CASE WESTERN RESERVE UNIVERSITY

SCHOOL OF DENTISTRY

GRADUATE STUDIES

We hereby approve the thesis of

JONATHAN JAY ECKHARDT

candidate for the degree Master of Science

in Dentistry.

Signed: _____ (Chairman)

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_____

_____

_____

Date: August 13, 1999

CHARACTERIZATION OF ORTHODONTIC SERVICES PROVIDED BY GENERAL DENTISTS IN OHIO

by

JONATHAN JAY ECKHARDT

Submitted in partial fulfillment of the requirements

for the Degree of Master of Science in Dentistry

Thesis Advisor: Dr. B. Douglas Amberman

Department of Orthodontics

School of Dentistry

CASE WESTERN RESERVE UNIVERSITY

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CHARACTERIZATION OF ORTHODONTIC SERVICES

PROVIDED BY GENERAL DENTISTS IN OHIO

Abstract

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The purpose of the present investigation was to examine specific factors associated with the provision of orthodontic services by general dentists in Ohio. A random sample of 529 general dentists across the State completed a forty-four item survey. Results indicated 11.3% performed comprehensive orthodontic care, 21.3% provided limited orthodontic treatment, and 67.4% performed no orthodontic services whatsoever. Most dentists in this sample indicated that their overall patient load had continued to increase over the past five years. Comprehensive providers reported referring fewer patients to orthodontic specialists and attended more continuing education courses. The saturation of the dental market, the size of the community, the age and gender of practitioner, and the distance from an orthodontist were not significantly related to the level of orthodontic treatment provided by general dentists.

DEDICATION

Dad, I would like to dedicate the past ten years of time and hard work to you. Without your positive influence and financial support I never would have become what I have always wanted to be, an orthodontist. I hope to serve my patients as well as I have seen you serve yours.

Mom, thank you for doing all the things that moms do. Your unconditional love, guidance and support has made my life much better.

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INTRODUCTION

Research has shown significant change of orthodontic providers over the past twenty years. It has been reported that as many as 76.3% of general dentists and 98% of pediatric dentists provide some type of orthodontic service. Many have implicated that a major reason for this finding is the decrease in caries due to water fluoridation which has resulted in a decline in the need for restorative dental care. A second suggestion is that there has been a surplus of graduating dental students in this country. This surplus coupled with the advent of water fluoridation has resulted in many believing that a competition has risen among dentists and that general practitioners have been "forced" to expand their scope of services to compensate financially for a reduced restorative need.

The aim of the current study is to determine the level of orthodontic care provided by general practitioners in Ohio. Trends in patient load, practice location, referral patterns, continuing education courses taken, records gathered, and topics of interest will be studied and described. The results will be compared to a

similar study which evaluated these trends in the state of Michigan.

REVIEW OF THE LITERATURE

Early History of the Orthodontic Specialty

Prior to the 1830's, the profession of dentistry had not yet been firmly established, with physicians rendering treatment to those who suffered from tooth and related mouth diseases. Some medical practitioners took a special interest in dental care and limited their practices to this branch of medicine, but it was not until 1834 that a group of dentists coalesced to form The Society of Surgeon Dentists of the City and State of New York. The goal of this group was to raise the status of dentistry to a distinct professional branch through the blending of the necessary ingredients: Association, education and literature. In 1840, under the leaders of this group and other dental societies, the University of Maryland opened the first College of Dental Surgery in America, with its members and graduates awarded the Degree of Doctor of Dental Surgery. By the late 1860's under the influence of Dr. James Edward Garretson, the specialized field of oral surgery became recognized. Shortly thereafter, in 1880, the publication of Dr. Norman W. Kingsley's textbook, A Treatise on Oral Deformities, spurred the realization for

the need to recognize a second dental specialty, orthodontics. This book focused on the scientific and mechanical treatments of oral deformities and dental irregularities. Even though much had been published in the literature prior to Kingsley's work, dentists did not devote much time to correcting misaligned teeth and actually considered orthodontics to be a minor branch of prosthetic dentistry (Clark 1969).

In 1726, a French dentist named Pierre Fauchard contributed to what would become the field of orthodontics, a device called the expansion arch that was designed for straightening teeth. Orthodontics during the early 1700's to the late 1800's involved patient tailored appliances and mechanics. Many dentists considered each malocclusion a problem within itself and designed or created an appliance which would meet the specific treatment objectives because there was no single orthodontic appliance which would serve uniform treatment. In 1878, Dr. Farrar expressed the opinion of many of his colleagues and his own vision of future orthodontic appliances when he wrote:

> "Although the simplification of regulation has been a great desideration for many years, it has for some time been evident to me that the time will come when the regulating process and the necessary apparatus will be so systemized and simplified that the latter will actually be kept in stock, in parts or wholes, at dental

> depots, in readiness for the profession at large, so that it may be ordered by catalogued numbers to suit the needs of any case." (Clark 1969)

In the late 1800's, a father figure arose in orthodontics who was the specialty's counterpart to dentistry's Greene Vardiman Black and his name was Edward Hartley Angle. His sheer dedication to the profession was evident through his numerous published articles and textbooks, clinics and demonstrations and respected leadership. It was his astounding influence that lead to the establishment of orthodontics as a specialty. After several universities rejected his proposal to form specialty clinics for orthodontic training, Dr. Angle became discouraged and decided to form a separate school which was independent from dental schools. Through a highly selective screening process, Dr. Angle hand-picked students to enroll in his Angle School of Orthodontia which he established in 1900. In addition to academia and private practice, Angle organized and served as the first president of the Society of Orthodontists, which later evolved to become the American Association of Orthodontists (AAO). He also aided in the establishment of the *American Orthodontist*, a journal dedicated to promote the profession of orthodontics. Another significant accomplishment in the orthodontic society

which earned him international recognition was his paper on "The Classification of Malocclusion" which was published in the 1899 issue of *Dental Cosmos* (Clark 1969; Weinberger 1926).

In 1896, Dr. Angle spoke at the Western Odontological Society of Pennsylvania. It was there that he presented a paper which expressed his views about the roles of the general dentist and the orthodontic specialist.

> "This is the plan I would suggest: Simply regard it (Orthodontia) as a specialty, teach it as such, and relieve the student in orthodontia from the study of mechanical and operative dentistry entirely. They are most demoralizing to the study of orthodontia, are of no use to him whatever, and are only a waste of valuable time. On the other hand, the student in general dentistry should not be compelled to study orthodontia. It is of no use to him and is fully as demoralizing as it is in practice to the general practitioner...I believe the time and conditions are ripe for the establishing of orthodontia in its true position, for I know there are today many of the best men in the profession in every city who are tired of this narrow 'dog in a manger' plan, and are anxious, and would be willing to refer their patients, if they could, to honest, competent specialists pursuing this branch only, knowing that by so doing they would be better served than they can serve them, just as does the broad and liberally educated practitioner of medicine, who now takes pride in referring his patient to the carefully educated oculist or rhinologist, and who, by so doing, uplifts his profession and benefits humanity." (Clark 1969)

Manpower in Orthodontics

Over the years the AAO created special committees

which were designed to assess orthodontic manpower. In 1972, the AAO developed a survey to determine the orthodontists' attitude toward the current and future manpower needs of the specialty. Of the 5,088 questionnaires mailed to AAO members, 3,335 were completed and returned (65%). At that time, orthodontists reported that their practices were definitely "leveling off". It was predicted that practice growth was not looking bright for orthodontists and many would experience a decrease or stabilization in case loads. A few reasons for this negative trend in orthodontic practice levels were provided; low ratio of children to orthodontists, poor public education to attract patients, and an increased number of general practitioners providing orthodontic care. When asked about referrals from general practitioners, one-third of the orthodontists reported an increase, one-third reported a decrease and one-third reported no change. Only 14.5% of the orthodontists said they had a waiting list and thirty-three percent claimed that they needed more work. Eighty-five percent of the orthodontists thought that most of the work was being done by specialists. A stunning fifty-four percent suggested that too many new orthodontists were being "pumped out" (AAO 1973).

The results from another manpower study were published in a 1977 issue of the *American Journal of Orthodontics* (AJO). A committee was arranged to study the role of the orthodontist, pedodontist and general practitioner in the provision of orthodontic treatment. The results from this survey suggested trends similar to the 1972 manpower survey. There was a decline in child-to-orthodontist ratio. Thirty-eight percent of the AAO members reported a decrease in patient load and thirty-nine percent felt they needed more work. Other trends included a decrease in referrals from general practitioners. The consensus was that too many orthodontists were being trained and that the number of patients being treated by nonspecialists was increasing. The average number of cases being started was determined to be ninety-nine per year and the average number that the orthodontist reported that he could have started was 124, a difference of twenty-five patients (Williams 1977).

The utilization rate of orthodontic treatment was also evaluated via survey information collected from 4,883 high school seniors in geographically separated metropolitan areas (AAO 1976). It was found that 22.9% of the population studied had received or were undergoing orthodontic treatment. Of these, 29.6% were treated by

nonspecialists. This study also concluded that there would continue to be a reduction in child to orthodontist ratio and that "too many orthodontists are being trained to meet any logical projected demand for orthodontic services" (Williams 1977).

Another manpower study by the AAO targeted recent graduates in the United States between the years of 1971 to 1975. Sixty-four percent (895) of the surveys were returned. Some of the questions with their results were as follows:

1. Number of offices in which one practices:
   - A. One office (49.6%)
   - B. Two or more offices (47.5%)
   - C. No response (2.9%)

2. A measure of workload was determined by asking if the orthodontist's chair time was:
   - A. Filled (17.1%)
   - B. Moderately filled (46.6%)
   - C. Definitely not filled (34.5%)
   - D. No response (1.8%)

3. If the orthodontist's practice lacked sufficient patients, the following reasons were given, in order of their significance:
   - Reason 1 - Too many orthodontists
   - Reason 2 - Economic situation
   - Reason 3 - General practitioners performing orthodontics
   - Reason 4 - Pedodontists performing orthodontics

4. Should the AAO and constituent societies do more in the way of educating the public regarding orthodontics?
   - A. Yes (85.4%)

B. No (9.9%)
C. No response (4.7%)

5. If the answer is "Yes," would you favor a dues increase to upgrade such a program?
   A. Yes (62.5%)
   B. No (15.1%)
   C. No response (22.5%)

6. What vehicles or types of media would you suggest to promote such a program?
   A. TV (33.1%)
   B. Magazines & TV (13.2%)
   C. Newspapers & Magazines (6.7%)
   D. TV & radio (5.4%)
   E. All three media (4.8%)
   F. Other (7.2%)
   G. No response (29.7%)

7. Do you feel that general dentists are sufficiently cognizant in recognizing orthodontic problems?
   A. Yes (21.3%)
   B. No (72.1%)
   C. No response (6.6%)

(Turpin 1977).

The data collected by Turpin suggested that orthodontists were not busy enough as a result of a saturation of specialists. The respondents also expressed a need for advertisement in orthodontics and were willing to pay increased dues to the AAO to accomplish this task. Ironically, seventy-two percent of the orthodontists perceived general dentists as not recognizing orthodontic problems, yet they listed 'general dentists providing orthodontic services' as the third reason for their lack of sufficient patients (Turpin 1977).

In other countries, dental health care systems and

education requirements are very different from those established in the USA. For instance, in the UK there are three groups available to provide orthodontic treatment. The first group consists of general dentists who have no additional specialty training. These practitioners tend to treat a small number of orthodontic patients. The second group is composed of dentists who have received some additional training by attending short postgraduate courses. These dentists limit their practice to orthodontics. The third group embodies practitioners who have achieved a diploma in orthodontics and they limit their practices to orthodontics with some acting as consultants. This group is associated with one of the three branches that comprise the National Health Service (General Dental Service, Hospital Dental Service, and Community Dental Service) (Stephens et al. 1985; McComb et al. 1995).

A study by Linge (1987) examined the role of the general practitioner and the orthodontist in the provision of orthodontic care in Norway. Linge was early to point out in his introduction that dental services greatly differ around the world. He noted that while dentistry, until more recent times, had primarily centered around restorative work, "orthodontic care may range from a fringe benefit to a time consuming complicated specialty."

In industrialized countries, there is a much reduced need for restorative and prosthetic care, and for this reason many dentists are now offering preventive, more complex and specialized dental procedures, as well as orthodontic therapy (Linge 1987; Elderton & Eddie 1983; Lawrence et al. 1995; Palmer 1984; Spencer & Lewis 1989). The boundaries, therefore, between general dentists and specialists have become "blurred" over the years (Linge 1987). In a society where an organized care system exists, Linge suggested that the responsibility of the general practitioner in orthodontics should include:

1. The diagnosis and assessment of the need for treatment.
2. Interceptive procedures and the supervision of development of the dentition (without appliances).
3. The referral to a specialist for advice and treatment (Myrberg 1986).

Linge also observed that most dental programs do not adequately train students for full responsibility in orthodontic care. With the scientific gains in all dental specialties, the depth of instruction into each individual field is thus somewhat limited. While continuing education courses may be attended to manage the deficit, experience indicates that training at the graduate level to attain the background and insight is necessary for successful orthodontic care. Linge commented on the

comprehensive and cooperative approach needed for competent care:

> "Specialist work does not reach its true potential until it is integrated into the framework of general oral health care and is effectively co-ordinated for the full benefit of the patient." (Linge 1987).

In *The Australian Dental Journal* (1990), Stewart et al. surveyed dentists in the State of Victoria reporting that little information existed concerning the educational needs and the community demand for their specialty services (Wright et al. 1986). While orthodontists comprised the largest population among the dental specialists, it was noted that general dentists were the practitioners clearly embarking on some of the work which had traditionally been completed by specialists (Anonymous 1988). Survey results revealed that half of the orthodontists reported an increase for their services and the other half claimed that there was a decrease or no change in their demand. Interestingly, many of the general practitioners who were surveyed about their orthodontic services reported an increase in the demand for orthodontic treatment (Stewart et al. 1990). It was also demonstrated that there was an increase in the enrollment of general dentists in short courses in orthodontics and a reduction or complete elimination of referrals to orthodontic specialists. This implies that

many of the general practitioners were providing orthodontic treatment themselves (Stewart et al. 1990).

Undergraduate and Graduate Orthodontic Education

A key aspect in providing any kind of dental care is the quality of the service provided and the outcome achieved. Critical in this process is the experience and educational background of the service provider. Prior studies in the health care field have found that the quality of technical care and of general health care is positively related to the quantity and quality of the training of the clinician, as well as to the degree of specialization in the field, and to the amount of clinical experience of the practitioner regardless of age (Donabedian 1980). Despite a vast literature in the health care industry, there have been few attempts to define quality orthodontics. In general, researchers who have investigated quality assurance including educational issues related to orthodontic service provision have found that orthodontic instruction at most schools accounts for less than four percent of the total instruction time (McDuffie & Kalpins 1985). A survey of sixty-two dental schools in the United States and Canada found that one-third of the institutions did not require a student to participate in an orthodontic clinical experience and that the average number of orthodontic clinical hours a student

experienced each year of dental school was approximately eight. The amount and diversity of didactic courses taught as well as the kinds of clinical experiences students received varied widely across institutions (Nieberg & Sinclair 1988). Moyers (1990) also expressed these concerns, stating that orthodontic corrections require more time and appointments than the single-treatment procedures as in most of dentistry. Orthodontics requires an extensive knowledge of facial growth and development to treat malocclusions correctly and thoroughly, and dentists entering practice have less background and competence in orthodontics than in any other specialized fields of dentistry. Quality assurance in orthodontics is not controlled by state or regional board exams. Competence in orthodontic theory and clinical ability are never tested at this level (Moyers 1990). Clearly, training in dental school alone is not adequate to prepare a general dentist for treating orthodontic cases competently. Examining more thoroughly the educational background of dentists providing orthodontic care and how this varies among practitioners providing different levels and amounts of treatment is critical for assessing the quality of care provided as well as trends in the field. The study undertaken here attempts to directly address these issues.

Dugoni et al.(1981) provided insight to the role of orthodontics in the predoctoral curriculum of a dentist. He stated that orthodontic specialists involved with educating dental students are feeling increasing pressure. Even though time slots available for specialty education to dental students are becoming more scarce, Dugoni et al. suggests that substantial efforts should be made to improve orthodontic education to predoctoral students. They asked a series of intellectually stimulating questions to orthodontists and orthodontic educators. Some included:

> "Do general practitioners refer patients properly, often, and at the correct time? Do general practitioners and other specialists show that they are aware of the sophistication of orthodontic skills and treatment planning? Do they know or understand what orthodontics can accomplish in occlusion, in function, with profiles, for adults, with growth, with orthognathic surgery, with early mixed-dentition treatment, and do they present these benefits to their patients?"

If dental students are not educated in areas such as these which include some of the basic concepts in orthodontics, it has been shown to be counterproductive. A dissertation completed in 1974 by Little compared graduates from two different dental programs. One school provided dental students with a strong predoctoral orthodontic education, while the other university provided minimal education in orthodontics to the dental students and "protected the

specialty". It was shown through Little's work that the graduates from the school which gave the most instruction referred more patients to the orthodontist, and a larger proportion conveyed a greater interest in orthodontics. In comparison to the Norweigan guidelines presented by Linge, the standards for teaching orthodontics to dental students presented by the American Dental Association, in 1976, were as follows:

1. Students will be able to recognize, classify, and differentiate occlusal problems of children and adults.

2. Students will be able to develop suitable treatment plans for patients to be treated in general practice and will possess those skills to deliver necessary care embodied in the treatment plan that is, mechanical needs, appliance design and prescription, clinical management of appliances and patients, fabrication of fixed and removable appliances.

3. Students will be able to select and treat patients with uncomplicated tooth malpositions and refer patients with more severe problems to an orthodontist.

The long treatment period for orthodontic patients makes securing meaningful clinical experiences for dental students difficult, but to refrain from teaching them the fundamentals leaves three unfavorable impressions: Dental students interpret the material as confusing; they think the instructors are "holding out on them", or they think the instructors do not know how to teach. Unfortunately,

dentists who graduate with these negative attitudes are vulnerable to "hucksters" who promise simple answers to orthodontics. For these reasons, Dugoni advocates a solid foundation in orthodontic education to provide dental students with a positive experience and the necessary skills to make sound treatment decisions for the good of the patient (Dugoni et al. 1981).

Specialty status does not suggest that the general dentist is not capable of providing orthodontic care. However, the additional training and experience received by a specialist does instill a measure of confidence and a safeguard to the public. The primary role of the specialist is to obtain optimal results using the most efficient methods for every patient. In the USA, orthodontic care has been traditionally provided by the specialist. However, many general practitioners and pedodontists have become increasingly attracted to orthodontics due to a diminishing workload as a result of a marked decrease in the prevalence of dental caries. Also with time, orthodontics has become a dynamic field which has gained sophistication through revolutionary advances in biomedical sciences. This has led to the need for more intense training, quality faculty and in-depth research at the postgraduate level. As a result, many specialty residencies have extended their program to three

years. This appears to be a common theme among the dental specialties. The additional training will broaden the foundation in clinical, biologic and basic sciences. In 1984, approximately twenty percent of the specialty residencies required a thirty-six month attendance. The additional year enables the resident to complete the treatment of many patients he started. This, in turn, permits the learning clinician to retrospectively evaluate treatment effects (Moorrees 1984).

Historically, orthodontists have received patients primarily from two sources: (1) previously treated patients who were satisfied and recommended other patients; and (2) general dentists. Many orthodontists are finding it increasingly difficult to obtain referrals through traditional routes and very few elect to advertise to the public. In addition, general dentists and pedodontists are competing for a decreasing amount of general dental work and are thus rendering orthodontic care for an increased source of income. Many specialists feel that it should be recognized inside and outside the profession that it requires at least two years of additional training to diagnose and treat orthodontic problems competently. "It is not what you call yourself, but how much knowledge of the subject you have that is important (Gotlieb 1984)." Gottlieb established an

interesting comparison when he wrote,

> "General dentists who object strenuously - and rightly - to the idea of denturists, hygienists, and dental auxiliaries practicing dentistry cannot in all conscience accept the practice of orthodontics by those without the education that is required for specialty practice."

The public views the general dentist as the gatekeeper to all aspects of dental care including specialized services seeking his guidance to specialty care when needed. If it is perceived by the public that the general dentist is withholding referral because of his own economic interest, the highly respected field of dentistry may fall. (Gottlieb, 1984)

Who is Providing Orthodontic Services?

Brown et al. (1982) investigated factors influencing the amount of orthodontic treatment attempted by recent graduates of two British dental schools. They surveyed 279 graduates from these two schools between the years of 1973 and 1975. Interestingly, they found that three quarters had been involved with six or more orthodontic patients since graduation, with a direct correlation between confidence in ability and provision of orthodontic care. Attendance at continuing education courses by general dentists and provision of orthodontic care were also found to be positively correlated. With regard to referral patterns, a third to a half of the general

dentists recommended 75-100% of their orthodontic patients to seek the care of an orthodontist. Approximately another third were found to refer twenty-four percent or less. This suggests a referral trend that follows a "nearly all" to "almost none" pattern. Similar results were reported by Sheiham et al. 1971) and Pender (1979). It was also interesting to note that over half of the general dentists were prepared to treat only twenty-four percent of their orthodontic patients without the advice of a specialist. (Brown et al. 1982)

McComb et al. (1995), surveyed 149 general practitioners in the UK to assess their perceptions of orthodontic services. One hundred twenty-one surveys (90%) were returned, reporting that sixty-seven percent of the practitioners did not provide orthodontic services. Those who did finished an average of 10.43 cases a year, while twenty-six percent did not refer any patients at all. The factors influencing the general dentists' choice of orthodontist for referral were as follows:

Standard of treatment	67%
Length of waiting list	62%
Personal knowledge of orthodontist	60%
Ease of access for patient	57%
Ease of making first appointment	49%
Difficulty of treatment involved	33%

Standard of orthodontist's report 14%

Interestingly, the difficulty of treatment involved and the standard of orthodontist's report were of little concern. In addition, the general dentist's choice of treatment provider was perhaps in many cases not influenced by the difficulty of treatment. Fifty-one percent of referrals made were to one type of treatment provider. A key piece of information noted was that forty-two percent of the general dentists were dissatisfied with the services provided by the specialists. (McComb et al. 1995)

Recent estimates suggest that over the course of the next ten years, a drastic expansion of orthodontic services provided by general dentists in America will be seen, resulting in a three hundred percent increase in provision of such therapies by nonspecialists. (Jacobs et al. 1991; Strom 1989) While determining with complete certainty the accuracy of such estimates is difficult, such projections nevertheless reflect a trend in the field of dentistry that is significant for both patients and practitioners (Jacobs et al. 1991). Studies over the course of the last twenty-five years, however, support the veracity of such estimates while others have documented similar patterns. (Gotlieb 1984; Moorrees 1984)

In one of the first large-scale studies to examine

this trend more extensively, McGann (1988) surveyed over 10,000 general dentists in the United States. The results indicated that seventy-five percent of those responding to the survey were providing some type of orthodontic care in their practice and that those who provided such services were busier and better compensated than their colleagues. Other researchers conducting more regional studies (e.g., general dentists in California, Canada, Indiana) have found similar numbers of non-specialists providing specialized orthodontic care. (Dugoni et al. 1981; Konchak & McDermott 1990; Koruluk et al. 1988) It was also reported by Dugoni et al. (1981) that non-orthodontists in California were providing fifty-five percent of the orthodontic services covered by prepayment programs.

In 1981, the US Polling Committee of the Association of Pedodontic Diplomats surveyed its members to record their educational background in orthodontics, pediatric dental practice trends and orthodontic services provided. Two hundred eighty-seven surveys (73%) were collected with seventy-four percent of the respondents reporting that they received orthodontic training as part of their pediatric training. Half claimed that they attend short (1-2 day) continuing education (CE)courses in orthodontics while twenty-six percent reported that they attend long CE courses such as a "straightwire" course. Four percent of

those surveyed completed an orthodontic program. Between 1976 and 1981, fifty-nine percent of the pedodontists experienced a reduction in the need for traditional pedodontic services and forty-eight percent reported that there was an increase in time spent on orthodontic services. Almost seventy percent spend less than one quarter of their practice time on orthodontic procedures. However, one third reported that they provide comprehensive orthodontic care. Interestingly, pedodontists appear to be an important referral source for the orthodontist with seventy-eight percent referring patients. It was suggested that the increased number of dental graduates, and the decline of the incidence of dental caries, birth rate and economy has clearly influenced pediatric dentists to look beyond the scope of traditional pedodontic care. (Myers et al. 1983)

In 1989, Jacobs et al. surveyed all 1,159 of the dentists in Iowa in an attempt to answer one fundamental question: Are general dentists limiting themselves to the simple orthodontic cases while referring difficult cases or are dentists expanding their scope of orthodontic services and referring less? They achieved a 62.8% response rate which corresponded to 728 returned surveys. They found that 33.9% did not provide orthodontic treatment while 66.1% did some orthodontics. Further

examination of the data revealed that 45.7% of the dentists provided orthodontic services to less than ten percent of their patients. Twenty and four-tenths percent of the clinicians reported that more than ten percent of their patients were receiving orthodontic care. When evaluating referral patterns, only 4.7% responded that they do not refer at all to the orthodontist. Fifty-one percent only referred between one to four patients a month, 34.2% referred between five to ten patients and 8.5% claimed to refer more than ten patients a month. With regard to continuing education courses in orthodontics among these practitioners, 43.8% reported that they do not attend any, 35.2% take one to four hours and 18.8% take five or more hours annually. With this data, it was suggested that orthodontic treatment is linked to an expanded scope of orthodontic services provided by the general practitioner and this was associated with a significant reduction in referral to the specialist. (Jacobs et al. 1991)

A study in 1994 by McKnight-Hanes et al. described dentists' perceptions of the variety of dental services provided for children. The literature has indicated that general dentists and pediatric dentists differ in their methods of dental care for children. (McKnight-Hanes et

al. 1990; Myers et al. 1990; McKnight-Hanes et al. 1990, 1991) For instance, pediatric dentists recommended more diagnostic radiographs, restorative procedures for smaller lesions, occlusal sealants, fluoride treatments and more stainless steel crowns (McKnight-Hanes et al. 1990; Myers et al. 1990; McKnight-Hanes et al. 1991; McKnight-Hanes et al. 1992). Even differences in behavior management have been noted. In comparison to general dentists, pediatric dentists use more of the following: Physical restraint, oral sedation and general anesthesia (McKnight-Hanes et al. 1993; McKnight-Hanes et al. 1992). McKnight-Hanes et al. surveyed two thousand general dentists and one thousand pediatric dentists. Thirty-three percent of the general dentists replied compared to forty-nine percent of the pediatric dentists. When reporting on orthodontic services rendered by these two groups, major differences were seen. Fifty-two percent of the general dentists referred all orthodontic care compared to only three percent of the pediatric dentists. Ninety-one percent of the pediatric dentists provided limited orthodontic care compared to forty-two percent of the general dentists. Comprehensive orthodontic treatment was provided by fifty-one percent of the pediatric dentists and only ten percent of the general dentists. These results suggest that the

additional training received by pediatric dentists has prepared them to recognize and treat malocclusions more effectively than general dentists (McKnight-Hanes et al. 1994).

