LINEAR AND ANGULAR MEASUREMENTS FROM PLAIN FILM CEPHALOMETRY, 3DCEPH, AND CBCT

by

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The advent of cone beam computed tomography (CBCT) in orthodontics raises the question of how it compares with existing diagnostic tools in providing useful quantitative measures. This study compared linear and angular measurements from craniometry (Cranio), plain film cephalometry (Ceph), three-dimensional cephalometry (3DCeph), and CBCT.

Sixteen linear and fourteen angular measurements were taken using Cranio, Ceph, 3DCeph, and CBCT in 6", 9", and 12" field of views (FOV) from five dry skulls. Cranio values defined the "gold standard" for linear measurements, and Ceph values the angular. Paired t-tests and correlations were used for comparison.

For linear measurements, Ceph had the most significant differences, followed by 3DCeph and CBCT. All had

high ($r > 0.75$) correlations. Average discrepancies were 4.18 mm for Ceph, 1.32 mm for 3DCeph, and less than 1 mm for CBCT in all three FOVs. For angular measurements, CBCT(9) and CBCT(6) were not considered due to incompleteness. Cranio had 6 significant differences, CBCT had 5, and 3DCeph had 2. Cranio and CBCT had low correlations for FMA and FMIA. Average discrepancies were 2.7° for Cranio, 2.1° for CBCT, and 1.8° for 3DCeph. CBCT compared favorably with craniometry for linear measurements, but not with traditional cephalometrics for angular.

DEDICATION

To Tony and Micky Discenzo:

You were good friends and neighbors.

You are in my prayers.

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INTRODUCTION

There is a great deal of excitement whenever new technology makes its first appearance. Computed tomography has been become a staple in medicine, but now it is starting to enter the dental field. Since Broadbent invented the cephalometer in 1931, cephalometrics has become a fundamental tool for formulating orthodontic treatment plans. At present the orthodontic records consist of the panoramic and cephalometric radiographs, the facial photographs and the dental casts. Out of all of these, only the plaster casts are three-dimensional. Orthodontists are making diagnoses and treatment plans from two dimensional images. With the advent of cone beam computed tomography, orthodontists have the potential to take records in three dimensions. In one scan, cone beam computed tomography can capture the teeth, the supporting bony structures and the soft tissue. It has the potential to replace conventional records. With lower cost and radiation exposure, cone beam computed tomography is a vi-

able alternative to the conventional medical computed tomography.

The question arises: How does cone beam imaging compare with present diagnostic tools in providing the orthodontist with useful information? Which of the present radiographic tools -- the cephalogram or the cone beam computed tomographic scan -- does a better job of representing the patient?

REVIEW OF THE LITERATURE

Digital Radiography

With the increased use of computers in orthodontic practices, digital imaging has become a viable option and in some ways a superior alternative to conventional film imaging. The traditional radiographic film consists of silver halide crystals attached to an acetate base. When exposed to radiation, the crystals are ionized and are reduced to black metallic silver in the developing process (Brennan 2002).

With digital imaging, picture elements (pixels) replace the silver halide crystals as the smallest components of the image. In contrast to the haphazard distribution of silver halide crystals in a film, pixels are organized in rectangular arrays. Every pixel has information encoded about its size, color, intensity value and position within an image. In general, radiographic images are displayed with grey color and intensity values range from 8 to 12 bits. An image with 8 bits possesses 256 (or 2^8) shades of grey, where 0 corresponds to black and 256

to white. Spatial resolution depends on the size of the pixel (pixel/mm) and contrast resolution depends on the number of grey levels. The three-dimensional equivalent for the pixel is the volume element (voxel), where each voxel also has a height width and thickness. A voxel volume may be considered a collection of layered bitmapped images (Hatcher and Aboudara 2004).

A digital image can be acquired directly or indirectly. With digital imaging, the image display and radiation detector are separate, unlike traditional radiography where the film is both. For both direct and indirect digital imaging, the computer monitor is the image display. But in direct digital imaging, the radiation sensor is usually a charge coupled device (CCD). The CCD sensor uses a network of silicon crystals to convert light energy into an electronic signal. The signal feeds directly to the computer and an image is projected on the monitor. In indirect digital imaging there is a step between acquiring the image with the detector and displaying it on the computer screen. Scanning the traditional radiograph into the computer with a flatbed scanner fitted with a transparency adaptor is the most "low tech" method of generating a digital image. Another method uses

a phosphor storage plate (PSP). Upon exposure to radiation, the PSP stores an image as energy. When scanned with a laser, the PSP emits light and the latent image can be transferred to the computer. Even though PSPs supposedly store energy for days, they should be scanned soon after exposure since they begin to lose information within minutes (Brennan 2002).

Advantages of digital imaging over conventional film radiography include speed, environmental friendliness, reduced radiation exposure, image manipulation, storage and communication. Reduction in working time is especially noticeable with CCD systems where the image is displayed at the chair side within 1 or 2 minutes of exposure (Wenzel and Gotfredsen 2002). PSP systems take longer due to the additional step of scanning the plate which takes approximately 3 minutes. But this processing time is still faster than conventional dark room film development (Brennan 2002).

