680 children. Br Dent J 278-280.

Segnar, D. 1989. Floating norms as a means to describe individual skeletal patterns. Eur J Orthod 11:214-220.

Shaw, WC, HG Lewis and NRE Robertson. 1975. Perception of malocclusion. Br Dent J 38:1:211-216.

Shaw, WC, MJ Gabe and BM Jones. 1979. The expectations of orthodontic patients in South Wales and St. Louis, Missouri. Br J Orthod 6:203-205.

Shaw, WC, M Addy and C Ray. 1980. Dental and social effects of malocclusion and effectiveness of orthodontic treatment: a review. Community Dent Oral Epidemiol 8:36-45.

Shaw, WC. 1981. Factors influencing the desire for orthodontic treatment. Eur J Orthod 3:151-162.

Shaw, WC. 1981. The influence of children's dentofacial appearance on their social attractiveness as judged by peers and lay adults. Am J Orthod Dentofacial Orthop 79(4): 399-415.

Shaw, WC, M Addy and C Ray. 1986. Dental and social effects of malocclusion and effectiveness of orthodontic treatment: A strategy for investigation. Community Dent Oral Epidemiol. 14:60-64.

Shaw, WC, S Richmond, KD O'Brien, P Brook, and CD Stephens. 1991. Quality control in orthodontics: Indices of treatment need and treatment standards. Br Dent J 107-113.

Siriwat, PP and JR Jarabak. 1985. Malocclusion and facial morphology: Is there a relationship? - An epidemiologic study. Angle Orthod April, 127-138.

Slakter, M et al. 1980. Validity of an orthodontic treatment priority index to measure need for treatment. Am J Orthod Dentofacial Orthop 78(4):422-425.

Spika, FX. 1990. Jaw tracking in orthodontic diagnosis. Int J Orthod 28:3-5.

Smith, RJ. 1987. General practitioners and orthodontics. Am J Orthod Dentofacial Orthop 92:169-172.

Smith, NJD. 1987. Orthodontic radiology: A review. Int Dent J 37:16-24.

Sprinthall, RD. 1987. Basic Statistical Analysis Ed.2, Englewood Cliffs, NJ, Prentice-Hall, Inc.

Steigman, S, M Kawar and Y Zilberman. 1983. Prevalence and severity of malocclusion in Israeli Arab urban children 13 to 15 years of age. Am J Orthod Dentofacial Orthop 84:337-343.

Summers, CJ. 1971. The occlusal index: a system for identifying and scoring occlusal disorders. Am J Orthod Dentofacial Orthop June, 552-567.

Tang, E LK and SHY Wei. 1993. Recording and measuring malocclusions: a review of the literature. Am J Orthod Dentofacial Orthop. April, 103(4):344-351.

Tedesco, LA et al. 1983. A dentofacial attractiveness scale. Part I: Reliability and Validity. Am J Orthod Dentofacial Orthop 83(1):38-43.

Tedesco, LA et al. 1983. A dentofacial attractiveness scale. Part II: Consistency of Perception. Am J Orthod Dentofacial Orthop 83(1):44-46.

Torres, D, A Manuel. 1981. Treatment objectives and treatment planning. Dent Clin North Am 25(1):27-41.

Trapani, AP. 1977. Nuts and bolts orthodontics for the general dentist. Quintessence Int 8(6):49-56.

Tulloch, JFC, WC Shaw, C Underhill, G Jones, M Jones and A Smith. 1984. A comparison of attitudes toward orthodontic treatment in British and American communities. Am J Orthod Dentofacial Orthop 85:253-259.

Turpin, DL. 1993. More options with early treatment. Angle Orthod 60(4):243.

Van Kirk, LE and EH Pennell. 1959. Assessment of malocclusion in population groups. Am J Orthod Dentofacial Orthop 45(10):752-758.

Vego, L and NC Murphy. 1982. Early orthodontic diagnosis in general dentistry: method and significance. J Calif Dent Assoc April, 67:68-75.

Viazis, AD. 1992. Cephalometric evaluation of skeletal open and deep bite tendencies. J Clin Orthod 26(6):338-343.

Wasson, JL. 1983. Importance of orthodontic diagnosis to the general practitioner. J Tenn Dent Assoc 63:36-44.

Weiss, J and HM Eiser. 1977. Psychological timing of orthodontic treatment. Am J Orthod Dentofacial Orthop 72:198-204.

Wood, D. 1992. Diagnosis from precise treatment goals. Ont Dent 67(7): 22-26.

Wright, CF. 1949. Analysis of malocclusion from models and photographs. Angle Orthod 19(3):188-202.

22 113CS TH 4741
03/96 00-104-07 GER