Hayakawa and Jedrychowski (1994) surveyed a unique population within the dental profession. They reported on practitioners who were dually trained in pediatric dentistry and orthodontics. Their findings for the 146 such specialists were as follows. Regarding orthodontic care, sixty-eight practitioners allocated fifty percent or more of their time to orthodontics. Of these sixty-eight dentists, thirty restricted their practices solely to orthodontics. On the other hand, it was found that twenty-three of these dually trained practitioners spent 50% or more of their time providing pediatric dental care. Only three clinicians provided pediatric dental care one hundred percent of the time. For this dually trained group, the optimal time allocation for services rendered would be twenty percent dedicated to pediatrics and seventy-three percent allotted to orthodontics. With respect to these findings it is not surprising that sixty-seven percent attended orthodontic related meetings and thirty-five percent attended pediatric dental meetings. (Hayakawa & Jedrychowski 1994) In comparison to

Gorczyca's findings in 1989, general practitioners devoted 1.6% of their time to orthodontics while pediatric dentists allocated 19.7%. Also, the orthodontic services accounted for 1.1% of the general practitioner's income compared to 21.4% for the pediatric dentist. (Gorczyca 1989)

There is a prevailing theme in the literature which suggests that because of preventive measures such as fluoridation, there has been a major shift in the provision of dental care. As a result, many dentists are seeking additional specialty training and general practitioners are providing orthodontic services. (Darbro 1977; AAO 1975) A large-scale study was completed in the State of Virginia in 1995, surveying all 196 members of the AAO in that state. The study yielded a return rate of ninety-three percent. The majority of the group reported that they practiced twenty-nine to thirty-two hours per week, and sixty-six percent said they used three to six chairs for patient care. Twenty-seven percent of the Virginian orthodontists reported they could use eighty-one or more new patients and fifty-five percent claimed that they were not busy enough. Thirty-five percent of the respondents said their patient load has remained the same while twenty-nine percent said it had declined. Forty-two

percent of these orthodontists felt that a significant amount of orthodontics was being performed by non-orthodontists. Only twenty-two percent reported that no general practitioners in their area were providing orthodontic services, nineteen percent did not know and sixteen percent replied that it was not applicable. (Davidovitch et al. 1995)

In another recent study by Wolsky and McNamara (1996), 1,020 Michigan general dentists were sent questionnaires. Seven hundred fifty-three surveys were returned which yielded a seventy-five percent response rate. In order to compare the types of orthodontic treatment provided by each general dentist, three categories were created to describe the services provided. The three categories were as follows:

1. Comprehensive treatment: Encompasses those dentists who used multibanded or bonded orthodontic appliances to treat class I malocclusions. They also may treat more complicated class II and class III malocclusions.

2. Limited treatment: Includes those who perform any orthodontic treatment not listed in the "comprehensive" category, such as correction of an anterior or posterior crossbite, molar uprighting, correction of rotations, or placement of space maintainers.

3. No treatment: Contains data from dentists who indicated that they provide no orthodontic treatment, whatsoever.

Their findings indicated that 19.3% of the general dentists provided comprehensive orthodontic care. This compares to twenty-six percent reported by Lawrence et al. (1995) in the UK. Fifty-seven percent rendered limited care and 23.7% claimed that they did not provide any orthodontic services. The group providing comprehensive treatment had a much greater patient load than their colleagues providing limited services. The majority of the respondents in this survey indicated that their office was located within four miles or less from an orthodontic office. Distance from the nearest orthodontist did not vary significantly among dentists providing comprehensive, limited, or no orthodontic treatment. The data also revealed that ninety-six percent of these clinicians spent a quarter or less of their total practice time rendering orthodontic services. Approximately fifteen percent of the clinicians offering comprehensive care allocated 26-50% of their work day to orthodontic treatment and a very small percentage reported spending more than fifty percent of their time performing orthodontic procedures. Evaluation of referral patterns showed that fifty-five percent of all the respondents referred one to four patients to an orthodontist every month and thirty percent reported five to ten referrals per month. It is

noteworthy that twenty-four percent of the clinicians who provided comprehensive orthodontic care did not refer any patients to an orthodontist. This is a much higher percentage than practitioners in the other two groups. It was also estimated that 65.1% of all orthodontic patients were treated by orthodontists, thirty-one percent by general practitioners and 3.7% by pediatric dentists. While this study made significant strides in asking critical questions about individualized and community variables which may contribute to orthodontic treatment patterns, our understanding of socioeconomic factors affecting patient access as well as the level of orthodontic education variation among practitioners is still limited.

Synopsis of the review

Overall, the literature reviewed indicated that fewer children, more dentists and increased utilization of preventive practices such as fluoridation have caused a fundamental change in the provision of dental care and the practice of general dentistry. The need for restorative and prosthetic dentistry has, therefore, declined. As a result, many general practitioners are seeking both additional training in orthodontics and providing more orthodontic services in an effort to expand their scope of

treatment. A primary outcome of this shift appears to be a reduction in dental referrals to specialists. It is evident that periodic national and local manpower and demographic studies are important for assessing the needs of patients, students, dentists and specialists and monitoring changes in practice and referral patterns so that treatment integrity and professional cooperation are maintained.

STATEMENT OF HYPOTHESIS

The purpose of the present descriptive study was to utilize survey data gathered from dentists in Ohio to answer critical questions regarding the delivery of orthodontic services. Specifically, the objective was to investigate the prevalence of orthodontic services provided by general dentists in Ohio. A second objective was to characterize differences between the providers from the non-providers of orthodontic services in terms of age, gender, patient activity, referral patterns, continuing education, orthodontic treatment planning, and topics of interest.

MATERIALS AND METHODS

Study Sample

Approval to collect data for this study was given by the Internal Review Board at Case Western Reserve University in, August 1998 (Appendix 1). Names and locations of the dentists to be included in the investigation were provided by the Ohio Dental Association (ODA). From the population of 6,151 practitioners in the state of Ohio, a systematic random sample of 1,200 dentists was selected to be surveyed.

All potential participants were contacted by mail. The 1,200 participants in the targeted group were sent a cover letter (Appendix 2) from the principal investigator explaining the purpose of the research and requesting his or her confidential participation; a survey; and a self-addressed envelope for returning the surveys. The cover letter was written on Case Western Reserve University letterhead and the return address on the enclosed envelope was to the Case Western Reserve University School of Dentistry, Department of Orthodontics.

The initial mailing began on October 12, 1998. Fifty letters were mailed each day for twenty-four consecutive

working days, with the final initial mailing completed on November 12, 1998.

To maximize return rates, individuals who had not returned surveys within two months were mailed a second survey and a follow-up letter requesting their participation. A stamp was placed on the self-addressed envelope for the second mailing. Given the holidays in December, the follow-up mailing was started on December 7, 1998. There was a hiatus after the December 18, 1998 mailing until the January 4, 1999 mailing. The final group of packets was mailed on January 12, 1999. The deadline for accepting returned surveys to be included in the study was one month after the last day of the second mailing (i.e., February 12, 1999).

Survey Instrument

The survey instrument (Appendix 3)used was developed in 1991 by researchers in the Department of Orthodontics at the University of Michigan School of Dentistry. After slight modifications, the final survey used in the present investigation was a six page, forty-four item questionnaire. Several questions contained multiple parts. Both background and practice information were obtained from dentists. Practitioner demographic information included: date of birth, gender, dental school attended, year of graduation and practice type. The Primary aim of

the questionnaire, however, was to assess the participant's level of involvement in providing orthodontic services. Practice characteristics such as office location, the number of active orthodontic patients in treatment, referral patterns to orthodontists and continuing education courses in orthodontics taken yearly were included.

Statistical Software

The Epi Info™ statistical package was used in data analysis. The data from each survey were entered in spreadsheet form with the assigned identification number to maintain respondent confidentiality. Descriptive statistics were calculated to obtain means, standard deviations, ranges, and total number of responses for each item. Frequency distributions and chi-square analyses were also computed. Significance was assessed at $p < 0.05$.

RESULTS

Study Sample

Of the 1,200 surveys mailed in the initial mailing, 363 were returned. Thirty-one of these surveys were returned because the dentist had moved his office location and the post office did not have a forwarding address. Thus, 1,169 surveys reached potential participants and 332 were returned, yielding a 28.4% return rate for the initial mailing. Eight hundred thirty-seven surveys were sent in the second mailing to those dentists who had not responded initially. Three hundred forty of the 837 surveys were returned yielding a response rate of 40.6%. In sum, 672 of 1,169 surveys were returned, providing a 57.5% return rate.

The 672 participants were categorized according to the type of practice in which they were engaged. Only the 529 participants who reported that they were actively practicing general dentists were included in the subsequent data analyses. The remaining 143 responders were excluded from this study due to being either: A specialist (n = 97); retired (n = 32); or "not interested in participating" (n = 14).

Profile of Dentists in the Sample

Descriptive statistics were utilized to analyze the data gathered. Assessment of the title and role of the person who completed the survey revealed that 97.2% were dentists, 2.3% were office managers and 0.4% identified themselves with the "other" category. The mean age of the respondents was 47.97 years (SD = 11.14). Sixty-four and one-half percent of the respondents reported that they were between the ages of thirty-five and fifty-four. The average year of graduation from dental school for the present sample was 1977.79 (SD = 10.8). The largest percentage of the dentists(65.4%) graduated between 1970 and 1989. Examination of the respondent's gender revealed that eighty-nine percent were male and eleven percent female. Characterization of the subjects by dental school attended showed that the majority (85.7%) had graduated from one of the two dental schools in Ohio. Sixty-six and eight-tenths percent graduated from Ohio State University, 18.9% from Case Western Reserve University and 14.3% from other schools. Figures 1-4 display the distribution of the sample by age, year of graduation, gender and dental school attended, respectively. None were statistically significant as a function of provider type.

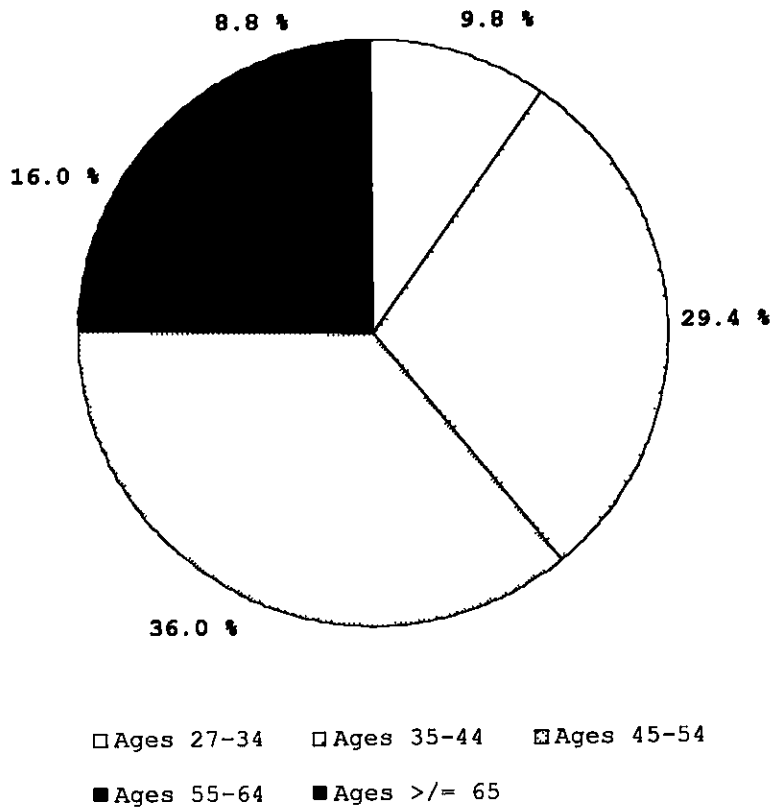


Figure 1. Pie chart showing the age distribution of general dentists in Ohio.

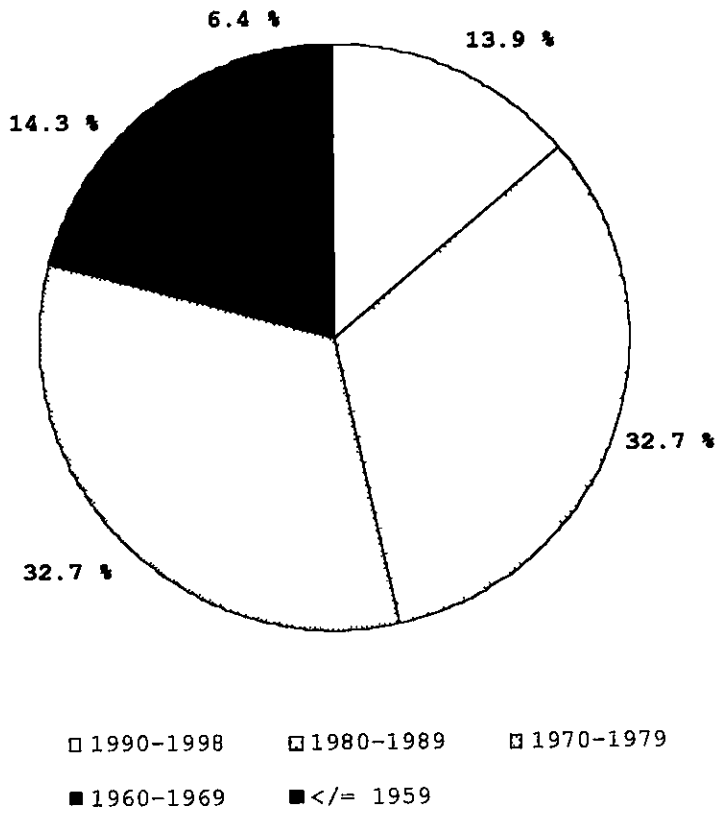


Figure 2. Pie chart illustrating the distribution of general dentists in Ohio by year of graduation.

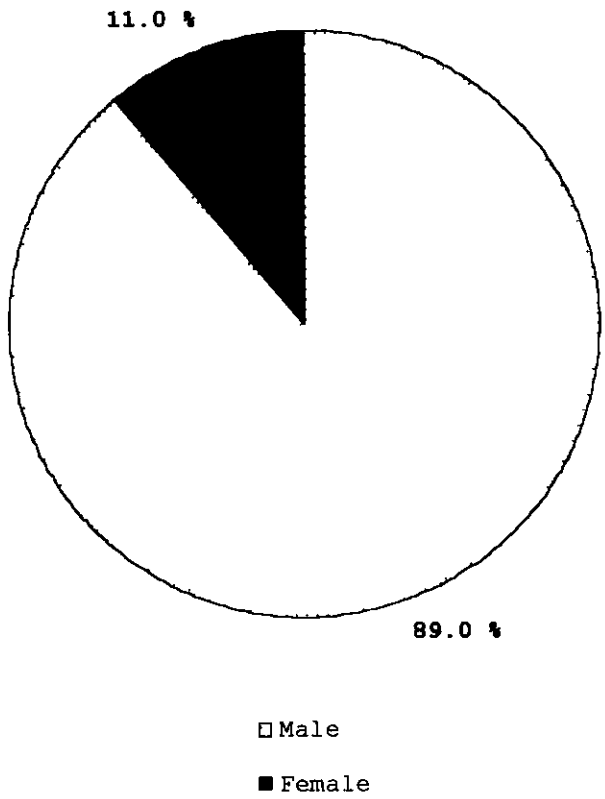


Figure 3. Pie chart displaying the gender distribution among general dentists in Ohio.

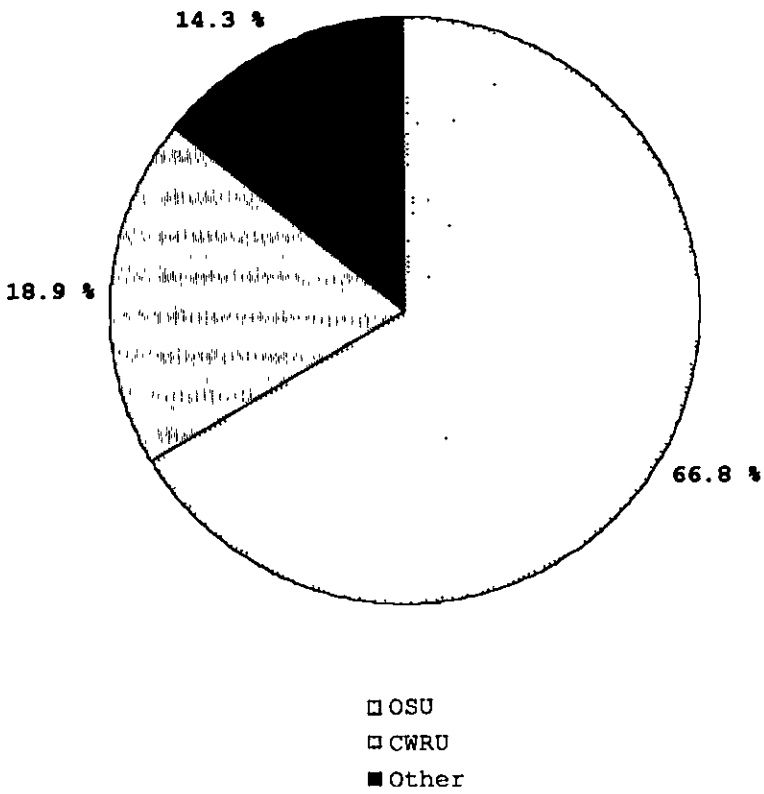


Figure 4. Pie chart illustrating the distribution of general dentists in Ohio by dental school attended.

Definition of Orthodontic Provider Groups

A primary aim of the present investigation was to assess the amount and type of orthodontic services provided by general dentists in Ohio. Question number seven on the survey (refer to Appendix 3) was designed to address this specific issue. This question inquired about fourteen different orthodontic services. Frequency distributions for all of these services are displayed in Table 1. Based on responses to the various components of this question, three groups were derived: (1)Comprehensive; (2) Limited; and (3) None. The definitions of the three groups were as follows:

> (1) Comprehensive - Any dentist who uses bonded orthodontic appliances to treat Class I, II or III malocclusions. This group was based on the subject responding yes (periodically or routinely) to question 7k which inquires about treatment of Class I malocclusions with fixed appliances. The assumption was made that if the respondent answered yes to treating Class II (question 7l) or Class III (question 7m) malocclusions then they also answered yes to treating Class I malocclusions (question 7k). Therefore, questions 7l and 7m were not used in defining this group.
>
> (2) Limited - Any dentist who periodically or routinely performs the following orthodontic services: space maintainers, treatment of minor tooth malpositions with removable appliances (spaces, rotations), molar uprighting, or treatment of anterior or posterior crossbites. These correspond to questions 7b, 7d, 7f, 7g, and 7h on the survey.

(3) None - Any dentist who indicated that they provide no orthodontic treatment whatsoever. This group was calculated by evaluating the mean number of individuals who responded "no" to providing any of the services used in defining the limited group (questions 7b, 7d, 7f, 7g, and 7h.

Practice Profile

The results suggest that for the present sample, only 32.6% of the general dentists in Ohio are rendering orthodontic treatment. The percentages of orthodontic services provided by each of the three groups are as follows: (1) 11.3% of the general dentists provide comprehensive orthodontic care; (2) 21.3% of the general dentists provide limited orthodontic care; and (3) 67.4% of the general dentists do not provide any orthodontic care (See Figure 5).

TABLE 1.--Orthodontic services provided by general dentists in Ohio.

Service	*No(%)	*P(%)	*R(%)	N
Diagnostic services	36.7	25.6	37.7	515
Space maintainers	37.9	38.7	23.4	517
Preventive/interceptive tx	67.3	20.0	12.7	510
Tx of minor tooth malpositions with removable appliances	67.1	20.4	12.5	511
Tx of minor tooth malpositions with fixed appliances	82.8	9.0	8.2	513
Molar uprighting	82.3	10.4	7.3	508
Tx of anterior crossbites	77.4	14.2	8.4	513
Tx of posterior crossbites	84.1	8.6	7.3	510
Tx with headgear	97.5	1.2	1.4	511
Tx with functional appliances	87.7	7.0	5.3	512
Comprehensive tx with fully banded appliances - Class I	88.3	3.7	8.0	512
Comprehensive tx with fully banded appliances - Class II	90.4	2.3	7.2	512
Comprehensive tx with fully banded appliances - Class III	94.7	3.3	2.0	511
Tx of orthognathic surgery patients	97.4	1.8	0.8	509

*No = None, P = Periodically, R = Routinely

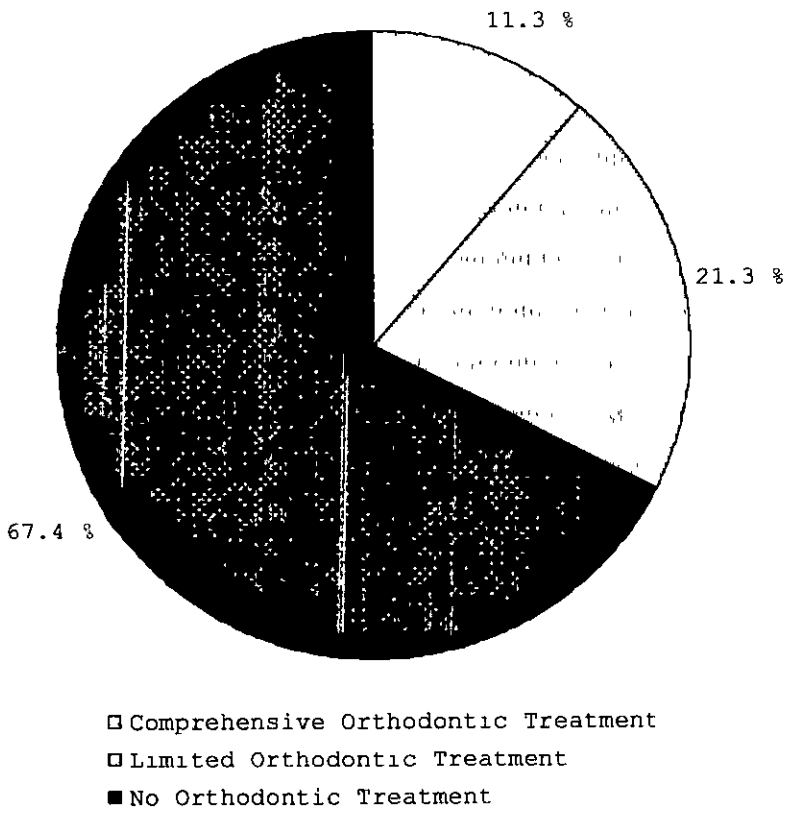


Figure 5. Pie chart representing the distribution of orthodontic treatment provided by general dentists in Ohio.

Overall Patient Load When examining trends over the past five years in the overall patient load experienced by general dentists, 74.9% of the responders reported an increase in the number of patients seen in their practice. Only 7.5% of dentists reported a decrease in overall patient activity, and 17.6% claimed no change. A breakdown of the overall patient load by provider group is shown in Figure 6. The majority of providers in all categories reported that they had seen an increase in their overall general dentistry patient load (74.1% comprehensive; 78.8% limited; and 74% no treatment group). There was no statistically significant relationship with provider type.

Orthodontic Patient Load In addition to examining trends in the general patient load for dentists, another focus was to assess shifts in orthodontic patient loads among dentists. For the present sample, 24.8% reported an increase in orthodontic patient load over the course of the past five years, while 12.8% reported no change, and 62.4% reported a decrease in orthodontic patient activity. Trends were also explored for orthodontic provider groups identified in this study. Of the practitioners in the comprehensive group, 58.6% claimed an increase in orthodontic patient activity. Only 22.8% of those dentists providing limited orthodontic care reported an

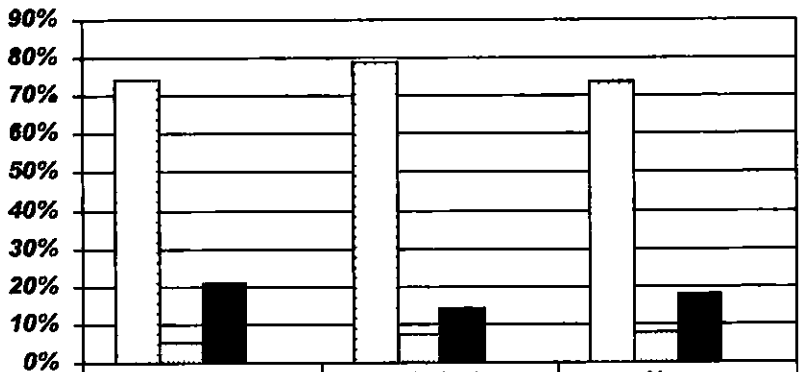
increase in orthodontic patient activity. A frequency distribution for this data is presented in Figure 7.

Results indicated a statistically significant difference among provider groups was found for changes in orthodontic patient load over the past five years (Chi-square = 48.91, DF = 4, p = 0.00000). Of all dentists who reported providing comprehensive care, 58.6% reported an increase in their orthodontic patient load over the past five years, suggesting a larger increase in the orthodontic patient load for dentists in this group compared with those in the limited or no treatment groups.

Time Spent Rendering Orthodontic Services Assessment of the percentage of practice time spent providing orthodontic services revealed that 63.3% of the dentists reported that they currently spent no time rendering orthodontic treatment. Thirty-five and one-tenth percent of the general dentists who provide orthodontic care indicated that they spent 1-25% of their practice time providing these services. Only 1.4% spend between 26-50% of their time providing orthodontic treatment. One general dentist (0.2%) spent between 51-75% of his time providing orthodontic care. The majority of the practitioners in the comprehensive and limited groups, 86.2% and 71.1% respectively, spent between 1-25% of their practice time providing orthodontic care. These results

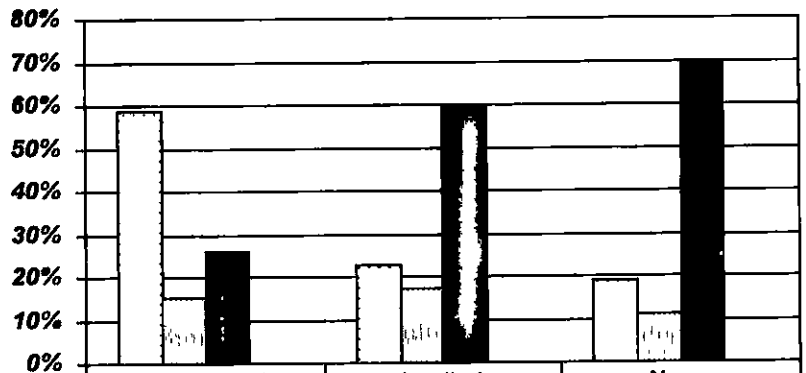
are displayed in Figure 8.

The percentage of practice time spent providing orthodontic treatment as a function of type of provider was found to be statistically significant as well (Chi-square = 31.20, DF = 2, p = 0.00000), with two primary peaks identified in the 1-25% of practice time spent. The comprehensive and limited provider groups reported the largest number and percentage of practitioners in this range (i.e., 86.2% and 71.1%, respectively).



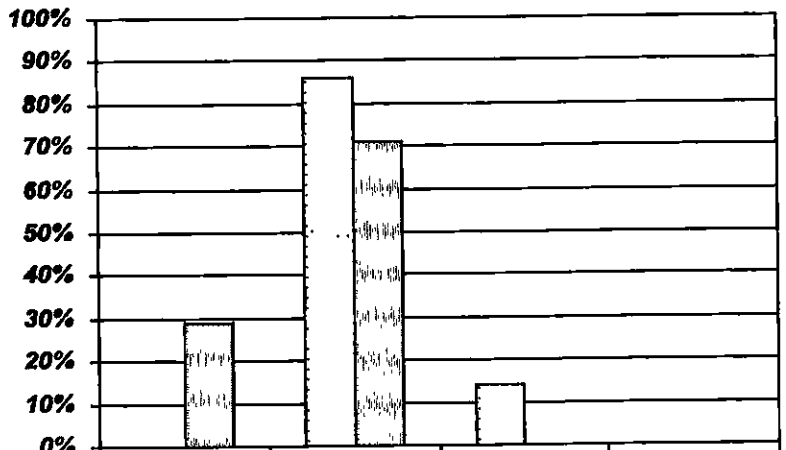
	Comprehensive	Limited	None
Increased	74 1%	78.8%	74%
Decreased	5 2%	7.1%	8%
Same	20.7%	14.1%	18%
Sample Size	n = 58	n = 99	n = 361

Figure 6. Bar chart showing the changes in overall patient load for general dentists during the past five years grouped by level of orthodontic services provided.



	Comprehensive	Limited	None
Increased	58.6%	22 8%	19 2%
Decreased	15 5%	17 4%	11%
Same	25 9%	59.8%	69.8%
Sample Size	n = 58	n = 92	n = 318

Figure 7. Bar chart demonstrating the changes in orthodontic patient load for general dentists during the past five years grouped by level of orthodontic services provided.



	0%	1-25%	> 25%	Sample Size
Comprehensive	0%	86.2%	13.8%	n = 58
Limited	28.9%	71.1%	0%	n = 97

Figure 8. Bar chart representing the percent of practice time spent by general dentists providing orthodontic treatment grouped by level of orthodontic services provided.

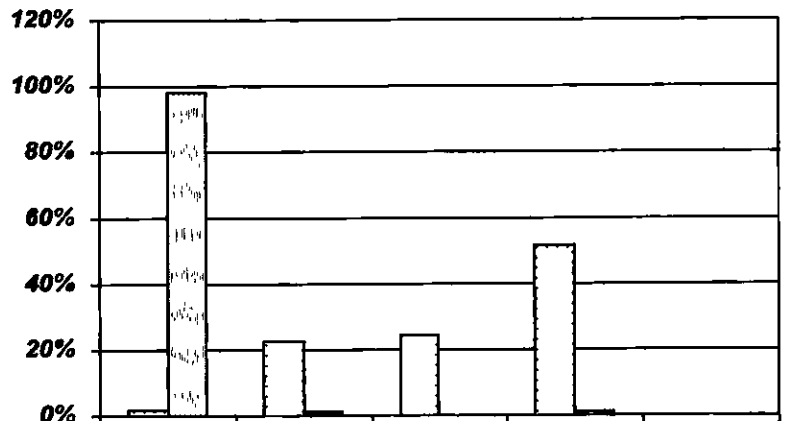
Comprehensive Orthodontic Care Provided Another focus of this investigation was to explore the timing and amount of comprehensive treatment provided by general dentists who reported doing this kind of work. In evaluating responses of those general dentists who report providing comprehensive orthodontic care, there were several interesting findings. A relatively consistent number of dentists in the comprehensive group reported that they had been treating comprehensive cases for one to more than fifteen years, suggesting that the provision of such services may be independent of changes in the dentistry market. The range of comprehensive providers from year one to more than fifteen years was only 2.5-3.5%, accounting for a difference of only five dentists. These trends are presented in Figure 9.

The relationship between the number of years providing comprehensive orthodontic treatment and provider type was statistically significant (Chi-square = 143.64, DF = 3, p = 0.00000). As expected, the comprehensive group as a whole reported treating significantly more cases in all categories of years of treatment compared with the limited group who reported zero years of treatment of comprehensive cases.

When asked about the number of comprehensive orthodontic cases in active treatment, results indicated

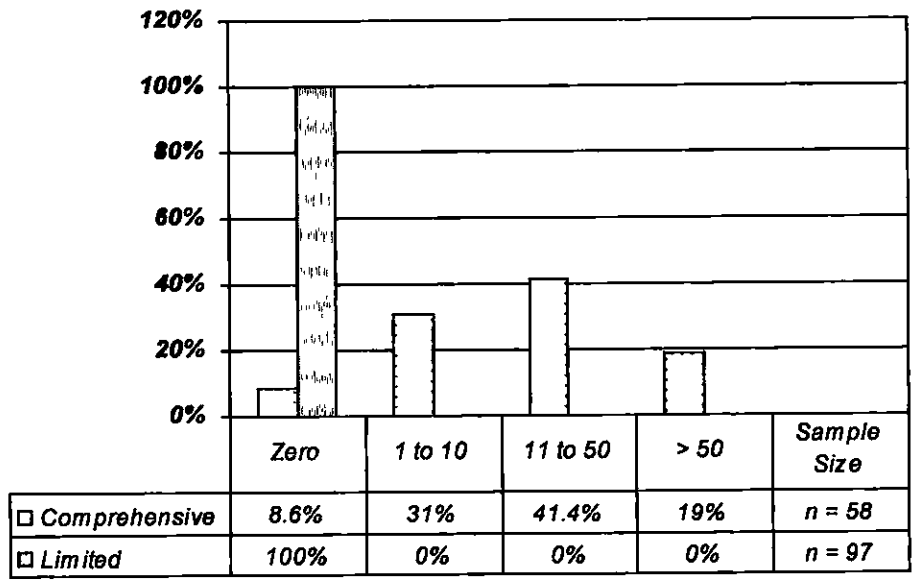
that 4.1% of the dentists were treating between 1-10 patients, 5.5% were treating 11-50 patients, 1.8% were treating 51-100 and only 0.6% of the dentists were comprehensive providers to more than one hundred patients. The distribution according to provider group is shown in Figure 10.

Statistically significant differences among provider groups were found for the number of comprehensive orthodontic cases in active treatment (Chi-square = 134.69, DF = 3, p = 0.00000). Thirty-one percent of the participants in the comprehensive treatment group reported having 1-10 active cases and 41.4% reported that they had approximately 11-50 patients in active treatment for complex orthodontic problems. Five and two tenths percent of the comprehensive group indicated that they have more than one hundred open comprehensive cases.



	Zero	1 to 5	6 to 10	> 10	Sample Size
Comprehensive	1 7%	22.4%	24 1%	51.7%	n = 58
Limited	98%	1%	0%	1%	n = 98

Figure 9. Bar chart displaying the number of years general dentists have been providing comprehensive orthodontic treatment grouped by level of orthodontic services provided.



	Zero	1 to 10	11 to 50	> 50	Sample Size
Comprehensive	8.6%	31%	41.4%	19%	n = 58
Limited	100%	0%	0%	0%	n = 97

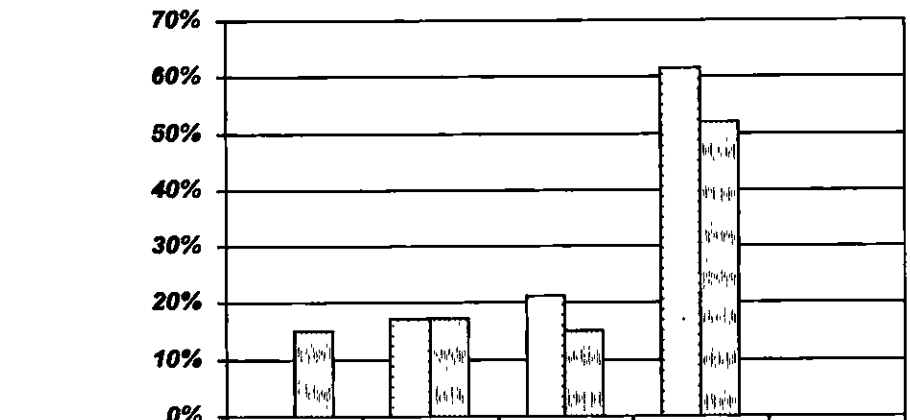
Figure 10. Bar chart showing the number of comprehensive orthodontic cases general dentists have in active treatment grouped by level of orthodontic services provided.

Limited Orthodontic Services Provided Evaluation of the number of years dentists had been treating limited orthodontic cases yielded the following results: Eight and eight-tenths percent had been treating limited cases between 1-5 years; 6.7% for 6-10 years; 8% for 11-15 years; and 16.4% reported treating limited cases for more than fifteen years. The distribution by provider group is shown in Figure 11. The majority of dentists providing limited and comprehensive orthodontic care reported that they had been treating limited cases for more than fifteen years (i.e., 40.8% and 36.8%, respectively).

Statistically significant differences were obtained for the number of years providing limited orthodontic treatment (Chi-square = 9.98, DF = 3, p = 0.01876). The groups treating the greatest number of limited orthodontic patients reported that they have been providing these services for fifteen or more years. Very few participants reported that they have been providing limited orthodontic services for less than a year.

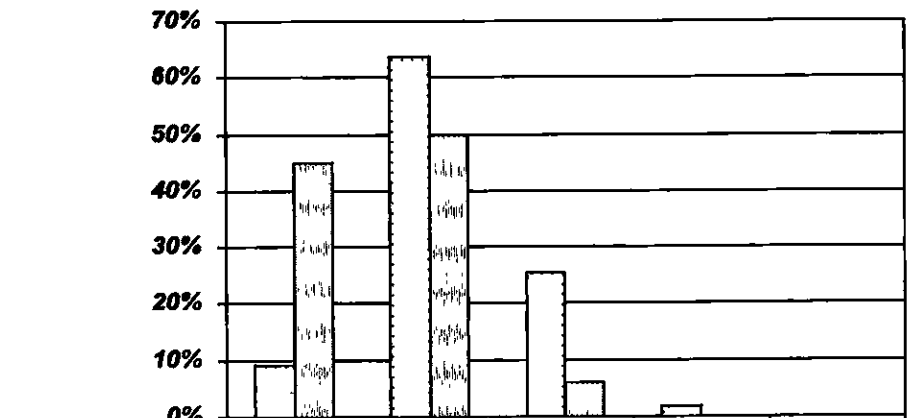
In addition to the number of years providing limited services, the number of limited patients in active treatment was also assessed. The majority of those practitioners providing limited orthodontic treatment (23.4%) had between 1-10 active limited patients. Four and seven-tenths percent had between 11-50 patients and

only one dentist (0.2%) had between 51-100 limited orthodontic patients. Results indicated that a statistically significant difference existed for the number of limited orthodontic cases in active treatment (Chi-square = 27.35, DF = 3, p = 0.00000). These results are illustrated as a function of provider type in Figure 12.



	Zero	1 to 5	6 to 10	> 10	Sample Size
Comprehensive	0%	17.5%	21 1%	61 4%	n = 57
Limited	15.3%	17.3%	15.3%	52%	n = 98

Figure 11. Bar chart showing the number of years general dentists have been providing limited orthodontic treatment grouped by level of orthodontic services provided.



	Zero	1 to 10	11 to 50	> 50	Sample Size
Comprehensive	9 1%	63.6%	25.5%	1.8%	n = 55
Limited	44.9%	49.9%	6.1%	0%	n = 98

Figure 12. Bar chart illustrating the number of limited orthodontic cases general dentists have in active treatment grouped by level of orthodontic services provided.

Community Factors Dentists were also asked specific questions about the location of their practice in order to address issues of proximity to specialized providers as well as other variables impacting referral patterns. These questions were aimed at gaining information about the community population, proximity to the closest orthodontic office, the number of active general dentists within a ten mile radius and the number of orthodontists within a ten mile radius. None of the practitioners reported having a primary office located in a community of less than one thousand people. Thirteen and six-tenths percent of the practitioners were practicing in a community between 1,000-9,999, 48.7% were in communities between 10,000-99,999, and sixteen percent were located in areas of 100,000-499,999 people. Twenty-one and seven-tenths percent practiced in a community of greater than 500,000 people. A distribution of the community population by type of provider is shown in Figure 13. The majority of respondents in each category indicated that they practice in communities of approximately 10,000-99,000 people.

Similar frequency distributions for office location were evident for those who had a second office. Figure 14 illustrates trends with regard to community population and secondary practice location according to practice type.

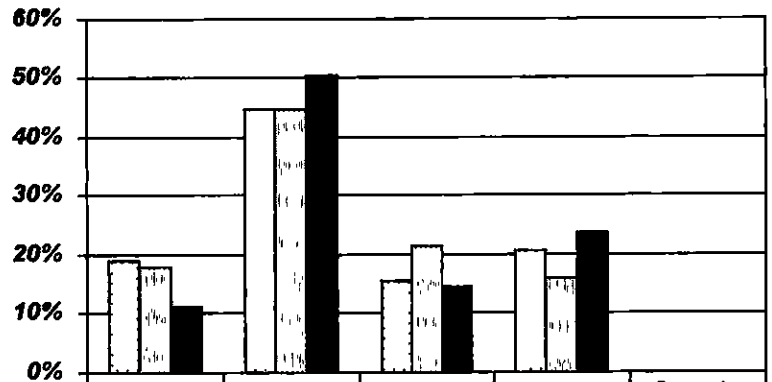
Trends here were similar to those for the primary office, with the exception of the comprehensive group in which one hundred percent of respondents reported that their second office was located in communities of 10,000-99,000 people. The population of the community in which either a primary or secondary office is located was not significantly related to provider type.

Proximity to other dentists Another community factor examined was the number of active general dentists within a ten mile radius of the practitioner's primary office. Results indicated that for the total sample, only two dentists (0.2%) practiced more than ten miles from another dentist. Six and seven-tenths percent of the participants reported being near 1-5 other dentists, 15% were near 6-10 other dentists, 22.1% near 11-20, 24.2% near 21-50 and the most (31.7%) reported being within ten miles of more than fifty other dentists. Figure 15 displays this distribution according to practice type. The majority of practitioners within the three groups reported practicing near 11-20 other dentists (i.e., 33.9% comprehensive orthodontic care; 25.5% limited care; and 22.1% no treatment). There was no statistically significant relationship with provider type.

Proximity to Orthodontists Another primary interest in this study was the proximity of dentists to orthodontic

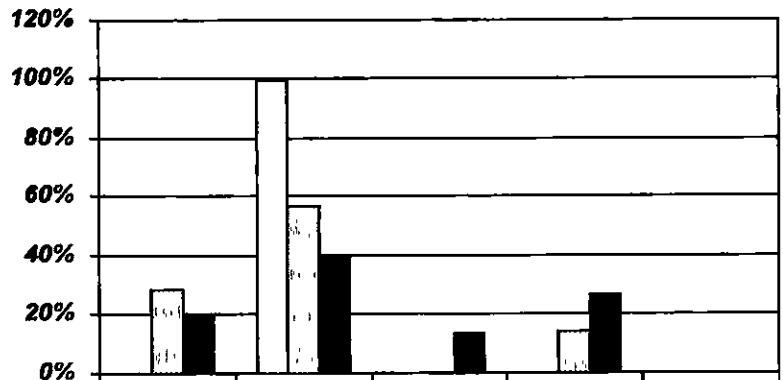
specialists and the relationship of this to referral and practice patterns for dentists. Thus, an additional question asked about the number of active orthodontists within a ten mile radius. Results found that 4.8% of the general dentists were not near any orthodontists, 44% were close to 1-5 orthodontists, 24.7% were near 6-10 orthodontists, 16.1% were by 11-20, 9.2% were near 21-50 and 1.3% of the dentists reported being within ten miles of more than fifty orthodontists. The distribution for orthodontists within ten miles of a dentist according to group type is displayed in Figure 16. A statistically significant relationship was not found as percentages were fairly evenly distributed across treatment groups.

A large percentage (83.7%) of the general dentists were practicing within four miles of an orthodontist. 10.8% were 5-10 miles from an orthodontist, 4.8% were 11-20 miles away and 0.8% were greater than twenty miles from an orthodontist. Surprisingly, the distribution when broken down by provider type followed the same pattern and was not statistically significant. This suggests that the distance from an orthodontist has no effect on whether or not general dentists provide orthodontic care. This is evident in Figure 17.



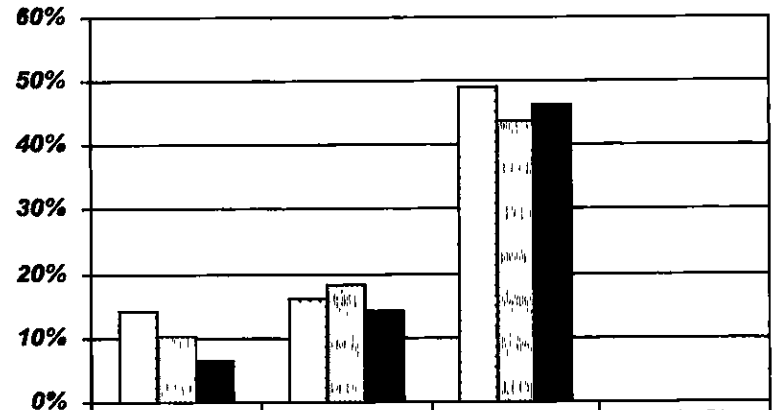
	1,000-9,999	10,000-99,999	100,000-499,999	> 500,000	Sample Size
☐ Comprehensive	19%	44.8%	15 5%	20 7%	n = 58
☐ Limited	18.1%	44.7%	21 3%	16%	n = 94
■ None	11.3%	50.6%	14.5%	23 6%	n = 318

Figure 13. Bar chart showing the population of the community in which the general dentist's primary office is located grouped by level of orthodontic services provided.



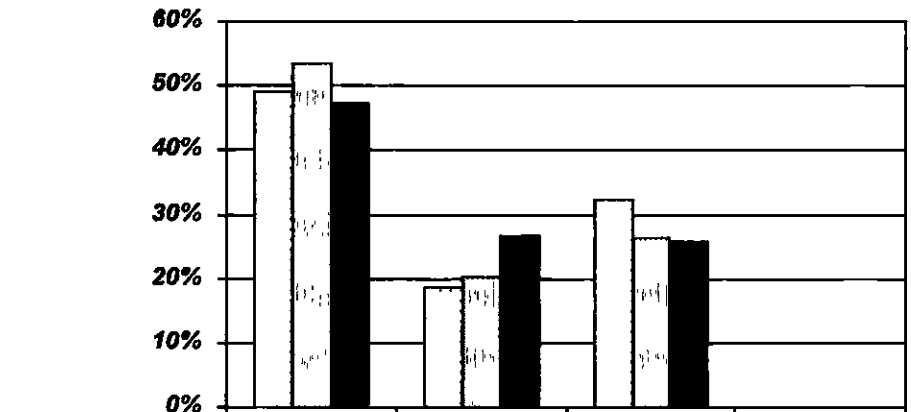
	1,000-9,999	10,000-99,999	100,000-499,999	> 500,000	Sample Size
Comprehensive	0%	100%	0%	0%	n = 2
Limited	28.6%	57.1%	0%	14 3%	n = 7
None	20%	40%	13.3%	26.7%	n = 15

Figure 14. Bar chart illustrating the population of the community in which the general dentist's secondary office is located grouped by level of orthodontic services provided.



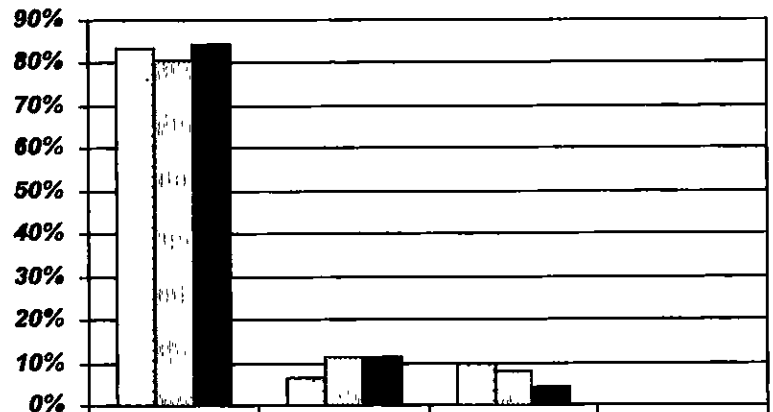
	0 to 5	6 to 10	> 10	Sample Size
Comprehensive	14.3%	16.1%	49.2%	n = 56
Limited	10%	18 4%	43.9%	n = 98
None	6.6%	14 2%	46.4%	n = 367

Figure 15. Bar chart representing the number of active general dentists within ten miles of another general dentists' office grouped by level of orthodontic services provided.



	0 to 5	6 to 10	> 10	Sample Size
Comprehensive	49.2%	18.6%	32.3%	n = 59
Limited	53.6%	20.2%	26 3%	n = 99
None	47 4%	26.8%	25 7%	n = 365

Figure 16. Bar chart illustrating the number of active orthodontists within ten miles of a general dental office grouped by level of orthodontic services provided.



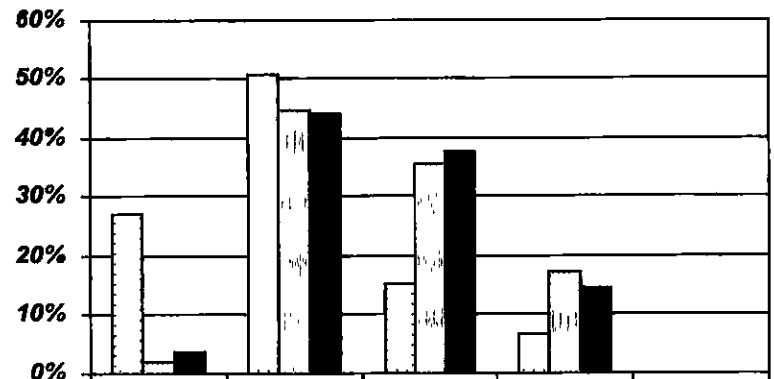
	< 4 miles	5-10 miles	> 10 miles	Sample Size
Comprehensive	83 3%	6.7%	10%	n = 60
Limited	80.8%	11.1%	8.1%	n = 99
None	84.5%	11.4%	4%	n = 367

Figure 17. Bar chart representing the distance from the general dentists' office to the closest orthodontic office grouped by level of orthodontic services provided.

Referral Patterns A key area of focus in the present investigation was the referral patterns of dentists who report various levels of involvement in providing specialized, orthodontic services. Two questions were asked about referral patterns of dentists to orthodontists. The first question examined the number of patients referred each month. Six and one-tenth percent of the dentists did not refer any patients to an orthodontic specialist a month. The majority (44.9%) referred 1-4 patients a month, followed by 34.7% who referred 5-10 patients, 12.9% referred 11-20 and 1.3% who reported referring more than twenty patients a month. Figure 18 shows the monthly referral patterns by dentists to orthodontists as a function of provider type. It is clear from this figure that those dentists who provide comprehensive orthodontic care refer significantly fewer patients to orthodontists. Chi-square results indicated that dentists in the comprehensive group refer significantly fewer patients to their orthodontic colleagues than dentists in either the limited or no treatment groups (Chi-square = 58.97, DF = 6, p = 0.00000). Approximately 66.1% of the practitioners in the comprehensive group reported that they refer between 1-10 orthodontic patients a month and 27.1% reported that they did not refer at all. In contrast, 81.1% of the combined

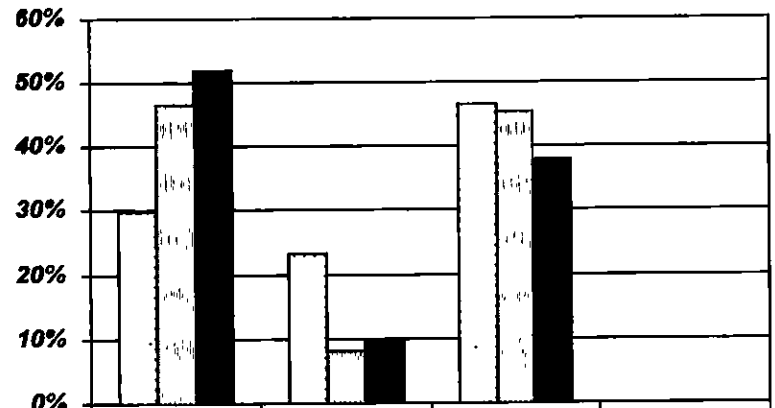
limited and none groups referred between 1-10 patients a month and only 5.8% indicated that they did not make any orthodontic referrals at all.

According to the data, referrals from general dentists to orthodontists over the past five years have been on the rise. Forty-eight and four-tenths percent of the dentists reported an increase in the number of patients being referred to the orthodontist for examination. Only 11.2% of the practitioners reported a decrease and 40.4% indicated no change in referral patterns over the past five years. Evaluation of referral patterns by provider type (see Figure 19) suggests that those providers represented in the comprehensive group are referring significantly fewer patients to the orthodontic specialist when compared with the dentists in the limited and no treatment groups. A statistically significant relationship was found between the number of orthodontic referrals given over the past five years and provider type. In contrast to dentists in the comprehensive group, the majority of the dentists in the limited and no treatment groups reported overall increases in the number of referrals they had made over the past five years.



	Zero	1 to 4	5 to 10	> 10	Sample Size
☐ Comprehensive	27 1%	50.8%	15.3%	6 8%	n = 59
☐ Limited	2%	44 9%	35 7%	17.3%	n = 98
■ None	3.8%	44%	37.6%	14 6%	n = 364

Figure 18. Bar chart showing the number of patients referred by a general dentist to an orthodontist each month grouped by level of orthodontic services provided.



	Inreased	Decreased	Same	Sample Size
Comprehensive	30%	23.3%	46.7%	n = 60
Limited	46 5%	8.1%	45.5%	n = 99
None	51 9%	10.1%	38%	n = 366

Figure 19. Bar chart showing the number of orthodontic referrals given by general dentists over the past five years grouped by level of orthodontic services provided.

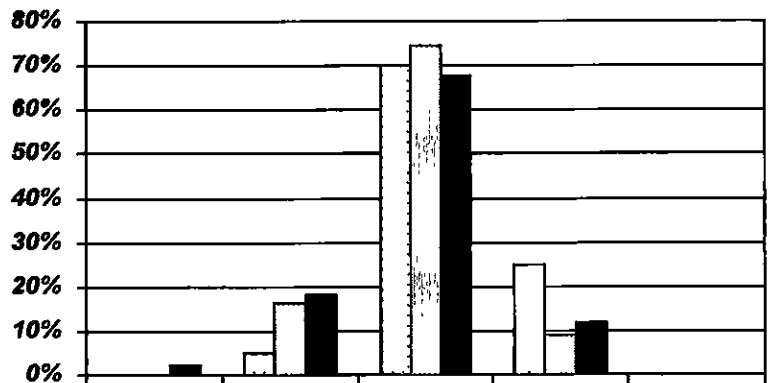
Continuing Education Three questions were directed at obtaining information about the amount and type of continuing education received each year. Question twenty-three was a general question which asked about the total number of hours of continuing education (CE) courses attended per year. One percent reported not attending any continuing education courses at all. Six-tenths percent attended 1-10 hours per year, 16.2% attended 11-20 hours per year, 69.5% attended 21-50 hours, 10.1% attended 51-100 and 2.7% reported that they received more than one hundred hours of continuing education credits per year. The frequency distribution of continuing education courses attended as a function of provider type is illustrated in Figure 20. Statistically significant differences were found among groups with more dentists in the comprehensive group reporting attending a larger number of CE courses per year (Chi-square = 17.79, DF = 6, p = 0.00678).

The next question examined the number of hours spent per year attending CE courses in orthodontics. Sixty and eight-tenths percent reported that they do not attend any CE courses pertaining to orthodontics. Thirty-two and three-tenths percent of the dentists attend between 1-10 hours per year, 4.2% attend 11-20 hours, 1.7% attend 21-50 hours, 0.6% attend 51-100 hours and two people (0.4%) reported that they attended more than one hundred hours

worth of CE courses a year aimed at instruction in orthodontics. Figure 21 illustrates the frequency distribution of the total number of hours of CE courses in orthodontics attended per year broken down by provider type. Results indicate that a larger percentage of those dentists who provide comprehensive orthodontic services attend significantly more hours of CE courses in orthodontics per year. Statistically significant differences among groups were found for the total number of CE courses specifically taken in orthodontics per year (Chi-square = 214.42, DF = 6, p = 0.00000). While 49.9% of the limited and none groups, combined, reported attending ten hours or less in CE courses in orthodontics per year, more than half (i.e., 51.7%) of the dentists in the comprehensive group reported that they attended eleven hours or more a year of CE in orthodontics.

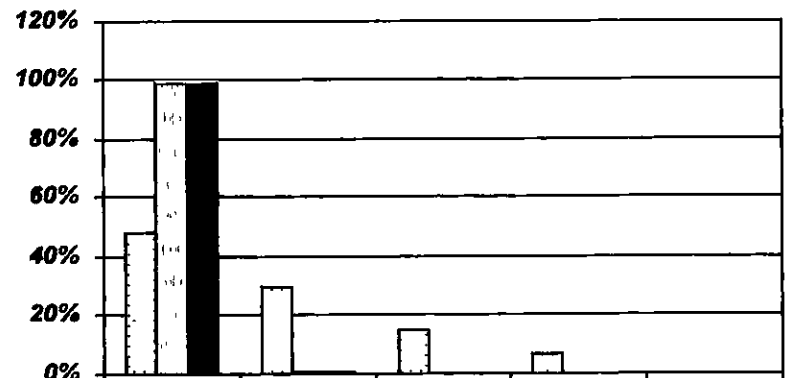
The final question pertaining to CE courses in orthodontics examined the trend in the number of CE hours taken in this specialty in the past five years. Eight and nine-tenths percent reported an increase, 14.7% indicated a decrease and 76.3% reported no change. When this question was examined as a function of provider type, it was evident that more dentists who provided comprehensive treatment reported an increase in CE courses taken than those who reported a decrease. However, the majority of

dentists in the limited and no treatment groups reported that the number of CE hours taken in orthodontics had remained the same. Figure 22 displays these trends. Finally, in exploring trends in orthodontic CE courses taken in the past five years, significantly more (i.e., 35.6%) of the dentists in the comprehensive group reported an increase in their attendance while only 12.5% of the limited and no treatment groups combined reported an increase (Chi-square = 82.19, DF = 4, p = 0.00000). The majority of these two groups reported no change in their attendance patterns.



	0 to 10	11 to 20	21 to 50	> 50	Sample Size
□ Comprehensive	0%	5%	70%	25%	n = 60
□ Limited	0%	16 2%	74.7%	9 1%	n = 99
■ None	2.2%	18.1%	67 9%	11.8%	n = 365

Figure 20. Bar chart displaying the annual number of continuing education hours attended by a general dentist per year grouped by level of orthodontic services provided.



	0 to 10	11 to 20	21 to 50	> 50	Sample Size
Comprehensive	48%	30%	15%	6 7%	n = 60
Limited	99%	1%	0%	0%	n = 99
None	98.9%	0 8%	0%	0 3%	n = 364

Figure 21. Bar chart showing the total number of continuing education hours in orthodontics attended by general dentists per year grouped by level of orthodontic services provided.



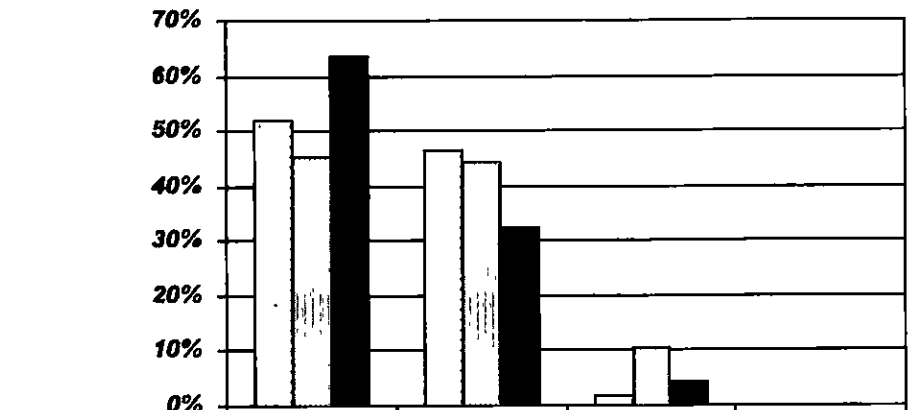
	Increased	Decreased	Same	Sample Size
Comprehensive	35 6%	25.4%	39%	n = 59
Limited	8.2%	22.4%	69 4%	n = 98
None	4.3%	10 5%	85.2%	n = 325

Figure 22. Bar chart showing the total number of continuing education hours in orthodontics taken by general dentists in the past five years grouped by level of orthodontic services provided.

Orthodontic Treatment While in Dental School Question twenty-six inquired about the number of limited and comprehensive orthodontic cases treated while in dental school. The data revealed that the majority (58.8%) of dentists did not treat any limited orthodontic cases while in dental school. Thirty-six and one-tenth percent treated between 1-3 limited cases, 4.3% treated between 4-6 patients, 0.6% treated 7-10 and 0.2% treated more than ten limited orthodontic treatment cases while in dental school. Results indicated that a large percentage of dentists in the no treatment group (65%) had never treated a limited orthodontic case while in dental school (Chi-square = 17.13, DF = 4, p = 0.00183). This compares to 48.5% of the comprehensive and limited groups, combined, who reported that they never treated a limited orthodontic case while in dental school. The majority of those dentists who did provide limited orthodontic care fell into the category of treating 1-3 patients prior to graduating from dental school.

With regard to treating comprehensive orthodontic cases while in dental school, 92.5% of dentists reported that they did not treat any such cases. Six and one-half percent treated 1-3 cases and one percent treated 4-6 comprehensive patients. The breakdown by provider type demonstrates comparable response percentages among groups

and was not statistically significant. These data are represented in Figures 23 and 24.



	Zero	1 to 3	> 3	Sample Size
Comprehensive	51.7%	46.6%	1.7%	n = 58
Limited	45.3%	44.2%	10.6%	n = 95
None	63.5%	32.3%	4.3%	n = 359

Figure 23. Bar chart displaying the number of limited orthodontic cases treated by general dentists while in dental school grouped by level of orthodontic services provided.

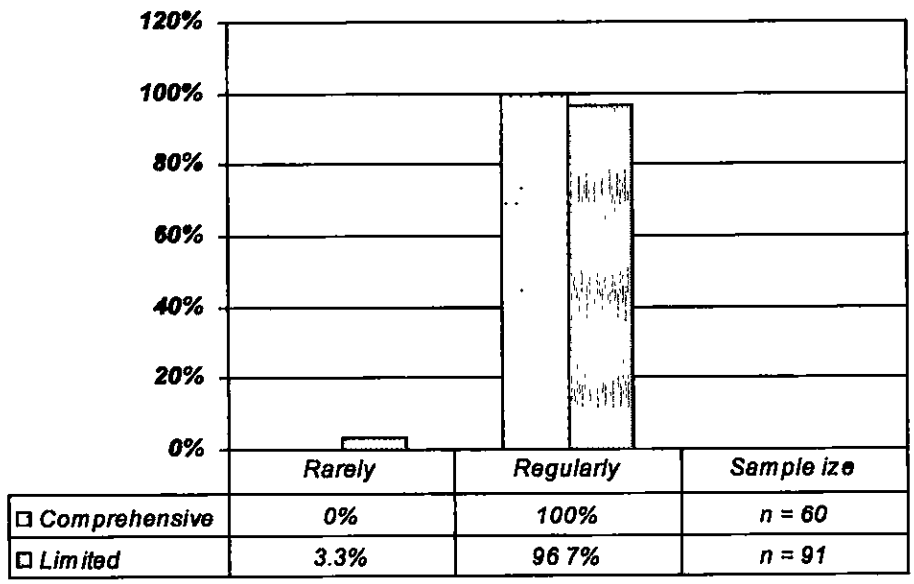


	Zero	1 to 3	> 3	Sample Size
□ Comprehensive	90%	10%	0%	n = 50
□ Limited	88.4%	10.1%	1 4%	n = 69
■ None	94%	4.9%	1 1%	n = 267

Figure 24. Bar chart representing the number of comprehensive orthodontic cases treated by general dentists while in dental school grouped by level of orthodontic services provided.

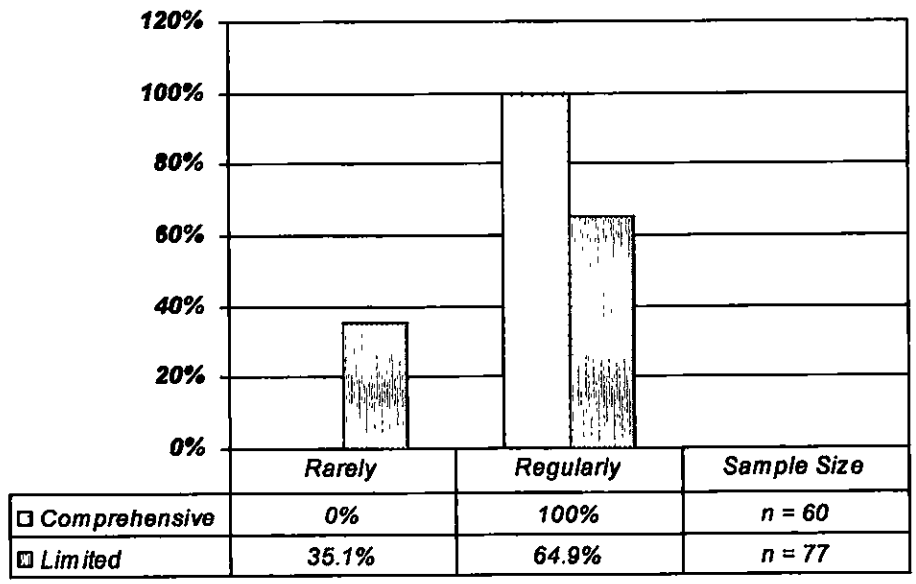
Pre-treatment Records Taken and Treatment Planning An additional area of inquiry was the kind of records taken when dentists treat orthodontic cases. Thus, questions twenty-seven and twenty-eight examined the pretreatment orthodontic records obtained and several common methods used when formulating an orthodontic treatment plan. The majority of the dentists in the comprehensive orthodontic provider group reported that they regularly take the following pre-treatment records: A clinical exam (98.3%); study models (98.3%); extra oral photos (79.3%); intra-oral photos (75%); panoramic radiographs (96.7%); bitewing radiographs (86.2%); a lateral cephalogram (76.7%); and a TMJ exam (65.5%). Those records not regularly gathered by the majority of the providers in this group included: periapical/full mouth radiographs; P-A cephalograms; transcranial radiographs or tomograms. The pretreatment records gathered by the majority of those dentists in the limited orthodontic treatment provider group followed the same trends as those in the comprehensive provider group with a few exceptions. The majority in this group reported that they do not regularly take intra or extra-oral photos, lateral cephalograms or perform TMJ exams. However, the majority in this group did report taking periapical/full mouth radiographs prior to treating their

limited orthodontic treatment patients. These trends are evident in Figures 25 through 36.



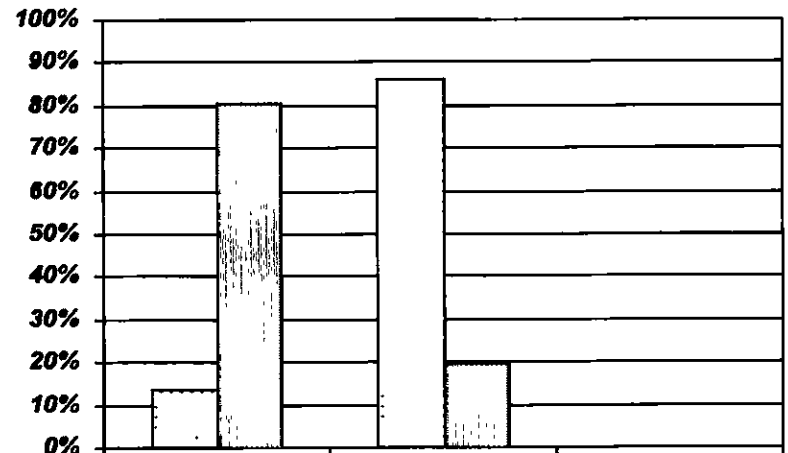
	Rarely	Regularly	Sample size
Comprehensive	0%	100%	n = 60
Limited	3.3%	96.7%	n = 91

Figure 25. Bar chart for the performance of a pre-treatment clinical exam by general dentists for orthodontic patients grouped by level of orthodontic services provided.



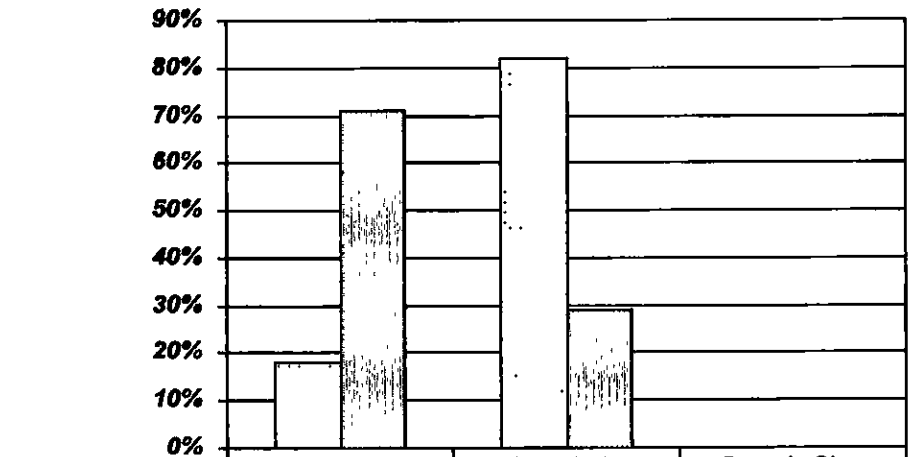
	Rarely	Regularly	Sample Size
Comprehensive	0%	100%	n = 60
Limited	35.1%	64.9%	n = 77

Figure 26. Bar chart showing the performance of pre-treatment study models taken by general dentists for orthodontic patients grouped by level of orthodontic services provided.



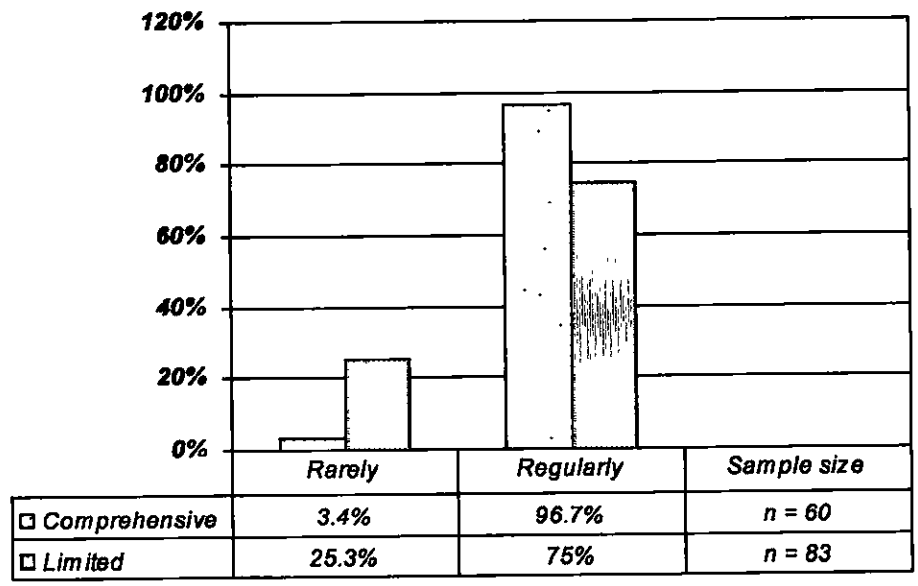
	Rarely	Regularly	Sample Size
Comprehensive	13.7%	86.2%	n = 58
Limited	80.6%	19.4%	n = 67

Figure 27. Bar chart showing pre-treatment extra oral photos taken by general dentists for orthodontic patients grouped by level of orthodontic services provided.



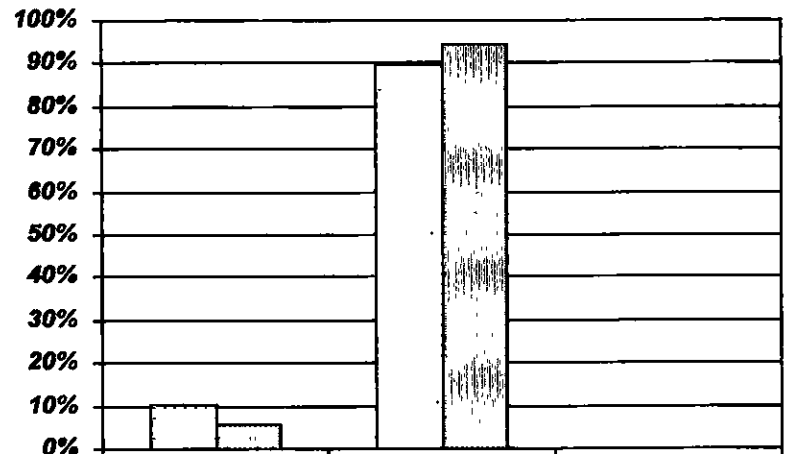
	Rarely	Regularly	Sample Size
Comprehensive	17.9%	82%	n = 56
Limited	71%	29%	n = 69

Figure 28. Bar chart displaying pre-treatment intra-oral photos taken by general dentists for orthodontic patients grouped by level of orthodontic services provided.



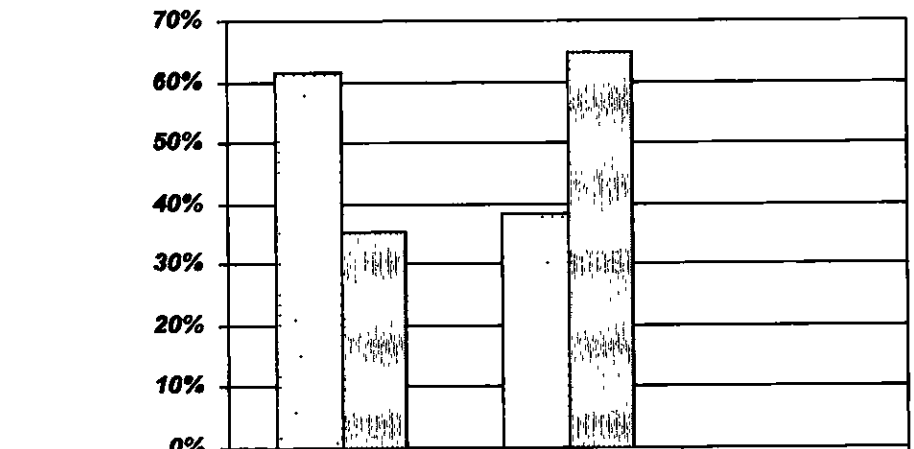
	Rarely	Regularly	Sample size
Comprehensive	3.4%	96.7%	n = 60
Limited	25.3%	75%	n = 83

Figure 29. Bar chart illustrating pre-treatment panoramic radiographs taken by general dentists for orthodontic patients grouped by level of orthodontic services provided.



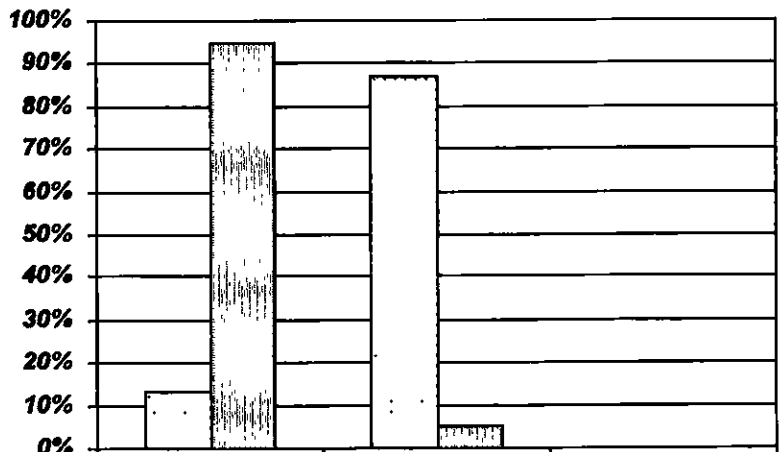
	Rarely	Regularly	Sample Size
Comprehensive	10 3%	89.6%	n = 58
Limited	5.6%	94.4%	n = 89

Figure 30. Bar chart for pre-treatment bitewing radiographs taken by general dentists for orthodontic patients grouped by level of orthodontic services provided.



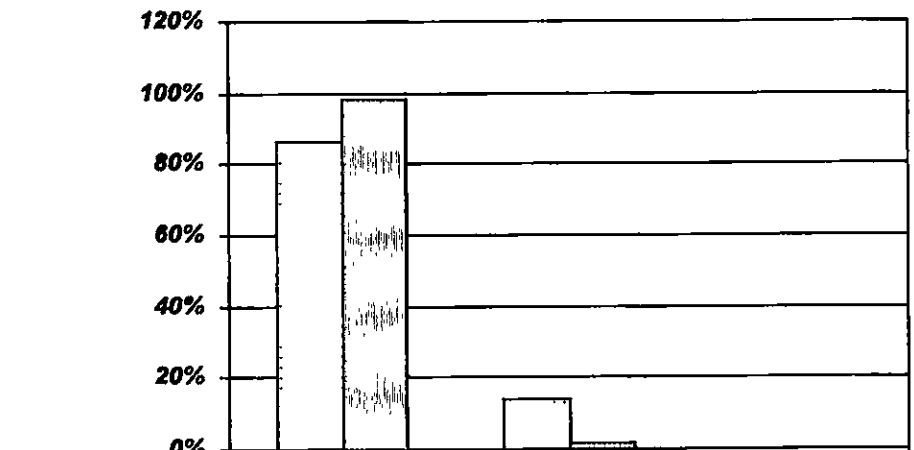
	Rarely	Regularly	Sample Size
Comprehensive	61.5%	38.4%	n = 52
Limited	35.2%	64.9%	n = 74

Figure 31. Bar chart demonstrating pre-treatment periapical/full mouth radiographs taken by general dentists for orthodontic patients grouped by level of orthodontic services provided.



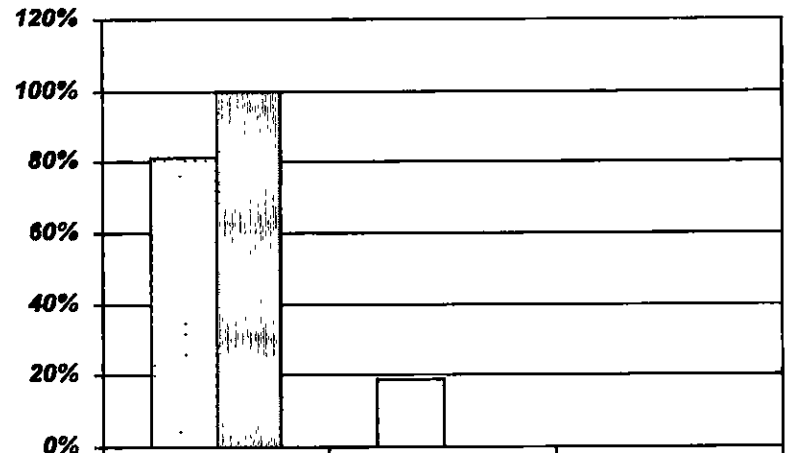
	Rarely	Regularly	Sample Size
Comprehensive	13%	86.7%	n = 60
Limited	94.9%	5.2%	n = 58

Figure 32. Bar chart representing pre-treatment lateral cephalograms taken by general dentists for orthodontic patients grouped by level of orthodontic services provided.



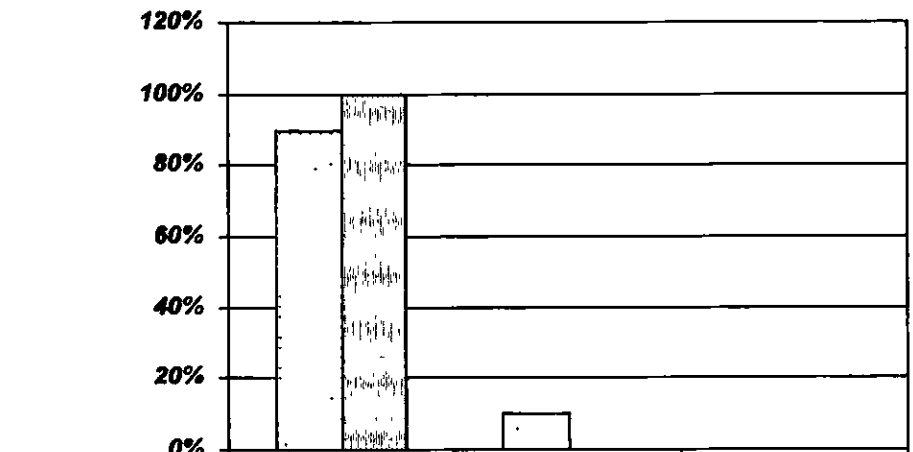
	Rarely	Regularly	Sample Size
Comprehensive	86.3%	13.8%	n = 51
Limited	98 2%	1.8%	n = 57

Figure 33. Bar chart showing pre-treatment P-A cephalograms taken by general dentists for orthodontic patients grouped by level of orthodontic services provided.



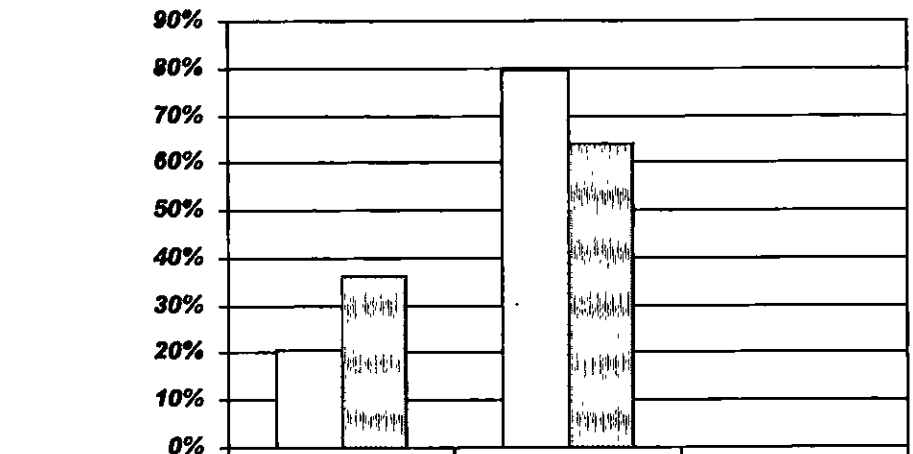
	Rarely	Regularly	Sample Size
Comprehensive	81.2%	18.8%	n = 53
Limited	100.0%	0%	n = 58

Figure 34. Bar chart for pre-treatment transcranial radiographs taken by general dentists for orthodontic patients grouped by level of orthodontic services provided.



	Rarely	Regularly	Sample Size
Comprehensive	90%	10%	n = 50
Limited	100%	0%	n = 57

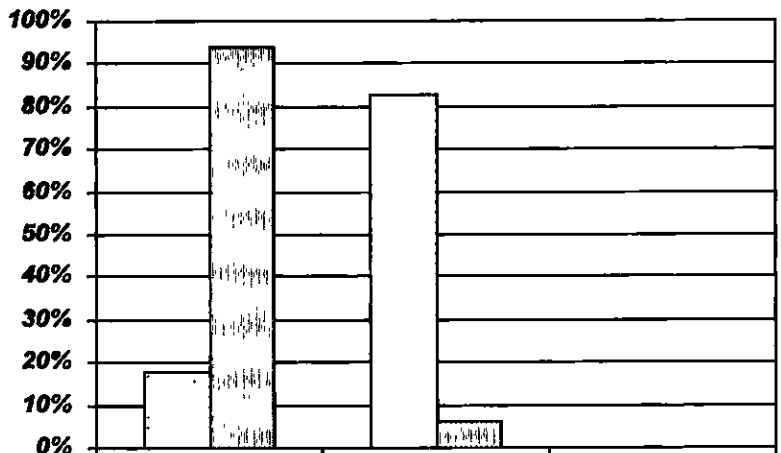
Figure 35. Bar chart displaying pre-treatment tomograms taken by general dentists for orthodontic patients grouped by level of orthodontic services provided.



	Rarely	Regularly	Sample Size
Comprehensive	20.7%	79 3%	n = 58
Limited	36.1%	63.9%	n = 72

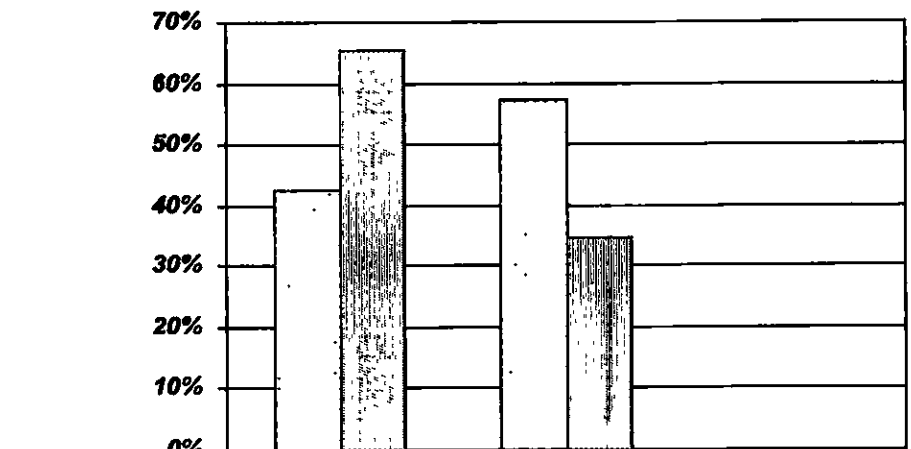
Figure 36. Bar chart showing pre-treatment TMJ exam performed by general dentists for orthodontic patients grouped by level of orthodontic services provided.

In evaluating the frequency distributions for the four items on the questionnaire designed to assess a few of the methods used in formulating orthodontic treatment plans several trends were noted. It was evident that the majority of the comprehensive providers regularly traced a lateral cephalogram (66.7%) and at least mounted casts in centric relation (CR) at least most of the time (57.4%). The majority of this group responded that they rarely performed a mixed dentition analysis (55.2%) and 55.3% responded that they only occasionally or rarely perform a tooth size (Bolton) analysis. In the limited treatment provider group, a number of pre-treatment practices were noted. The majority of this group performs a mixed dentition analysis at least most of the time (80.3%). The majority do not mount casts in CR (65.4%). In addition, the majority rarely trace a lateral cephalogram (89.4%) or perform a tooth size (Bolton) analysis (81.8%). These trends are clearly illustrated in Figures 37-39.



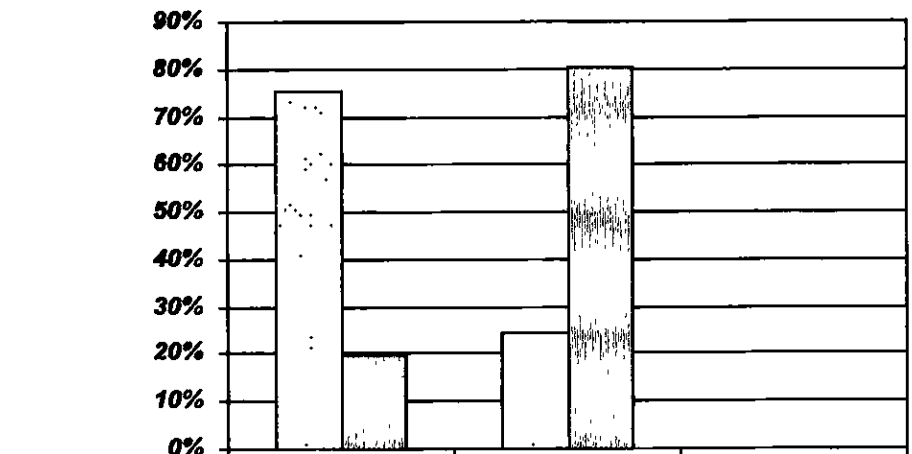
	Rarely	Regularly	Sample Size
Comprehensive	17.6%	82.5%	n = 57
Limited	93.9%	6.1%	n = 66

Figure 37. Bar chart showing general dentists who trace lateral cephalograms in creating a treatment plan for orthodontic patients grouped by level of orthodontic services provided.



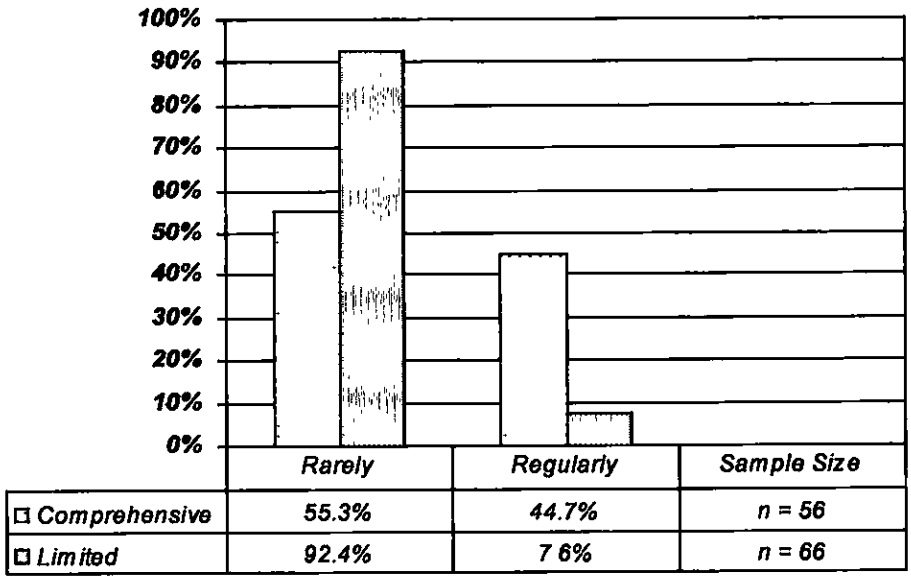
	Rarely	Regularly	Sample Size
Comprehensive	42.6%	57.4%	n = 54
Limited	65.4%	34.6%	n = 75

Figure 38. Bar chart representing dentists who mount casts in CR when creating a treatment plan for orthodontic patients grouped by level of orthodontic services provided.



	Rarely	Regularly	Sample Size
Comprehensive	75.4%	24.6%	n = 56
Limited	19.7%	80.3%	n = 69

Figure 39. Bar chart showing general dentists who perform a mixed dentition analysis when creating a treatment plan for orthodontic patients grouped by level of orthodontic services provided.



	Rarely	Regularly	Sample Size
Comprehensive	55.3%	44.7%	n = 56
Limited	92.4%	7 6%	n = 66

Figure 40. Bar chart showing general dentists who perform a tooth size (Bolton) analysis when creating a treatment plan for orthodontic patients grouped by level of orthodontic services provided.

Practitioner Views and Opinions A series of questions focused on the dentists' thoughts and perceptions regarding dental school, CE courses and private practice. About as many dentists agreed as disagreed when questioned if the dental school curriculum meets the needs of today's general practitioner. Several questions were also aimed at exploring dentists' opinions of dental school in general. A statistically significant difference among provider groups was found for one question exploring the issue of dental schools adequately meeting the general educational needs of dentists (Chi-square = 13.14, DF = 4, p = 0.01059). Significantly more of the dentists in the comprehensive group (57.9%) disagreed or strongly disagreed that their undergraduate curriculum was adequate while 40.9% of the limited group and 39.4% of the practitioners in the no treatment group reported similar feelings.

When asked if their orthodontic education while in dental school was comprehensive and extensive, 59.7% strongly disagreed and 31.3% disagreed. As a function of provider type, this question was not statistically significant. Less than half (48.9%) felt they had learned enough while in dental school to differentiate between limited and comprehensive orthodontic cases. A statistically significant difference among groups was also

found for dentists' opinions of their undergraduate training in differentiating between limited and comprehensive cases (Chi-square = 15.77, DF = 4, p = 0.00335). Ironically, significantly more dentists in the comprehensive group reported that they were inadequately trained to differentiate between limited and comprehensive orthodontic cases while in dental school.

Only 17.1% believed that they had learned enough in dental school to successfully treat limited orthodontic cases. However, a significantly larger percentage of practitioners in the limited group indicated that they felt able to successfully treat limited orthodontic cases based on their dental school education alone (Chi-square = 21.50, DF = 4, p = 0.00025). Nevertheless, the majority of practitioners in all groups reported that overall they felt that their dental school education was inadequate in preparing them to treat even limited orthodontic cases. Less than one percent (0.6%) thought they could successfully treat a comprehensive orthodontic case and as a result, this question was not statistically significant as a function of provider type.

Lastly, 77.6% suggested that there should be more orthodontic education in dental school. There was a definite agreement among all three groups with regard to the need for more orthodontic education in dental school.

Despite this trend, a statistically significant difference was still found among groups with sixty-nine percent of the dentists in the comprehensive group voicing a strong need for this, compared with only 29.7% of practitioners in the no treatment group (Chi-square = 16.39, DF = 4, p = 0.00254). A fairly even distribution of feelings was seen when asked about the availability of CE courses and if the current CE system fulfills their orthodontic needs. Only 28.5% of the dentists felt that they have learned enough through continuing education to successfully treat limited orthodontic cases. Additionally, only 11.6% reported that they feel they have learned enough through continuing education to successfully treat comprehensive orthodontic cases. Seventy-seven and six-tenths percent of the dentists in the comprehensive group agreed or strongly agreed that their orthodontic needs are fulfilled through CE courses, while only 45.9% of the limited group and 26.4% of the no treatment group felt that their educational needs are fulfilled through CE courses. Similar results were found for perceptions of the adequacy of CE courses in orthodontics with 79.3% of the dentists in the comprehensive group, 40.8% of the limited group and only 33.6% of practitioners in the no treatment group agreeing or strongly agreeing that they were satisfied with the availability of CE courses in orthodontics.

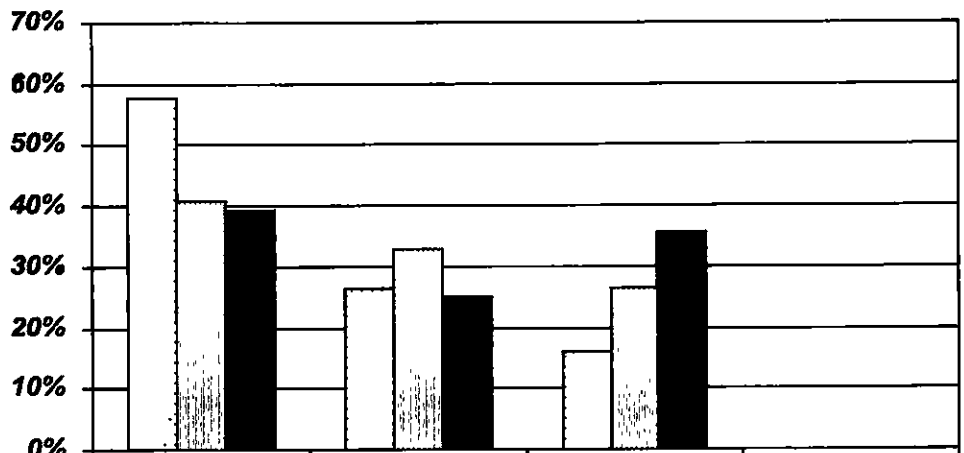
Results indicated that significantly more practitioners in the comprehensive group (100%) felt that they had learned enough to successfully treat limited orthodontic cases through CE training (Chi-square = 224.92, DF = 4, p = 0.00000). In comparison, only 10.7% in the no treatment group agreed or strongly agreed with the statement that they had learned enough after dental school to treat such cases. Similar results were found for opinions on the role of CE training in preparing dentists for treating comprehensive cases. For this question, significantly more dentists in the comprehensive group (91.4%)agreed or strongly agreed that they could successfully treat comprehensive orthodontic cases based on CE training (Chi-square = 426.30, DF = 4, p = 0.00000). This compares to only 3.9% of the other two groups combined who felt that they had learned enough in CE courses to successfully treat comprehensive orthodontic cases. Overall, there was also a statistically significant difference among groups in their opinions on the current education system fulfilling their orthodontic needs (Chi-square = 70.42, DF = 4, p = 0.00000).

With regard to some of the dentists' opinions about private practice, the majority (83.3%) of the respondents felt that general dentists and orthodontists have a healthy, working relationship. However, statistically

significant differences were found among practitioner groups (Chi-square = 96.58, DF = 4, p = 0.00000). While only 38.6% of the comprehensive group agreed or strongly agreed that their relationship with orthodontists was a healthy, working one, 88.8% of the limited group and 88.8% of dentists in the no treatment group agreed or strongly agreed to having a positive relationship. A similar pattern was found for perceptions of the competitive nature of the relationship between dentists and orthodontists (Chi-square = 77.18, DF = 4, p = 0.00000). While 48.2% of the comprehensive group agreed or strongly agreed that the relationship was a competitive one, only 13.2% of practitioners in the limited group and eight percent in the no treatment group agreed with this statement. Finally, when asked if dental schools were graduating too many dentists the majority had no opinion. Significantly more dentists in the no treatment group (23.9%)agreed or strongly agreed that too many dentists were being graduated compared with 12.3% and 13.8% for the limited and comprehensive groups, respectively (Chi-square = 27.93, DF = 4, p = 0.00001).

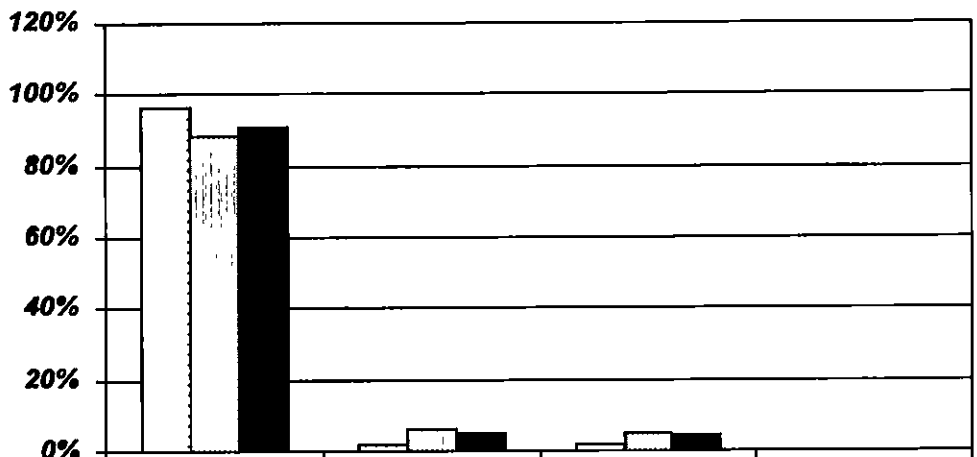
When examining practitioner views and opinions as a function of provider type most of the same trends were identified. However, it is noteworthy that the responses of those practitioners in the comprehensive category

tended to be more evenly distributed than the responses of individuals in the other treatment groups. A much higher percentage of dentists currently treating comprehensive cases described the relationship between dentists and orthodontists as competitive. In addition, a larger percentage of individuals in this group disagreed with the statement that dentists and orthodontists have a healthy working relationship. The frequency distributions by provider type are displayed in Figures 41 through 53.



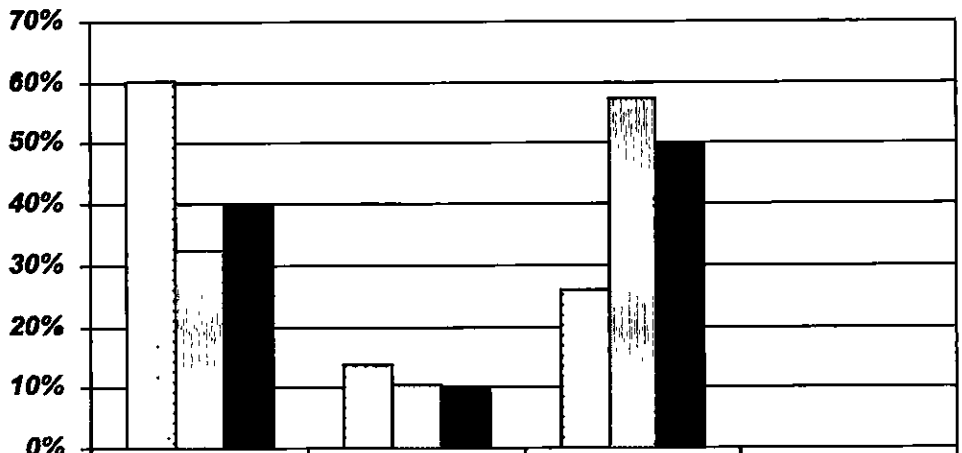
	Disagree	No Opinion	Agree	Sample Size
□ Comprehensive	57.9%	26.3%	15.8%	n = 57
□ Limited	40.9%	32.7%	26.5%	n = 98
■ None	39.4%	24.8%	36%	n = 363

Figure 41. Bar chart for the question, "In general, undergraduate curricula in dental schools meet the needs of today's general practitioner" grouped by level of orthodontic services provided.



	Disagree	No Opinion	Agree	Sample Size
□ Comprehensive	96.6%	1.7%	1.7%	n = 58
□ Limited	88.7%	6.2%	5.2%	n = 97
■ None	90.7%	4.9%	4.4%	n = 366

Figure 42. Bar chart for the question, "My orthodontic education while in dental school was comprehensive and extensive" grouped by level of orthodontic services provided.



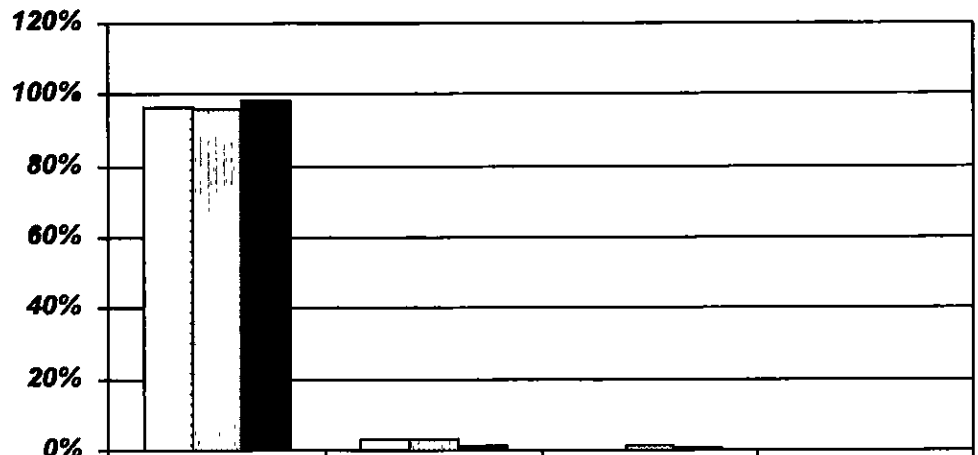
	Disagree	No Opinion	Agree	Sample Size
☐ Comprehensive	60.4%	13.8%	25.8%	n = 58
☒ Limited	32%	10.4%	57.3%	n = 96
■ None	39.6%	10.1%	50.3%	n = 366

Figure 43. Bar chart for the question, "While in dental school, I learned to differentiate between limited and comprehensive orthodontic cases" grouped by level of orthodontic services provided.



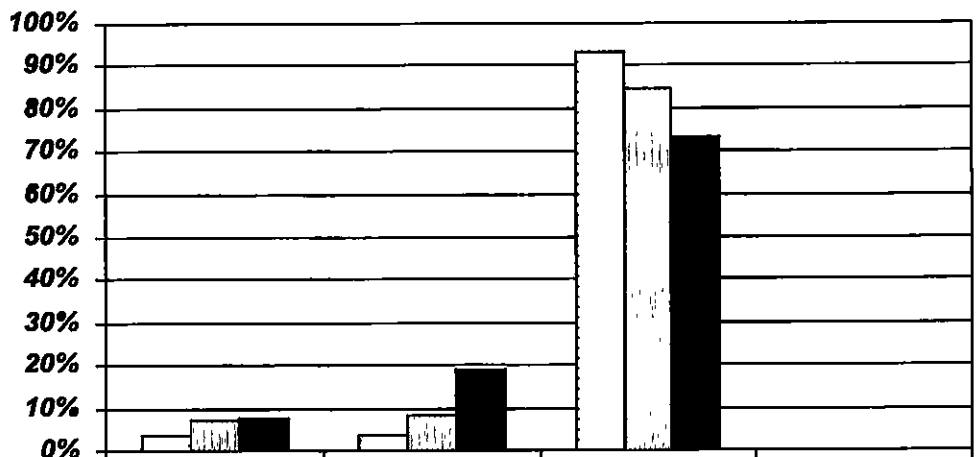
	Disagree	No Opinion	Agree	Sample Size
□ Comprehensive	81.1%	5.2%	13.8%	n = 58
□ Limited	60.3%	7.1%	32.7%	n = 98
■ None	80%	6.6%	13.4%	n = 365

Figure 44. Bar chart for the question, "While in dental school, I learned enough to successfully treat limited orthodontic cases" grouped by level of orthodontic services provided.



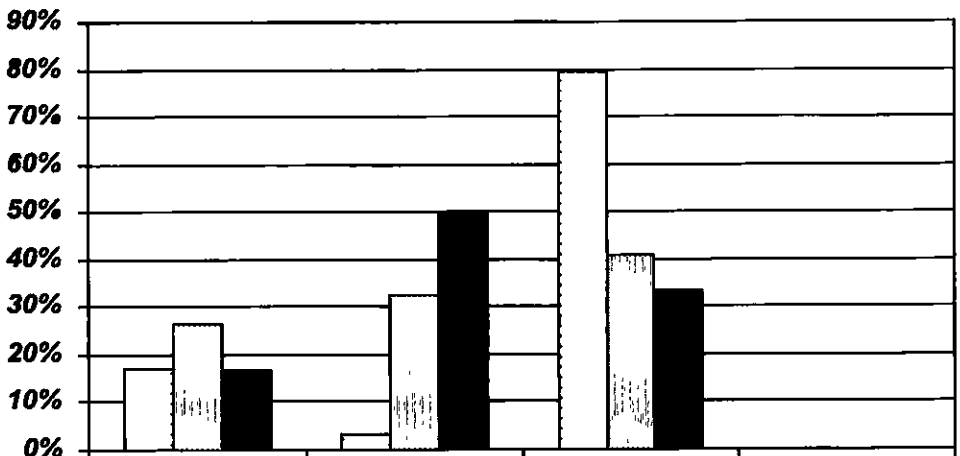
	Disagree	No Opinion	Agree	Sample Size
Comprehensive	96.6%	3.4%	0%	n = 58
Limited	95.8%	3.1%	1%	n = 96
None	98.3%	1.1%	0.6%	n = 363

Figure 45. Bar chart for the question, "While in dental school, I learned enough to successfully treat comprehensive orthodontic cases" grouped by level of orthodontic services provided.



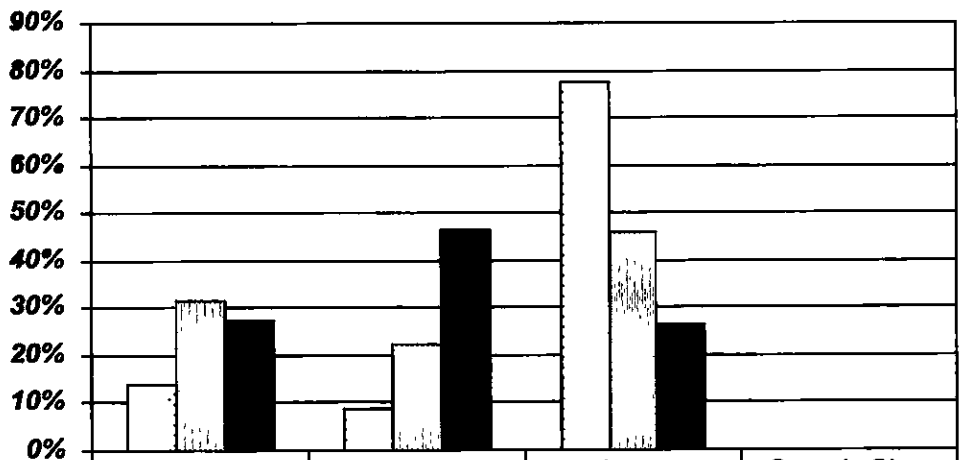
	Disagree	No Opinion	Agree	Sample Size
☐ Comprehensive	3.4%	3.4%	93.1%	n = 58
☐ Limited	7.1%	8.2%	84.7%	n = 98
■ None	7.6%	19%	73.4%	n = 364

Figure 46. Bar chart for the question, "There should be more orthodontic education while in dental school" grouped by level of orthodontic services provided.



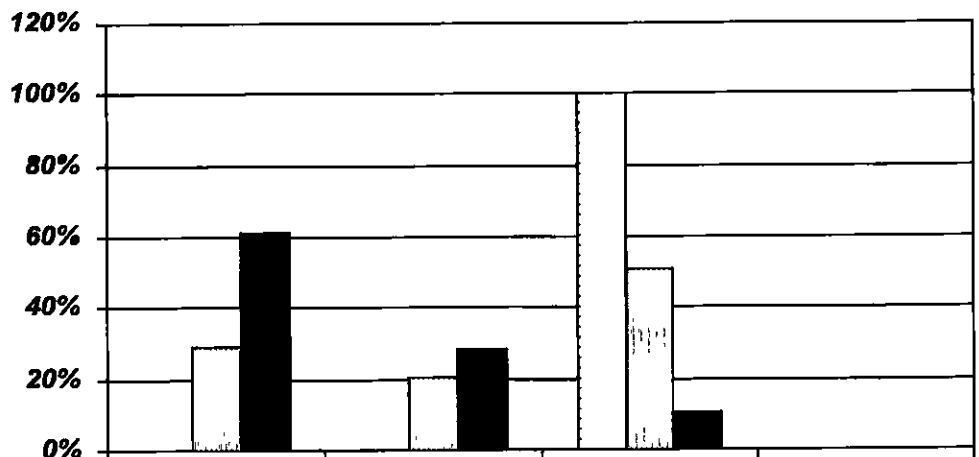
	Disagree	No Opinion	Agree	Sample Size
Comprehensive	17.2%	3.4%	79.3%	n = 58
Limited	26.5%	32.7%	40.8%	n = 98
None	16.6%	49.9%	33.6%	n = 357

Figure 47. Bar chart for the question, "I am satisfied with the availability of continuing education courses in orthodontics" grouped by level of orthodontic services provided.



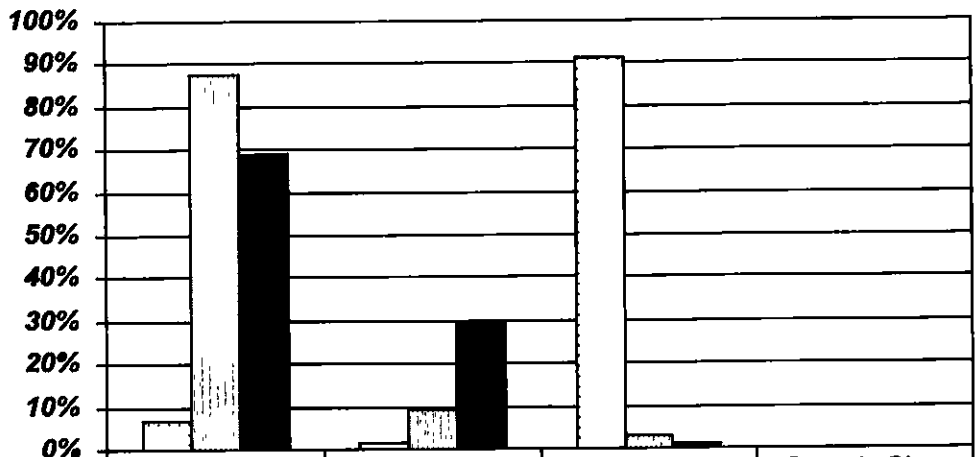
	Disagree	No Opinion	Agree	Sample Size
□ Comprehensive	13.8%	8.6%	77.6%	n = 58
□ Limited	31.6%	22.4%	45.9%	n = 98
■ None	27.3%	46.2%	26.4%	n = 359

Figure 48. Bar chart for the question, "I feel that the current continuing education system fulfills my orthodontic needs" grouped by level of orthodontic services provided.



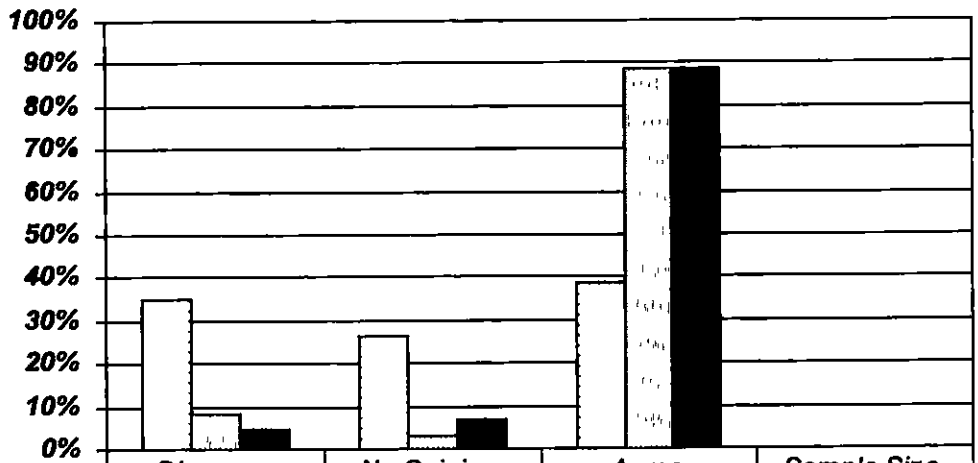
	Disagree	No Opinion	Agree	Sample Size
□ Comprehensive	0%	0%	100%	n = 58
□ Limited	28.8%	20.6%	50.5%	n = 97
■ None	61.1%	28.2%	10.7%	n = 354

Figure 49. Bar chart for the question, "I feel that through continuing education in orthodontics, I have learned enough to successfully treat limited orthodontic cases" grouped by level of orthodontic services provided.



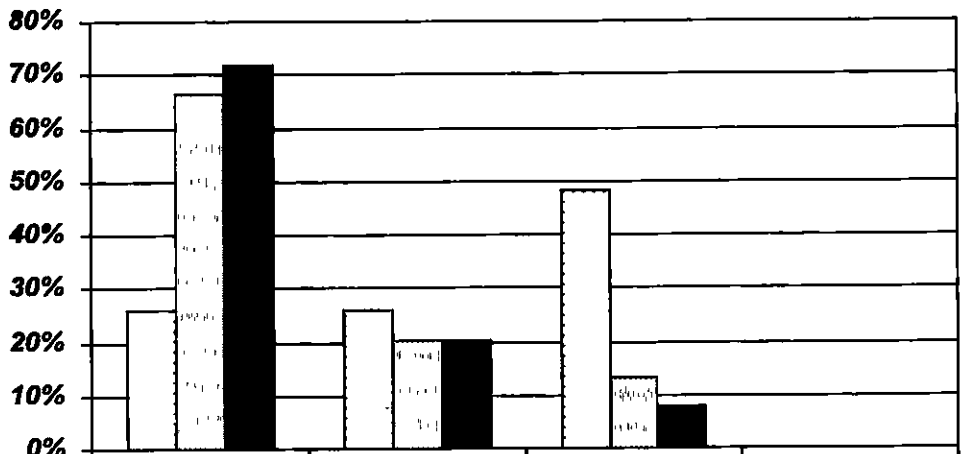
	Disagree	No Opinion	Agree	Sample Size
□ Comprehensive	6.9%	1.7%	91.4%	n = 58
□ Limited	88%	9.3%	3.1%	n = 97
■ None	69%	30.1%	0.8%	n = 355

Figure 50. Bar chart for the question, "I feel that through continuing education in orthodontics, I have learned enough to successfully treat comprehensive orthodontic cases" grouped by level of orthodontic services provided.



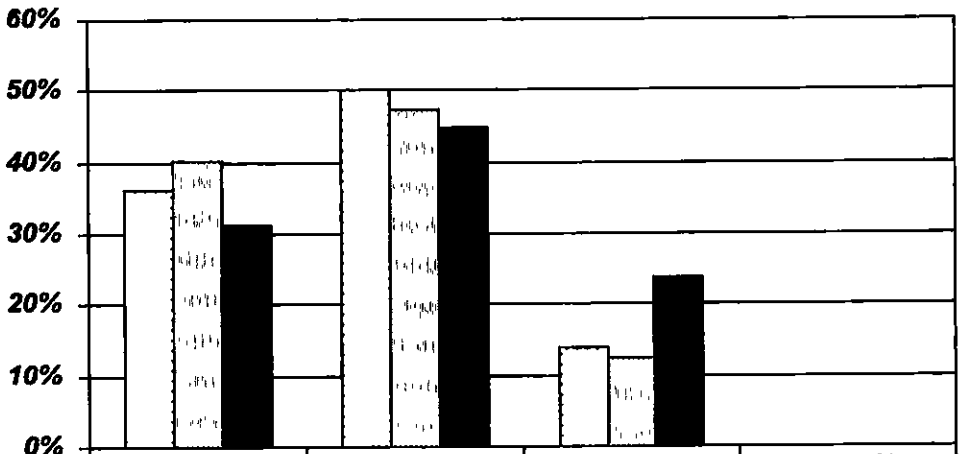
	Disagree	No Opinion	Agree	Sample Size
☐ Comprehensive	35.1%	26.3%	38.6%	n = 57
☐ Limited	8.1%	3.1%	88.8%	n = 98
■ None	4.4%	6.9%	88.8%	n = 364

Figure 51. Bar chart for the question, "I feel that general dentists and orthodontists have a healthy, working relationship" grouped by level of orthodontic services provided.



	Disagree	No Opinion	Agree	Sample Size
□ Comprehensive	25.9%	25.9%	48%	n = 58
□ Limited	66%	20.4%	13.2%	n = 98
■ None	71.7%	20.3%	8%	n = 364

Figure 52. Bar chart for the question, "I feel that the current relationship between general dentists and orthodontists is competitive" grouped by level of orthodontic services provided.



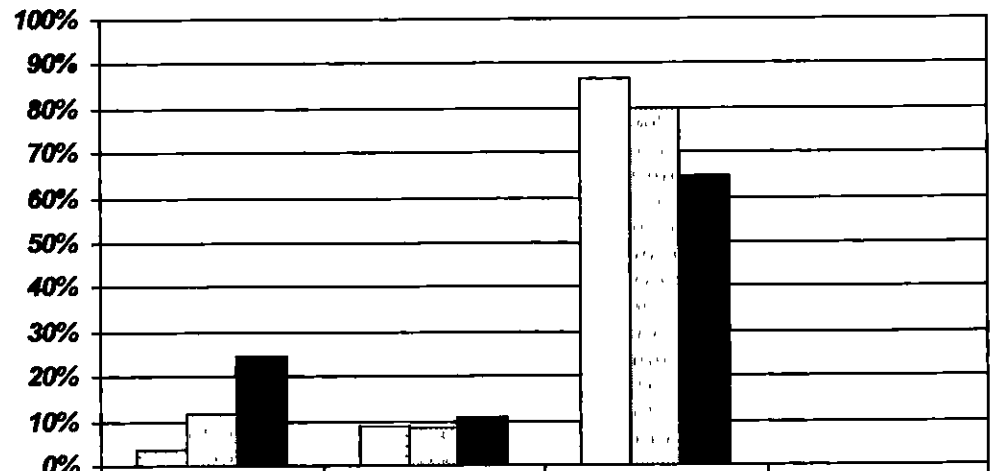
	Disagree	No Opinion	Agree	Sample Size
☐ Comprehensive	36.2%	50%	13.8%	n = 58
☐ Limited	40.2%	47.4%	12.3%	n = 97
■ None	31.2%	44.9%	23.9%	n = 365

Figure 53. Bar chart for the question, "dental schools are graduating too many dentists" grouped by level of orthodontic services provided.

Interest in Specific Orthodontic Topics Question forty-one contained eleven different orthodontic CE topics. Participants were asked to indicate the strength of their interest in each of the given topics. The majority of the respondents showed greater than fifty percent interest in only two orthodontic topics: Orthodontic diagnosis and treatment planning. Table 2 displays the rank order of topic interest by treatment group. When analyzing these data by provider type, the comprehensive and limited groups consistently showed greater interest in all topics than the none group. In addition, the comprehensive group consistently displayed the greatest interest in all topics, with more than half of the dentists in the group reporting interest. In fact, if all eleven topics were combined into one, seventy-five percent of the comprehensive treatment group demonstrated interest in the presented subjects. Figures 54 through 64 represent topic interest as a function of provider type.

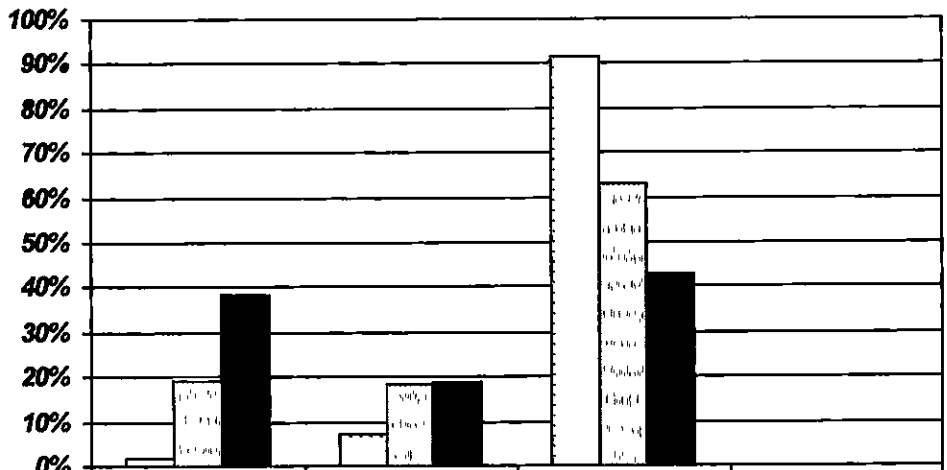
Table 2.--Ranked order of interest in orthodontic CE courses as a function of provider type.

Rank	Total	None	Limited	Comp.
1	Diagnosis	Diagnosis	Diagnosis	Tx planning
2	TMJ	TMJ	TMJ	Diagnosis
3	Occlusion	Occlusion	Occlusion	Fixed tech.
4	Tx planning	Tx planning	Tx planning	Growth mod
5	Growth/Dev	Growth/Dev	Growth/Dev	Growth/Dev
6	Growth mod	Ortho. Sx.	Growth mod	Occlusion
7	Ortho. Sx.	Pt manage.	Pt manage.	TMJ
8	Pt manage.	Growth mod	Ortho. Sx.	Biomechanic
9	Fixed tech.	Fixed tech.	Fixed tech.	Pt manage.
10	Biomechanic	Biomechanic	Biomechanic	Ortho. Sx.
11	Biomaterial	Biomaterial	Biomaterial	Biomaterial



	No Interest	No Opinion	Interested	Sample Size
Comprehensive	3.6%	8.9%	86.8%	n = 56
Limited	11.6%	8.4%	80%	n = 95
None	24.5%	10.7%	64.7%	n = 354

Figure 54. Bar chart demonstrating the general dentists' level of interest in the topic of diagnosis for orthodontic continuing education grouped by level of orthodontic services provided.



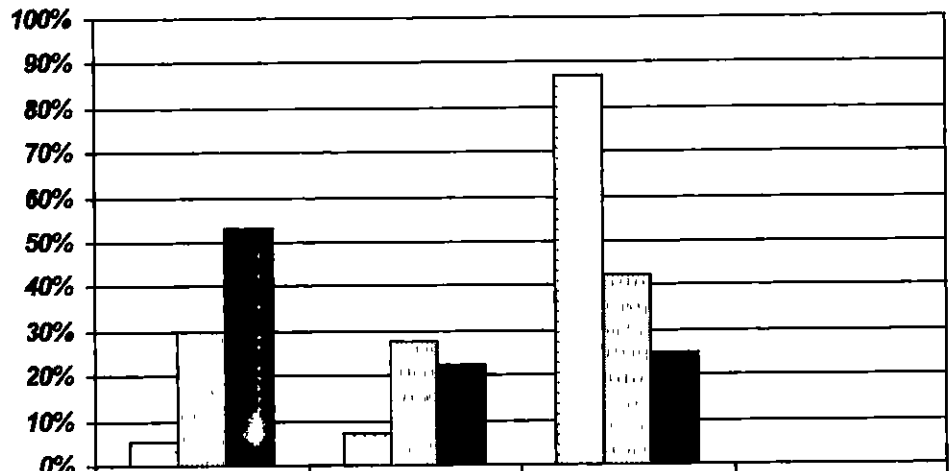
	No Interest	No Opinion	Interested	Sample Size
Comprehensive	1.8%	7%	91.3%	n = 57
Limited	19.2%	18.1%	62.8%	n = 94
None	38.6%	18.8%	42.7%	n = 352

Figure 55. Bar chart showing the general dentists' level of interest in the topic of treatment planning for orthodontic continuing education grouped by level of orthodontic services provided.



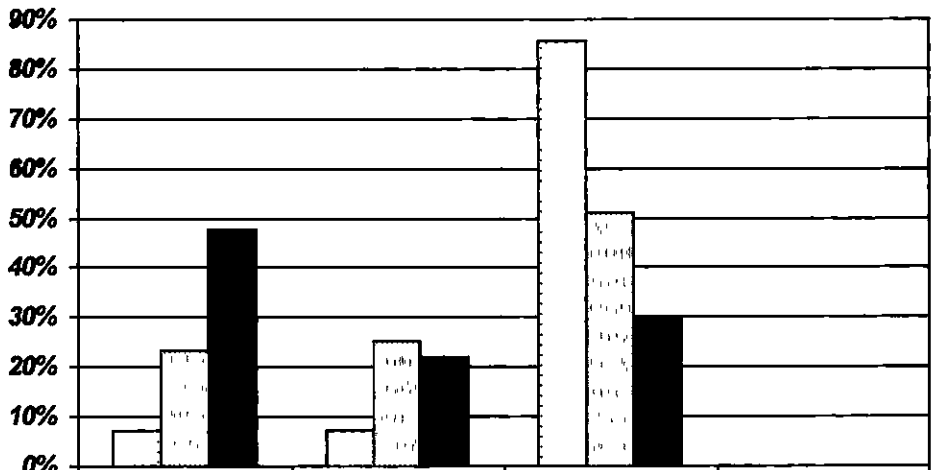
	No Interest	No Opinion	Interested	Sample Size
□ Comprehensive	10.9%	7.3%	82.4%	n = 55
□ Limited	23.4%	21.3%	55.3%	n = 94
■ None	41.7%	18%	40.3%	n = 350

Figure 56. Bar chart showing the general dentists' level of interest in the topic of craniofacial growth and development for orthodontic continuing education grouped by level of orthodontic services provided.



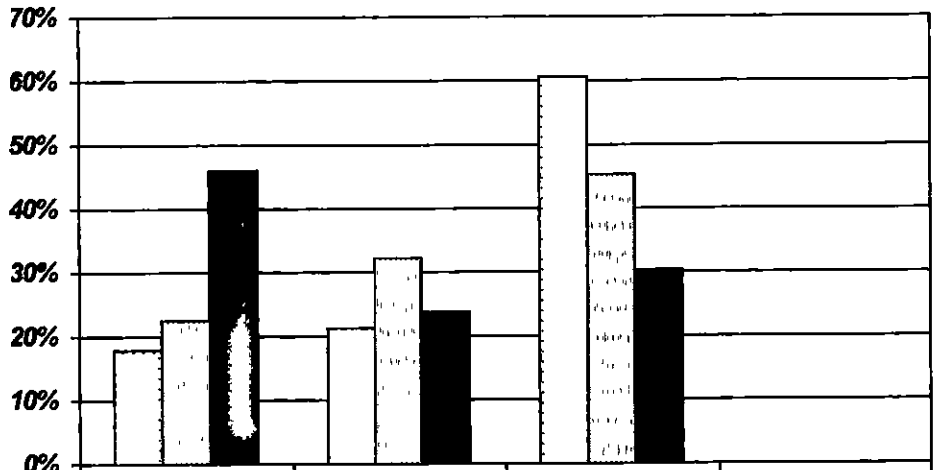
	No Interest	No Opinion	No Interest	Sample Size
□ Comprehensive	5.4%	7.3%	87.2%	n = 55
□ Limited	29.8%	27.7%	42.6%	n = 94
■ None	53%	22.2%	24.8%	n = 347

Figure 57. Bar chart representing the general dentists' level of interest in the topic of fixed appliance technique for orthodontic continuing education grouped by level of orthodontic services provided.



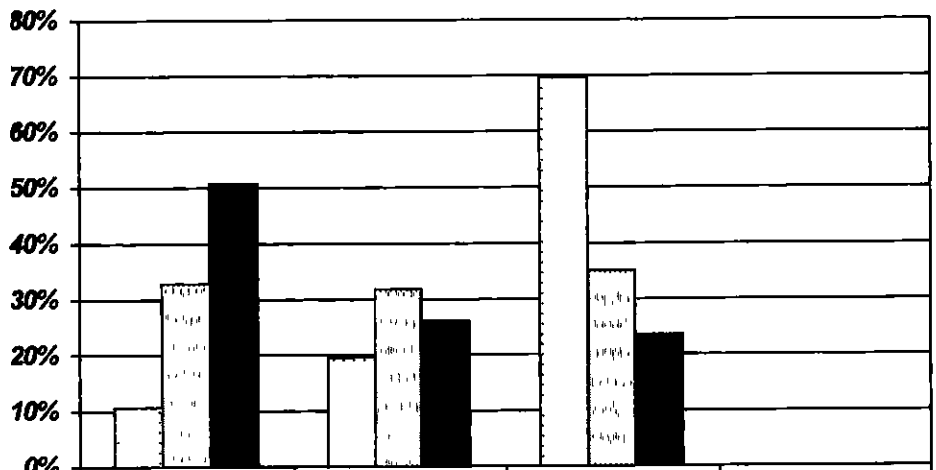
	No Interest	No Opinion	Interested	Sample Size
□ Comprehensive	7.2%	7.1%	85.7%	n = 56
□ Limited	23.4%	25.5%	51%	n = 94
■ None	48 0%	22%	30%	n = 350

Figure 58. Bar chart showing the general dentists' level of interest in the topic of growth modifying/functional appliances for orthodontic continuing education grouped by level of orthodontic services provided.



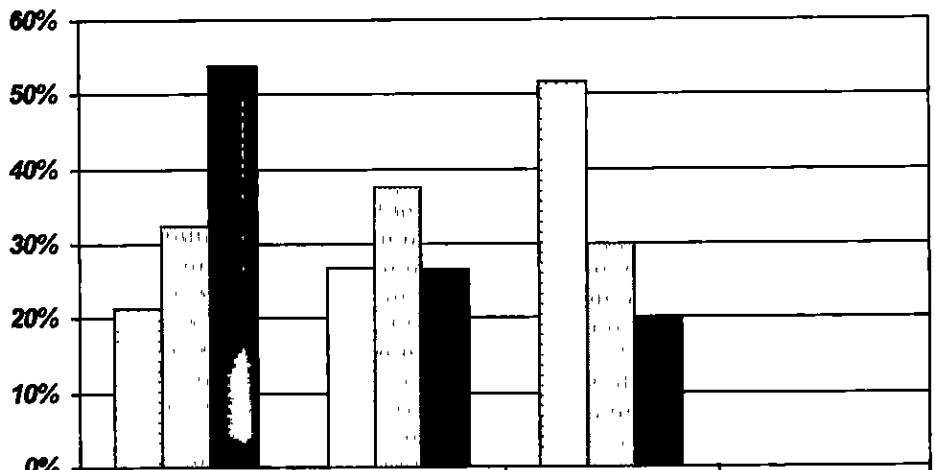
	No Interest	No Opinion	Interested	Sample Size
□ Comprehensive	17.9%	21.4%	60.7%	n = 56
□ Limited	22.6%	32.3%	45.2%	n = 93
■ None	45.9%	23.9%	30.2%	n = 351

Figure 59. Bar chart illustrating the general dentists' level of interest in the topic of patient management for orthodontic continuing education grouped by level of orthodontic services provided.



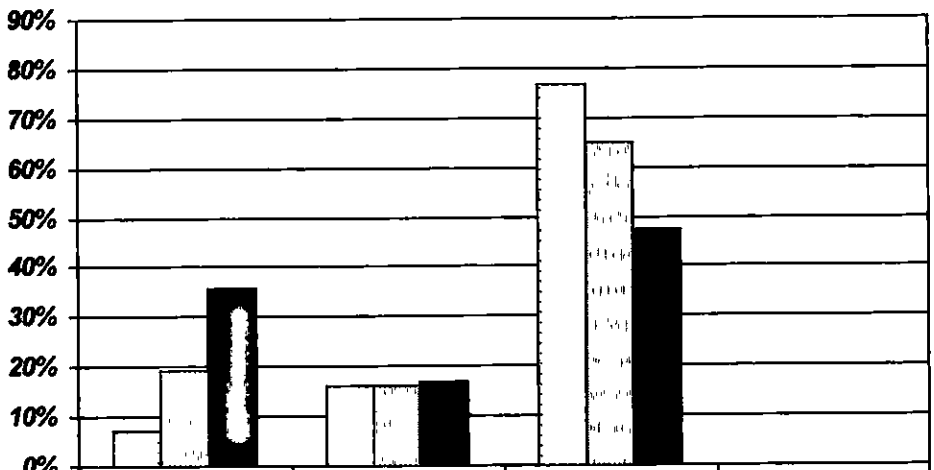
	No Interest	No Opinion	Interested	Sample Size
□ Comprehensive	10.7%	19.6%	69.6%	n = 56
□ Limited	33%	31.9%	35.1%	n = 94
■ None	50.6%	25.9%	23.6%	n = 348

Figure 60. Bar chart displaying the general dentists' level of interest in the topic of biomechanics for orthodontic continuing education grouped by level of orthodontic services provided.



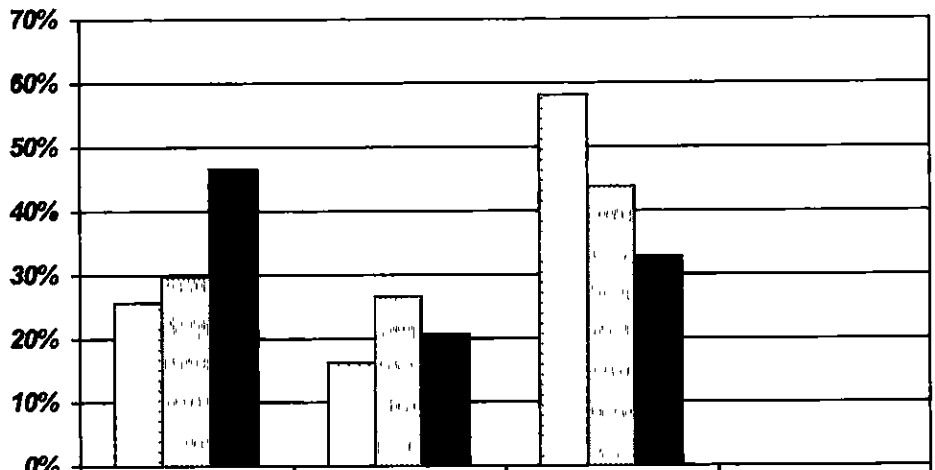
	No Interest	No Opinion	Interested	Sample Size
□ Comprehensive	21.5%	26.8%	51.6%	n = 56
□ Limited	32.3%	37.6%	30.1%	n = 93
■ None	53.8%	26.6%	19.7%	n = 350

Figure 61. Bar chart showing the general dentists' level of interest in the topic of biomaterials for orthodontic continuing education grouped by level of orthodontic services provided.



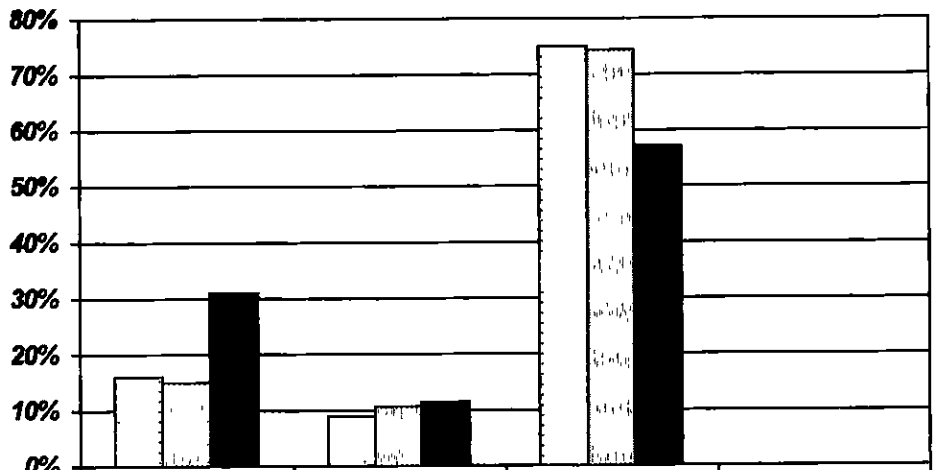
	No Interest	No Opinion	Interested	Sample Size
Comprehensive	7.2%	16.1%	76.8%	n = 56
Limited	19 1%	16%	64.9%	n = 94
None	35.8%	16.8%	47.5%	n = 352

Figure 62. Bar chart illustrating the general dentists' level of interest in the topic of development of occlusion for orthodontic continuing education grouped by level of orthodontic services provided.



	No Interest	No Opinion	Interested	Sample Size
□ Comprehensive	25.5%	16.4%	58.2%	n = 55
□ Limited	29.8%	26.6%	43 6%	n = 94
■ None	46.7%	20.5%	32.8%	n =347

Figure 63. Bar chart displaying the general dentists' level of interest in the topic of orthodontics and orthognathic surgery for orthodontic continuing education grouped by level of orthodontic services provided.



	No Interest	No Opinion	Interested	Sample Size
□ Comprehensive	16.1%	8.9%	75%	n = 56
□ Limited	15.1%	10.8%	74.2%	n = 93
■ None	31.1%	11.6%	57.2%	n = 353

Figure 64. Bar chart showing the general dentists' level of interest in the topic of TMJ disorders and treatment for orthodontic continuing education grouped by level of orthodontic services provided.

How the Data was Gathered

In the final question, participants indicated how they gathered the data to complete the survey questionnaire. Ninety-seven and three-tenths percent reported that they based their answers on their own best estimate, 2.1% retrieved information from an office computer and 0.6 used other means. Figure 65 represents these data gathering process.

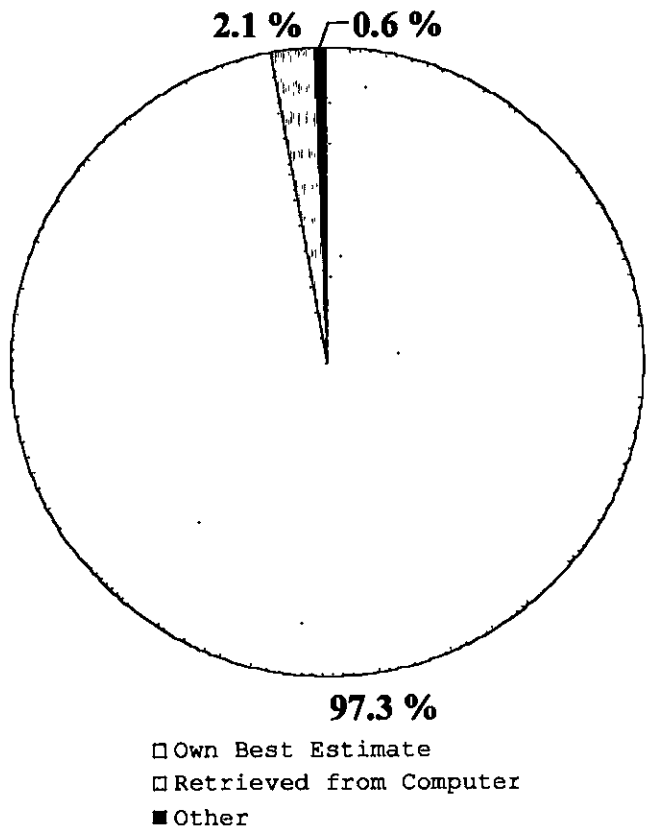


Figure 65. Pie chart showing the distribution of how data were gathered to answer the survey questionnaire.

DISCUSSION

Representativeness of the Sample

Studies that involve survey questionnaires are always associated with survey bias. Survey bias may be introduced by respondents failing or refusing to return the survey, surveys not reaching the respondent, or respondents who are uninterested and rush to complete the survey. This study attempted to reduce survey bias by assuring practitioner confidentiality, using a positively written cover letter on Case Western Reserve University letterhead conveying professionalism and an association with a major university, setting cut-off dates for survey return, and enclosing a self addressed stamped envelope. The 57.5% return rate was considered good by the American Dental Association (Bentley 1991).

In an attempt to support the validity of the sample obtained, the Ohio State Dental Board was contacted. They reported that there were 6,152 licensed dentists in Ohio as of June 1, 1998. Therefore, the 6,151 labels purchased from the ODA is an accurate representation of dental practitioners in Ohio. The Ohio State Dental Board did not have access to other demographic information.

Therefore, the ODA was contacted in an attempt to gather information such as the male to female dentist ratio and the mean age or year of graduation. Unfortunately, their database did not have this information. Therefore, the demographics of our sample was compared to those reported in the Michigan study. Sixty-five and four-tenths percent of the respondents in the current study were between the age of thirty-five and fifty-four. This is compared to 56.3% for the Michigan sample yielding a difference of nine point one percent difference. Wolsky and McNamara reported that 92.9% of their respondents were male compared to eighty-nine percent gathered in this study. The similarity in demographics between the two Mid-western studies suggests an appropriate representation of the target population.

The distribution of provider types were also evaluated for the first and second mailings to support the validity of the sample used. In the first mailing, 11.9% were identified in the comprehensive group, 18.6% were in the limited group, and 69.5% were in the no treatment group. This compares to 10.7%, 19.3%, and 70.1%, respectively for the three groups in the second mailing. Thus, the percent differences are 1.2%, 0.7%, and 0.6% for the comprehensive, limited, and no treatment groups, respectively.

Orthodontic Services

The primary purpose of the present investigation was to explore the type and amount of orthodontic treatment being provided by general dentists in Ohio. The results indicate that for the current sample most of the orthodontic services provided in Ohio are being performed by orthodontic specialists. Only 11.3% of the dentists surveyed reported that they provide comprehensive orthodontic treatment, while 21.3% indicated that they render limited orthodontic care and 67.4% of general dentists claimed they do not provide any orthodontic services at all.

The results obtained in this investigation are actually quite different from those reported in a study performed in Michigan in 1996 using a similar survey instrument developed by Wolsky and McNamara of the University of Michigan. Those investigators reported that 19.3% of general dentists surveyed in Michigan provided comprehensive orthodontic care, fifty-seven percent provided limited orthodontic treatment and 23.7% did not perform any orthodontic services. An interesting and important finding with regard to the Michigan study was that their results were not reproducible even when their data were analyzed and the principal investigators consulted. The major reason for the inability to

reproduce their results and categories was the ambiguity in the survey items selected to define each provider type. Thus, in order to make valid comparisons between the two studies, the survey items utilized in defining each provider type for the present study were applied to the raw data from the Michigan study. The Michigan data were then re-analyzed. With these adjustments, it was calculated that 19.3% of the general dentists in Michigan provided comprehensive orthodontic care, 27.2% provided limited orthodontic services and 53.5% did not provide any orthodontic treatment. A major difference between the two studies was seen in the limited and no orthodontic treatment provider groups. Figures 66 & 67 (Appendix 4) demonstrate the published and re-calculated results of the Michigan study. Given the ambiguity in the Michigan study with regard to treatment groups and the inability to replicate their groupings with their own raw data, one plausible hypothesis is that their groups may have been mislabeled from the outset.

Results from the current survey mirrored those reported by McKnight-Hanes et al. in 1994. Those researchers reported that ten percent of the general dentists surveyed provided comprehensive orthodontic care and forty-two percent rendered limited orthodontic services. This left forty-eight percent who did not

provide any orthodontic care. The present study also parallels the findings of a field study performed in Cuyahoga County, Ohio by Hans and co-workers in 1998-1999 who reported that twelve percent of a group of randomly selected tenth grade students were treated by general dentists and eighty-seven percent of the students were treated by an orthodontist.

Other studies, however, have reported somewhat different findings. In an early investigation, Dugoni et al. (1981) reported that fifty-five percent of the orthodontic services covered by prepayment programs in California were provided by non-orthodontists. In a larger national study of dentists, McGann (1988) estimated that seventy-five percent of practicing general dentists were providing some type of orthodontic treatment. Finally, researchers in Iowa found that 66.1% of the dentists provided orthodontic care and 33.9% did not. (Jacobs et al. 1989) One possible explanation for the discrepancies between the earlier studies and more recent investigations (i.e., Hans et al. 1998; Wolsky & McNamara 1996) may be the time when the studies were completed. As the results of the earlier studies indicate, more dentists may have been providing orthodontic treatment at that time, reflecting trends in dental service in general at that time. Unlike the present study and other more recent

investigations, earlier studies did not differentiate between the level of orthodontic care provided, thus somewhat limiting comparisons among investigations.

Practice Trends

To make comparisons more viable and understand more completely the possible trajectory of general dentistry practices, a key area of focus in the present study was change in patient load. Seventy-five and six-tenths percent of the respondents in the current study reported that their practices have increased their overall patient load over the course of the past five years. Only 6.8% of dentists reported a decrease. This could be explained by the fact that a relatively small percentage (8.8%) of the dentists were sixty-five years of age or older, and practitioners in this age group are likely to be in the process of reducing their overall patient load for retirement reasons.

Among dentists who are offering orthodontic services, the majority in this sample report that they are treating more orthodontic patients now than five years ago. Nevertheless, the overall volume of orthodontic treatment provided is still relatively low. Eighty-six and two-tenths percent of the dentists in the comprehensive provider group and one hundred percent of the limited group reported that they spend twenty-five percent or less

of their practice time providing orthodontic treatment. This translates to eighty percent of the comprehensive providers treating fifty orthodontic patients or fewer and 99.1% of limited orthodontic providers treating fifty or fewer orthodontic patients. It is interesting to note that those dentists in the comprehensive group reported having more orthodontic patients overall, and also more limited treatment patients than did the dentists in the limited group. This indicates that those dentists who treat limited cases only do not have many active orthodontic cases. The present findings may be interpreted to suggest that the dentists in the comprehensive group may have become better trained over time, may have more experience, and may ultimately feel more comfortable providing orthodontic care.

The results of the current investigation indicate that there does not appear to be a trend for more and more dentists to provide orthodontic care, at least in Ohio. The concentration of orthodontic providers over time was relatively constant for this sample. Taken together with the information gathered about practice trends leads to different perspectives on the popular hypothesis that general dentists are providing more orthodontic care to compensate for a lack of work due to the advent of flouridation. The results of the current study suggest

that dental practices are, in fact, becoming busier whether or not they provide orthodontic treatment or not. One alternative explanation about why dentists provide orthodontic care may be one of career satisfaction as opposed to seeking needed financial gains. In addition, investment in cosmetic dental procedures among both dentists and patients may be helping dentists to compensate financially and pragmatically in terms of staying busy. As the general public becomes more educated about dental care (e.g., proliferation of tooth whitening products, etc), dentists may continue to see a rise in their productivity, with a decline in specialized services such as orthodontics.

Community Factors

While proximity to specialized providers would, on the surface, seem to be related to the kinds of services provided, none of the questions on the survey regarding practice location were significantly related to whether or not the practitioner provided orthodontic services. Intuitively, one would hypothesize that practitioners in smaller communities would tend to offer orthodontic services because they are the least likely to be located near an orthodontist. One would also expect that those dental practitioners who are not located near an orthodontic office would be more likely to offer

orthodontic care. If there were many general dentists within close proximity to one another, it would seem plausible that there would be more competition for work and for this reason those dentists would expand their scope of dental care to include specialty services such as orthodontics. Lastly, it would make intuitive sense that if there were many orthodontists in the area then there would be fewer orthodontic patients for general dentists to treat. Surprisingly, none of these factors were found to be statistically related to the level of orthodontic care provided. Similar trends were reported by Wolsky and McNamara (1996). These findings may be taken to support the possibility that dentists who provide orthodontic care may be doing so for career satisfaction rather than financial gain. Basically, those dentists who are interested in orthodontics will take steps to provide orthodontic care and those who are not interested will not render orthodontic services.

Referral Patterns

The results from this study concerning referral patterns tend to reflect those found by Sheiham et al. (1971), Pender (1979), Brown (1982), Jacobs et al. (1991) and Wolsky & McNamara (1996). Overall, those dentists who provide orthodontic services clearly refer significantly fewer patients to orthodontists. This was especially true

for the comprehensive treatment group in the current investigation. Furthermore, those dentists providing comprehensive orthodontic care have been identified as referring significantly fewer patients to orthodontists historically. (i.e., over the past five years) These dentists might view the relationship with specialists as adversarial and competitive in nature. Likewise, they may actually be somewhat under represented in research studies of this nature as they may be somewhat less likely to participate. This is a possible outcome which can not be directly assessed in the present study.

Continuing Education

The results from this section also parallel the work of others such as Brown (1982), Jacobs et al. (1991) and Wolsky & McNamara (1996). Like those researchers, the current investigation found that dentists in the comprehensive treatment group appear to attend more overall continuing education courses than the other two groups and definitely took significantly more continuing education courses in orthodontics than the other two groups. The comprehensive group was the group most likely to have reported an increase in the total number of hours attended in orthodontic continuing education courses during the past five years. It is extremely interesting to note that the entire comprehensive group agreed or

strongly agreed that they have learned enough through continuing education courses in orthodontics to successfully treat limited orthodontic cases and 91.4% felt the same way about treating comprehensive cases. Most specialty trained orthodontists would likely argue with this claim. Thus, one strategy for intervening with dentists would be to re-structure orthodontic continuing education courses to highlight the need to refer in complex cases and help dentists to better understand and differentiate between limited and comprehensive treatment cases.

Pre-treatment Records for Orthodontic Patients

Results of the current study indicate that dentists who provide comprehensive orthodontic treatment tend to follow a diagnostic record protocol similar to that used by orthodontists. The records regularly gathered by the comprehensive group in order of highest to lowest response percentage included 98.3% performed a clinical exam, 98.3% obtained study models, 96.7% had a panorex, 86.2% had bitewings, 79.3% took extra oral photos, 76.7% had a lateral cephalogram, 75% took intra-oral photos and 65.5% performed a TMJ evaluation. These data parallel the findings of Wolsky & McNamara (1996), who reported numbers similar to pre-treatment practices among active orthodontists. Also similar to the findings of the

Michigan study was the finding that some records were gathered less frequently. The records that were rarely collected among dentists in the current study included 34.6% rarely took periapical/full mouth radiographs, 60.4% rarely obtained a transcranial radiograph, 80.4% rarely taking a P-A cephalogram, and 88% rarely had a tomogram.

The comprehensive group was also examined by assessing how often they perform certain tasks in creating a treatment plan for their orthodontic patients. Some of the results in this study were consistent with those reported by Wolksy & McNamara (1996). Of the comprehensive group, 66.7% regularly traced a lateral cephalogram while seventy-two percent of the Michigan comprehensive group performed this same task and 12.3% of the comprehensive group rarely traced a lateral cephalogram compared to 6.4% of the Michigan comprehensive group. Wolsky & McNamara (1996) found that 59.7% of their comprehensive group regularly performed a mixed dentition analysis and 47.4% regularly performed a tooth size (Bolton) analysis when creating treatment plans for their orthodontic patients. A significant difference was noted in the comprehensive group. Only 14.5% reported that they regularly perform an mixed dentition analysis and 28.6% performed a Bolton analysis. One possible explanation for this difference in treatment plan formulation between the

two studies could be undergraduate dental training. Eighty-five percent of the respondents from their sample graduated from the University of Michigan or Detroit. Meanwhile, 85.7% of our respondents graduated from The Ohio State University or Case Western Reserve University. One aim of future investigations might be to explore differences among dental school curricula and this association with later specialized practices among general dentists.

Practitioner Views and Opinions

Responses provided by participants themselves highlight the need to evaluate both the undergraduate orthodontic curriculum as well as the overall general dental curriculum. Only 26.1% of the respondents in the present study agreed or strongly agreed that their dental school education prepared them to meet the needs of today's general practitioner. There was also a prevailing theme that most dentists felt that the undergraduate dental curriculum had failed to teach the student how to manage orthodontic patients from almost every standpoint. Not only did they feel inadequately prepared to treat limited and comprehensive orthodontic cases, but they also claimed that they could not differentiate between the limited and the comprehensive cases. Among dentists in the current study, there was an overall general consensus

that there should be more orthodontic education while in dental school. Ninety-nine and one-tenth percent of the respondents reported treating three or fewer comprehensive orthodontic patients while in dental school and the majority (94.5%) treated three or fewer limited orthodontic cases. It is noteworthy to mention that those in the comprehensive group were not only the most negative about being prepared to meet the needs of today's dental patients but also the most negative about their orthodontic education while in dental school. It is possible that this group responded this way because once they were exposed to additional and specialized information they then realized how much they did not learn while in dental school. Overall experience could also play a role. It is also noteworthy to mention that when frequency distributions were calculated as a function of dental school attended (i.e., OSU vs. CWRU) similar views and opinions about general dental and undergraduate orthodontic training were expressed.

This is an obvious area that needs to be investigated by the American Dental Association or council on dental education. It appears that changes need to be made in the dental school curriculum to adequately prepare the new graduate to confidently and competently diagnose and treat patients "in the real world". This means introducing the

student to the new age restorative materials and familiarizing the student with the concepts of cosmetic dentistry. As far as pre-doctoral orthodontic education is concerned, dental students should also be exposed to modern orthodontic technology such as the properties and usage of sentalloy arch wires, for example. Nevertheless, dentists will likely continue to feel under prepared to treat orthodontic patients and this is understandable. This is why specialized training is offered and acceptance into a graduate program is competitive in nature. The provision of quality orthodontic care is complex and requires focused and extensive training that dental school alone can not and should not provide.

Topics of Interest

The general responses to the questions directed at assessing interest in orthodontic continuing education indicated that a hierarchy of interest exists. The respondents in the comprehensive provider group displayed the greatest interest in specialized orthodontic topics followed by the limited then no treatment groups. This was not a surprising finding but what was somewhat interesting is that even many of those respondents in the no treatment group showed a high level of interest in orthodontic topics (e.g., 64.7% of the dentists in the no treatment group displayed an interest in orthodontic

diagnosis). This was an extremely high percentage considering that these dentists do not provide orthodontic care. This finding demonstrates an overall interest in the good of the patient which may allow dentists to better identify problems, communicate concerns to the patient, and refer them to a specialist for proper ancillary care.

SUMMARY AND CONCLUSIONS

Over the years there has been increasing interest and concern in the general dentists provision of orthodontic services. The present study attempted to explore this in a randomly selected sample of general dentists in Ohio. Of a total population of 6,151 dentists, 1,200 were targeted for participation. Six hundred seventy-two surveys were returned reflecting a 57.5% response rate. Dentists were categorized into one of three groups reflecting the various level of orthodontic service provided; comprehensive, limited, and no treatment. An analysis of the results indicated that 11.3% of the dentists in Ohio render comprehensive orthodontic care, 21.3% provide limited orthodontic services and 67.4% provide no orthodontic care. These percentages were comparable to some recent studies but are significantly lower than findings of earlier investigators. Dentists in the present study, who reported providing orthodontic care, were more likely to attend continuing education courses in orthodontics and reported referring fewer patients to orthodontists. The majority of these providers maintained that they spend less than twenty-five

percent of their practice time rendering orthodontic care.

Future research directions may include one of many options. First, practice trends could be further investigated to identify where specific changes in patient load are occurring (i.e., restorative, cosmetic, endodontic, etc.) A more detailed instrument or a field study may be needed. An alternative study could be to compare dental school curriculum. Third, researchers could attempt to evaluate the content of CE courses in orthodontics. A longitudinal study of new graduates could be attempted to see if their practice patterns change over time and how this varies with their school curriculum and with changes in patient load. Fourth, one could examine the treatment outcome among patients treated by general dentists and orthodontists and how it differs among dentists who claim to be comprehensive versus limited providers. An additional study could be one that assessed GPA or class rank and provider type. Lastly, researchers could survey orthodontists with a similar questionnaire to assess their perceptions about orthodontic services being provided by general practitioners. Also, how regularly various pre-treatment records are taken, how regularly certain methods are used in creating treatment plans, and

topics of interest could be compared with the data collected in this study.

APPENDIX 1. -- IRB Approval Form

CASE WESTERN RESERVE UNIVERSITY
REVIEW COMMITTEE FOR HUMAN STUDIES
NOTICE OF APPROVAL

TO: Hans, Mark G.

Dept/School: Dentistry

Subject: Notice of (X) Review and approval
( ) Exemption

The committee has reviewed and approved your proposal entitled:
Characterization of Dental Practice Services in Cuyahoga County

Please be advised that with respect to: (1) the rights and welfare of the individual(s) involved, (2) the appropriateness of the methods to be used to secure informed consent, and (3) the risks and potential benefits of the investigation, the Committee considers your project:

( ) Exempt
(X) Fully acceptable
( ) Acceptable with reservations noted
( ) Not acceptable for reasons noted

Follow-up: The Committee wishes to have a status report on this project on 6/16/1999

SIGNED FOR THE COMMITTEE BY:

Approval Date:
6/30/1998

Christian L. LaMantia
Assistant Director
Office of Research Administration

CZ

ORA USE ONLY**********

Type Project: (X) NEW ( ) RENEWAL
Human Risk: ( ) Yes ( ) No
Source of Support:(X) Outside Funding ( ) Department/other
Agency (Potential): AADP Agency No.

Are any of the following involved: ( ) Yes (X) No
If yes, which category(ies):

() Minors () Fetuses () Abortuses () Pregnant Women
() Prisoners () Mentally Retarded () Mentally Disabled

cc: Dean
Department Chairman
Follow-up (Book)
File

APPENDIX 2. -- Cover Letter

CASE WESTERN RESERVE UNIVERSITY

October 12, 1998

Dear Colleague,

I am writing to request your assistance in completing an important project. I am currently a second year resident working on my masters thesis. The goal of my project is to examine and characterize the kinds of orthodontic services provided by dentists in Ohio. I would greatly appreciate your help in completing the enclosed questionnaire which asks a variety of questions about your dental practice. All information gathered in this study will be kept strictly confidential, and only numerical tracking will be used for data entry. Your input will be invaluable in helping us to carry out future studies investigating present and future trends in dental health services, and the results may be used to ensure better orthodontic training for dental students. Participation in this study is voluntary. Completing and returning the survey indicates your consent.

Please return the survey in the enclosed envelope by November 20, 1998 or as soon as possible. I will be happy to provide you with a copy of the results. Simply check the indicated box at the end of the survey and include a business card with your returned response. If you have any concerns or questions pertaining to this study please do not hesitate to call me at (216) 368-3200 extension 1065.

Thank you for your time and cooperation in completing this important investigation.

Yours sincerely,

Jonathan Jay Eckhardt, D.D.S.

School of Dentistry

MAILING ADDRESS
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-4905

VISITORS AND DELIVERIES
2123 Abington Road

Phone 216-368-3300
Fax 216-368-3304

APPENDIX 3. -- Survey Questionnaire

Survey Questionnaire

General Practitioners Only

This questionnaire is part of a study examining the types of services provided by dentists in Ohio. Please answer the following questions or check the appropriate answers for each statement as it would apply to the *dentist* to which this survey was sent.

1. Title of person completing this survey (e.g. dentist, office manager etc.) Dentist 514; office Mgr 13; Other 2 — 529

2. Date of birth. 1951.03

3. Which of the following best describes your practice:
   a. General practice/Family dentistry 529
   b. Exclusive specialty practice in:

Orthodontics	32
Prosthodontics	8
Periodontics	16
Oral surgery	15
Oral pathology	
Pediatric dentistry	13
Endodontics	13

No Forwarding Address 31
Not interested in participating 14
Retired 32

4. Please indicate:
   a. Sex: Males 469 Females 58

5. Please indicate:
   a. Dental school attended: _____
   b. Year of graduation: 1977.79

6. Practice zip code:
   a. Primary office: _____
   b. Secondary office: _____
   c. Other office: _____

7. When a patient requires orthodontic treatment, I provide the following services: (please check appropriate columns).

	NO	YES	
		Periodically	Routinely
a. Diagnostic services	189	132	194
b. Space maintainers	196	200	121
c. Preventive/Interceptive treatment	343	107	65
d. Treatment of minor tooth malposition with removable appliances (spaces, retainers)	343	104	64
e. Treatment of minor tooth malposition with fixed appliances (braces)	475	46	47
f. Molar uprighting	418	54	37
g. Treatment of anterior crossbites	397	73	47
h. Treatment of posterior crossbites	478	44	37
i. Treatment with headgear	498	9	7
j. Treatment with functional appliances	449	36	27
k. Comprehensive treatment with fully banded appliances—Class I	452	19	41
l. Comprehensive treatment with fully banded appliances—Class II	463	17	37
m. Comprehensive treatment with fully banded appliances—Class III	484	17	10
n. Treatment of orthognathic surgery patients	496	9	4

For the following questions, please place an "X" by the appropriate answer:

The following definitions should be applied accordingly: Limited orthodontic cases pertain to those treated with simple orthodontic tooth movement either with removable appliances or fixed appliances in one quadrant or one arch only. Comprehensive orthodontic cases pertain to those treated with full fixed appliances in one arch or both arches.

8. In the past five years, my overall patient load in general dentistry has:

a. Increased	388
b. Decreased	39
c. Stayed the same	91

9. In the past five years, the number of *orthodontic* patients treated in my office has:

a. Increased	116
b. Decreased	60
c. Stayed the same	292

10. The number of years I have been treating limited orthodontic cases is:

a. Zero	307
b. 1-5	45
c. 6-10	34
d. 11-15	41
e. More than 15	84

11. The number of years I have been treating comprehensive orthodontic cases is:

a. Zero	453
b. 1-5	15
c. 6-10	14
d. 11-15	13
e. More than 15	18

12. The percent of time in my practice I spend providing orthodontic services and treatment (limited and comprehensive) is:

a. 0%	326
b. 1-25%	181
c. 26-50%	7
d. 51-75%	1
e. 76-100%	0

13. At the present time, the number of limited orthodontic cases I have in active treatment is:

a. Zero	367
b. 1-10	120
c. 11-50	24
d. 51-100	1
e. More than 100	0

14. Approximately what percent of your limited orthodontic cases fall into the following categories?

a. Children (5-12 years)	46.59 %
b. Teenagers (13-17 years)	20.4% %
c. Adults (18-64 years)	19.34 %

15. At the present time, the number of comprehensive orthodontic cases I have in active treatment is:

a. Zero	447
b. 1-10	21
c. 11-50	28
d. 51-100	9
e. More than 100	3

16. Approximately what percent of your comprehensive orthodontic cases fall into the following categories?

a. Children (5-12 years)	19.59 %
b. Teenagers (13-17 years)	31.61 %
c. Adults (18-64 years)	7.45 %

17. The population of the community in which my office is located is: (the office in which I provide orthodontic services)

	Primary office	Secondary office
a. Greater than 500,000	102	5
b. 100,000-499,999	75	2
c. 10,000-99,999	229	12
d. 1,000-9,999	64	5
e. Less than 1,000	0	0

18. The distance (in miles) from my office to the closest office of an orthodontist is:

a. Less than 4 miles	440
b. 5-10 miles	57
c. 11-20 miles	25
d. Greater than 20 miles	4

19. In my community, the number of active *general dentists* (in a 10 mile radius) is: (please estimate if unsure)

a. Zero	2
b. 1-5	35
c. 6-10	78
d. 11-20	115
e. 21-50	126
f. Greater than 50	145

20. In my community, the number of active *orthodontists* (in a 10 mile radius) is: (please estimate if unsure)

a. Zero	25
b. 1-5	230
c. 6-10	129
d. 11-20	54
e. 21-50	46
f. Greater than 50	7

21. Each month, the number of patients I refer to the orthodontic specialist is:

a. Zero	32
b. 1-4	234
c. 5-10	181
d. 11-20	67
e. Greater than 20	7

22. The number of orthodontic referrals I have given over the past five years has:

a. Increased	254
b. Decreased	59
c. Stayed the same	211

23. Per year, the total number of hours of continuing education I take is:

a. Zero	5
b. 1-10	31
c. 11-20	85
d. 21-50	344
e. 51-100	53
f. Greater than 100	14

24. Per year, the number of hours of continuing education in *orthodontics* I take is:

a. Zero	318
b. 1-10	169
c. 11-20	22
d. 21-50	9
e. 51-100	3
f. Greater than 100	2

25. The number or orthodontic continuing education hours I have taken in the past five years has:

a. Increased	43
b. Decreased	71
c. Stayed the same	368

26. While in dental school, the number of orthodontic cases I treated directly was:

	Limited cases	Comprehensive cases
a. Zero	301	357
b. 1-3	185	25
c. 4-6	27	4
d. 7-10	7	0
e. Greater than 10	1	9

27. For my orthodontic patients, I take the following pre-treatment records:

	Rarely	Occasionally	Most of the time	Regularly
a. Clinical exam	38	12	32	296
b. Study models	111	59	25	133
c. Extra-oral photos	183	33	12	65
d. Intra-oral photos	172	39	16	74
e. Panoramic radiograph	87	24	50	192
f. Bitewing radiographs	46	14	47	257
g. Periapical/full mouth radiographs	99	74	30	114
h. Lateral cephalogram	214	9	7	52
i. Posterior-anterior cephalogram	256	5	1	9
j. Transcranial radiograph	247	16	4	8
k. Tomograms	260	4	1	6
l. TMJ exam	104	45	52	116

28. For my orthodontic patients; I perform the following in creating a treatment plan:

	Rarely	Occasionally	Most of the time	Regularly
a. Trace lateral cephalogram	215	7	10	42
b. Mount casts in centric relation	172	39	25	50
c. Mixed dentition analysis	176	30	33	42
d. Tooth size (Bolton) analysis	207	35	9	23

Please circle the number that indicates how strongly you agree or disagree with the following statements:

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
29. My orthodontic education while in dental school was comprehensive and extensive.	1 311	2 163	3 25	4 21	5 1
30. While in dental school, I learned to differentiate between limited and comprehensive orthodontic cases.	1 92	2 119	3 55	4 224	5 30
31. While in dental school, I learned enough to successfully treat limited orthodontic cases.	1 215	2 183	3 34	4 83	5 6
32. While in dental school, I learned enough to successfully treat comprehensive orthodontic cases.	1 409	2 96	3 9	4 1	5 2
33. There should be more orthodontic education while in dental school.	1 11	2 24	3 79	4 215	5 189
34. I feel that through continuing education in orthodontics, I have learned enough to successfully treat limited orthodontic cases.	1 142	2 102	3 120	4 86	5 59
35. I feel that the current continuing education system fulfills my orthodontic needs.	1 61	2 76	3 193	4 139	5 46
36. I am satisfied with the availability of continuing education courses in orthodontics.	1 28	2 67	3 212	4 170	5 36
37. I feel that general dentists and orthodontists have a healthy, working relationship.	1 12	2 32	3 43	4 277	5 155
38. I feel that the current relationship between general dentists and orthodontists is competitive.	1 91	2 250	3 109	4 55	5 15
39. In general, undergraduate curricula in dental schools meet the needs of today's general practitioner.	1 66	2 150	3 137	4 150	5 15
40. Dental schools are graduating too many dentists.	1 25	2 149	3 239	4 82	5 25
40.5. I feel that through continuing education in orthodontics, I have learned enough to successfully treat comprehensive orthodontic cases.	1 238	2 96	3 117	4 29	5 30

41. Please circle the number that indicates how strongly you are interested in the following topics for orthodontic continuing education:

	Absolutely no Interest		No Opinion		Extremely Interested
a. Diagnosis	1 76	2 24	3 51	4 257	5 97
b. Treatment planning	1 105	2 50	3 87	4 193	5 68
c. Craniofacial growth and development	1 112	2 62	3 87	4 196	5 42
d. Fixed appliance techniques	1 127	2 88	3 107	4 140	5 34
e. Growth modifying/Functional appliances	1 120	2 74	3 105	4 157	5 44
f. Patient management	1 120	2 72	3 126	4 147	5 35
g. Biomechanics	1 127	2 86	3 131	4 128	5 26
h. Biomaterials	1 135	2 95	3 143	4 108	5 18
i. Development of Occlusion	1 100	2 48	3 83	4 201	5 70
j. Orthodontics and orthognathic surgery	1 123	2 81	3 105	4 161	5 26
k. TMJ disorders and treatment	1 90	2 43	3 56	4 209	5 104
Other _____	1 83	2 15	3 44	4 27	5 17

42. Please indicate below how you gathered the data to answer the survey questionnaire:

a. My own best estimate 500
b. Retrieved information from office computer 11
c. Other _____ 3

43. If you have any additional comments you would like to add, please do so below:

44. Please indicate here if you would like a copy of the results: (If yes, please add a separate note with your address to help maintain confidentiality.)

a. Yes 97
b. No 432

THANK YOU VERY MUCH FOR YOUR TIME AND EFFORT IN COMPLETING THIS SURVEY!

Survey Questionnaire

This questionnaire is part of a study examining the types of services provided by dentists in Ohio. Please answer the following questions or check the appropriate answers for each statement as it would apply to the *dentist* to which this survey was sent.

1. Title of person completing this survey (e.g. dentist, office manager etc.) Dentist 97.2% / Office Mgr 2.5% / Other 0.4% n = 529

2. Date of birth. ____

3. Which of the following best describes your practice:
   a. General practice/Family dentistry ____
   b. Exclusive specialty practice in:

Orthodontics	____
Prosthodontics	____
Periodontics	____
Oral surgery	____
Oral pathology	____
Pediatric dentistry	____
Endodontics	____

4. Please indicate:
   a. Sex: Male 89% Female 11%

5. Please indicate:
   a. Dental school attended: _____
   b. Year of graduation: ____

6. Practice zip code:
   a. Primary office: _____
   b. Secondary office: _____
   c. Other office: _____

7. When a patient requires orthodontic treatment, I provide the following services: (please check appropriate column).

	NO	YES		n
		Periodically	Routinely	
a. Diagnostic services	36.7%	25.6%	37.7%	515
b. Space maintainers	37.9%	38.7%	23.4%	517
c. Preventive/Interceptive treatment	67.3%	20.0%	12.7%	510
d. Treatment of minor tooth malposition with removable appliances (spacers, retainers)	67.1%	20.4%	12.5%	511
e. Treatment of minor tooth malposition with fixed appliances (braces)	82.8%	9.0%	8.2%	513
f. Molar uprighting	82.3%	10.4%	7.3%	508
g. Treatment of anterior crossbites	77.4%	14.2%	8.4%	513
h. Treatment of posterior crossbites	84.1%	8.6%	7.3%	510
i. Treatment with headgear	97.5%	1.2%	1.4%	511
j. Treatment with functional appliances	87.7%	7.0%	5.3%	512
k. Comprehensive treatment with fully banded appliances—Class I	88.3%	3.7%	8.0%	512
l. Comprehensive treatment with fully banded appliances—Class II	90.4%	2.3%	7.2%	512
m. Comprehensive treatment with fully banded appliances—Class III	94.7%	2.3%	2.0%	511
n. Treatment of orthognathic surgery patients	97.4%	1.8%	0.8%	509

For the following questions, please place an "X" by the appropriate answer:

The following definitions should be applied accordingly: Limited orthodontic cases pertain to those treated with simple orthodontic tooth movement either with removable appliances or fixed appliances in one quadrant or one arch only. Comprehensive orthodontic cases pertain to those treated with full fixed appliances in one arch or both arches.

8. In the past five years, my overall patient load in general dentistry has:

a. Increased	74.9%	
b. Decreased	7.5%	n = 518
c. Stayed the same	17.6%	

9. In the past five years, the number of *orthodontic* patients treated in my office has:

a. Increased	24.8%	
b. Decreased	12.8%	n = 468
c. Stayed the same	62.4%	

10. The number of years I have been treating limited orthodontic cases is:

a. Zero	60.1%	
b. 1-5	8.8%	
c. 6-10	6.7%	n = 511
d. 11-15	8.0%	
e. More than 15	16.4%	

11. The number of years I have been treating comprehensive orthodontic cases is:

a. Zero	88.3%	
b. 1-5	2.9%	
c. 6-10	2.7%	n = 513
d. 11-15	2.5%	
e. More than 15	3.5%	

12. The percent of time in my practice I spend providing orthodontic services and treatment (limited and comprehensive) is:

a. 0%	63.3%	
b. 1-25%	35.1%	
c. 26-50%	1.4%	n = 515
d. 51-75%	0.2%	
e. 76-100%	0.0%	

13. At the present time, the number of limited orthodontic cases I have in active treatment is:

a. Zero	71.2%	
b. 1-10	23.4%	
c. 11-50	4.7%	n = 512
d. 51-100	0.7%	
e. More than 100	0.0%	

14. Approximately what percent of your limited orthodontic cases fall into the following categories?

a. Children (5-12 years) ____
b. Teenagers (13-17 years) ____
c. Adults (18-64 years) ____

15. At the present time, the number of comprehensive orthodontic cases I have in active treatment is:

a. Zero	88.0%
b. 1-10	4.1%
c. 11-50	5.5%
d. 51-100	1.8%
e. More than 100	0.6%

n = 508

16. Approximately what percent of your comprehensive orthodontic cases fall into the following categories?

a. Children (5-12 years)	____
b. Teenagers (13-17 years)	____
c. Adults (18-64 years)	____

17. The population of the community in which my office is located is: (the office in which I provide orthodontic services)

	Primary office	Secondary office
a. Greater than 500,000	21.7%	20.8%
b. 100,000-499,999	16.0%	8.3%
c. 10,000-99,999	48.7%	50.0%
d. 1,000-9,999	13.6%	20.8%
e. Less than 1,000	0.0%	0.0%

n = 470 n = 24

18. The distance (in miles) from my office to the closest office of an orthodontist is:

a. Less than 4 miles	83.7%
b. 5-10 miles	10.5%
c. 11-20 miles	4.8%
d. Greater than 20 miles	0.8%

n = 526

19. In my community, the number of active *general dentists* (in a 10 mile radius) is: (please estimate if unsure)

a. Zero	0.4%
b. 1-5	6.7%
c. 6-10	15.0%
d. 11-20	27.1%
e. 21-50	24.7%
f. Greater than 50	31.2%

n = 521

20. In my community, the number of active *orthodontists* (in a 10 mile radius) is: (please estimate if unsure)

a. Zero	4.8%
b. 1-5	44.0%
c. 6-10	24.7%
d. 11-20	16.1%
e. 21-50	9.2%
f. Greater than 50	1.3%

n = 523

21. Each month, the number of patients I refer to the orthodontic specialist is:

a. Zero	6.1%
b. 1-4	44.9%
c. 5-10	34.7%
d. 11-20	12.9%
e. Greater than 20	1.3%

n = 521

22. The number of orthodontic referrals I have given over the past five years has:

a. Increased	48.4%
b. Decreased	11.2%
c. Stayed the same	40.4%

23. Per year, the total number of hours of continuing education I take is:

a. Zero	1.0%	
b. 1-10	0.6%	
c. 11-20	16.2%	
d. 21-50	69.5%	n = 524
e. 51-100	10.1%	
f. Greater than 100	2.7%	

24. Per year, the number of hours of continuing education in *orthodontics* I take is:

a. Zero	60.8%	
b. 1-10	32.3%	
c. 11-20	4.2%	
d. 21-50	1.7%	n = 523
e. 51-100	0.6%	
f. Greater than 100	0.4%	

25. The number of orthodontic continuing education hours I have taken in the past five years has:

a. Increased	8.9%	
b. Decreased	14.7%	n = 482
c. Stayed the same	76.3%	

26. While in dental school, the number of orthodontic cases I treated directly was:

		Limited cases	Comprehensive cases	
a. Zero		58.1%	92.5%	
b. 1-3	n = 512	36.1%	6.5%	
c. 4-6		4.3%	1.0%	n = 386
d. 7-10		0.6%	0.0%	
e. Greater than 10		0.2%	0.0%	

27. For my orthodontic patients, I take the following pre-treatment records:

	Rarely	Occasionally	Most of the time	Regularly	n
a. Clinical exam	10.1%	3.2%	8.5%	78.2%	378
b. Study models	33.8%	18.0%	7.6%	40.5%	328
c. Extra-oral photos	62.5%	11.3%	4.1%	22.2%	293
d. Intra-oral photos	57.1%	13.0%	5.3%	24.6%	301
e. Panoramic radiograph	24.1%	6.8%	14.2%	54.4%	353
f. Bitewing radiographs	12.6%	3.8%	12.9%	70.6%	314
g. Periapical/full mouth radiographs	31.2%	23.3%	9.5%	36.0%	317
h. Lateral cephalogram	75.9%	3.2%	2.5%	18.4%	282
i. Posterior-anterior cephalogram	94.5%	1.8%	0.4%	3.3%	271
j. Transcranial radiograph	89.8%	5.8%	1.5%	2.9%	275
k. Tomograms	95.9%	1.5%	0.4%	2.2%	271
l. TMJ exam	77.8%	14.7%	11.4%	36.6%	317

28. For my orthodontic patients, I perform the following in creating a treatment plan:

	Rarely	Occasionally	Most of the time	Regularly	n
a. Trace lateral cephalogram	78.5%	2.6%	3.6%	15.3%	274
b. Mount casts in centric relation	80.1%	13.4%	3.7%	7.5%	286
c. Mixed dentition analysis	62.6%	19.7%	11.7%	14.9%	281
d. Tooth size (Bolton) analysis	75.5%	12.8%	3.3%	8.4%	274

Please circle the number that indicates how strongly you agree or disagree with the following statements:

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree	n
29. My orthodontic education while in dental school was comprehensive and extensive.	1 59.7%	2 31.2%	3 4.8%	4 4.0%	5 0.2%	521
30. While in dental school, I learned to differentiate between limited and comprehensive orthodontic cases.	1 17.7%	2 23.9%	3 10.6%	4 43.1%	5 5.8%	520
31. While in dental school, I learned enough to successfully treat limited orthodontic cases.	1 41.3%	2 35.1%	3 6.5%	4 15.9%	5 1.2%	521
32. While in dental school, I learned enough to successfully treat comprehensive orthodontic cases.	1 79.1%	2 18.6%	3 1.7%	4 0.2%	5 0.4%	517
33. There should be more orthodontic education while in dental school.	1 2.1%	2 5.0%	3 15.2%	4 41.3%	5 36.2%	520
34. I feel that through continuing education in orthodontics, I have learned enough to successfully treat limited orthodontic cases.	1 27.9%	2 20.0%	3 23.6%	4 16.9%	5 11.6%	509
35. I feel that the current continuing education system fulfills my orthodontic needs.	1 11.8%	2 14.8%	3 37.5%	4 27.0%	5 8.9%	515
36. I am satisfied with the availability of continuing education courses in orthodontics.	1 5.5%	2 13.1%	3 41.3%	4 33.1%	5 7.0%	513
37. I feel that general dentists and orthodontists have a healthy, working relationship.	1 2.3%	2 6.2%	3 8.3%	4 53.4%	5 29.9%	519
38. I feel that the current relationship between general dentists and orthodontists is competitive.	1 17.5%	2 48.1%	3 21.0%	4 10.6%	5 2.9%	520
39. In general, undergraduate curricula in dental schools meet the needs of today's general practitioners.	1 12.7%	2 29.0%	3 26.4%	4 29.0%	5 2.9%	518
40. Dental schools are graduating too many dentists.	1 4.8%	2 26.7%	3 46.0%	4 15.8%	5 4.8%	520
40.5. I feel that through continuing education in orthodontics, I have learned enough to successfully treat comprehensive orthodontic cases.	1 46.7%	2 18.8%	3 22.9%	4 5.7%	5 5.9%	510

41. Please circle the number that indicates how strongly you are interested in the following topics for orthodontic continuing education:

	Absolutely no Interest		No Opinion		Extremely Interested	n
a. Diagnosis	1 1.5%	2 4.8%	3 10.1%	4 50.9%	5 19.2%	505
b. Treatment planning	1 20.9%	2 7.9%	3 17.5%	4 36.4%	5 12.5%	502
c. Craniofacial growth and development	1 22.4%	2 12.4%	3 17.4%	4 29.3%	5 8.4%	499
d. Fixed appliance technique	1 35.6%	2 17.7%	3 21.6%	4 20.2%	5 4.9%	495
e. Growth modifying/Functional appliances	1 24.0%	2 14.8%	3 24.0%	4 31.4%	5 8.8%	500
f. Patient management	1 24.0%	2 14.4%	3 25.2%	4 29.4%	5 7.0%	500
g. Biomechanics	1 25.5%	2 17.3%	3 26.3%	4 25.7%	5 5.2%	498
h. Biomaterials	1 27.1%	2 19.0%	3 28.7%	4 21.6%	5 3.6%	499
i. Development of Occlusion	1 19.9%	2 9.6%	3 16.5%	4 40.0%	5 13.9%	502
j. Orthodontics and orthognathic surgery	1 24.8%	2 16.3%	3 24.2%	4 32.5%	5 12.2%	496
k. TMJ disorders and treatment	1 17.9%	2 9.6%	3 11.3%	4 41.6%	5 20.7%	502
Other _____	1 44.6%	2 8.1%	3 23.7%	4 14.5%	5 9.1%	136

42. Please indicate below how you gathered the data to answer the survey questionnaire:

a. My own best estimate	97.3%	
b. Retrieved information from office computer	2.1%	n = 514
c. Other _____	0.6%	

43. If you have any additional comments you would like to add, please do so below:

44. Please indicate here if you would like a copy of the results: (If yes, please add a separate note with your address to help maintain confidentiality.)

a. Yes ____
b. No ____

THANK YOU VERY MUCH FOR YOUR TIME AND EFFORT IN COMPLETING THIS SURVEY!

APPENDIX 4. -- Michigan Data

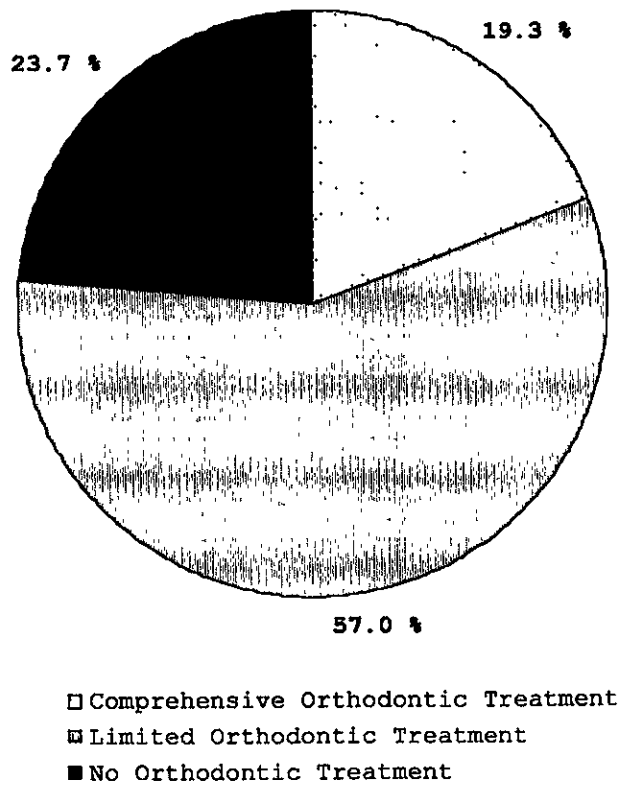


Figure 66. Pie chart illustrating the published distribution of orthodontic treatment provided by general dentists in Michigan.

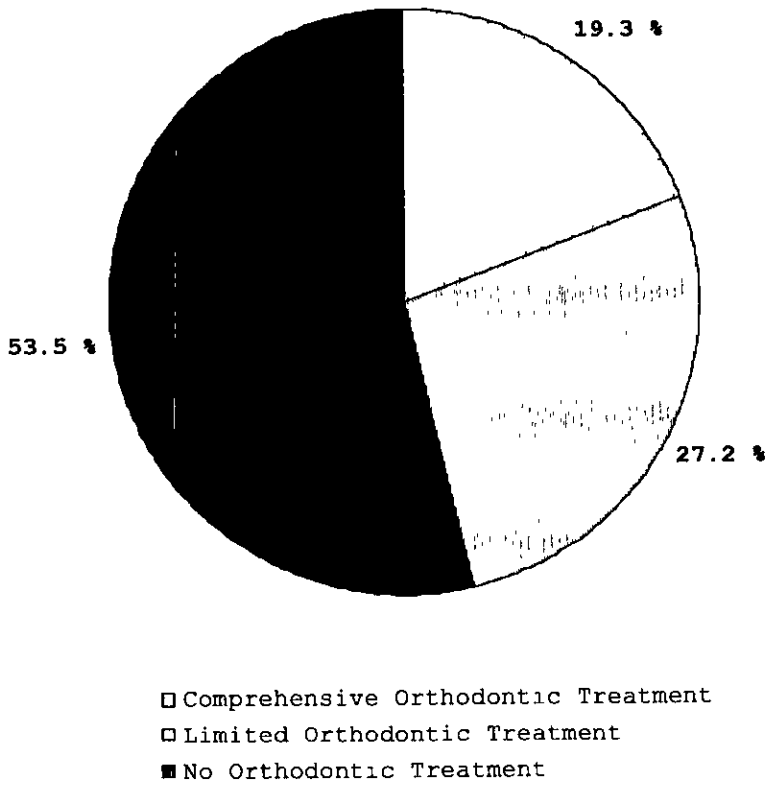


Figure 67. Pie chart showing the calculated distribution of orthodontic treatment provided by general dentists in Michigan.

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