Processing chemicals and the dark room become superfluous with digital imaging. Both CCD sensors and the PSP plates are reusable and may be exposed repeatedly. In addition, developing errors are avoided (Wenzel and Gotfredsen 2002).

Radiation dose may be lowered with CCD systems because the sensors are more sensitive to x-rays than film. However there is no consensus for PSP systems. Most manufacturers of PSP systems recommend using the same exposure settings as with film (Wenzel and Gotfredsen 2002).

With the software programs available, orthodontists can focus on the areas of greatest diagnostic importance and ignore the rest. Adjustment of brightness and contrast can improve overexposed or underexposed images. The airspace around the face can be filtered to define the soft tissue profile more clearly. Software programs can also help the clinician to determine and analyze cephalometric measurements. With fears of tampering with medical records, many software companies have implemented "audit trails" so that the original image may be retrieved (Brennan 2002).

With the prevalence of DVDs and CD-ROMs, images can be saved economically and indefinitely. A digital cephalogram taken at 150 dots per inch resolution will have approximately 1,000,000 pixels. Assuming a memory requirement of 1 byte per pixel, the cephalogram would use 1 megabyte of memory space -- a tiny amount by present standards (Halazonetis 2005).

Digital images may be compressed and electronically transmitted to colleagues for evaluation. Many companies in the USA allow the submission of digital images for insurance claims (Brennan 2002). Recently, a standard developed for Digital Imaging and Communication in Medicine (DICOM) has also entered dentistry. The DICOM standard was first devised to allow computers with different viewing software to read images taken with various imaging devices. Conventions for the communication, formatting and exchange of digital images and other visual information are part of the DICOM standard. In dentistry, the DICOM standard would apply for radiographs and photographs (Farman 2005).

Cephalometry

Since Broadbent first developed the cephalometer in 1931, cephalometrics has become an integral part of orthodontics. Orthodontists use it for diagnosis, treatment planning and evaluating growth. At the time, cephalometrics offered distinct advantages over previous methods of measuring the face and head. Cephalometrics enabled orthodontists to visualize the bony structures beneath the soft tissues covering of the face. Previously, bony measurements could only be performed on a dead skull with a

craniostat. In addition, growth and development was difficult to study since adolescent skulls usually do not come from normal, healthy children. The invention of the cephalometer allowed orthodontists to observe the living from the growing child through to the mature adult. Cephalometrics offered a way to relate changes in the jaws and teeth to the rest of the head (Broadbent 1931).

However, cephalometrics does have its limitations. Baumrind and Frantz (1971a) showed that a large source of error in cephalometrics comes from identifying landmarks. They studied sixteen conventional landmarks from repeated tracings of twenty cephalometric films. The amount of error observed varied from landmark to landmark, and each landmark had a distinctive and frequently noncircular envelope of error. The ability to find landmarks depends on how sharply the skull surface curves in the area of interest and the contrast of the bony surface with the surrounding image. Greater experience also helps the operator to filter the confounding noise of overlapping structures.

In a follow-up study, Baumrind and Frantz (1971b) evaluated the reliability of angular and linear measurements from cephalometric films. They wanted to see how

errors in locating landmarks contributed to the errors of linear and angular measurements. Again they found that the errors in angular and linear measurements were considerable. They showed that measurement errors depended on errors in locating the landmarks, the distances separating landmarks, and the direction of spread for the envelopes of error.

As recently as 2000, Perillo and associates found that errors in locating landmarks still posed a problem. Five examiners (three orthodontists, a dental radiologist and a second-year orthodontic resident) evaluated lateral cephalograms taken from 34 adult subjects. The landmarks right and left condyle, sella, nasion point A, infradentale, pogonion and menton were identified on each film and subjectively scored as identifiable, non-identifiable or interpreted. In addition, linear measurements between select landmarks were determined. The investigators found that right condyle, nasion and point A were scored as non-identifiable most frequently. Pogonion and menton were considered most easily identifiable. However, less variability was found for determining linear distances than for identifying the landmarks themselves. Their findings seem to indicate that researchers rather than

clinicians need to worry about precision in locating landmarks.

With the increased prevalence of computers in the office, many orthodontists have turned to digital radiography. However, Chen and coworkers (2000) showed that the conversion from film to digital images does not correspond to an improvement in landmark identification. They compared the locations of nineteen landmarks from original cephalograms and their scanned digital counterparts. Horizontal and vertical displacements were calculated for each landmark on the digital images. Statistically significant displacements in the horizontal direction were found for the landmarks Me, Gn, ANS, PNS and LIA. Landmarks with significant vertical displacements included Po, Or and Gn. However, only the landmarks Or, Me, PNS and LIA had displacements greater than 1 mm. Reliability in locating landmarks was poorer in general for the digital images, but only Po, Ar, ANS, and UM had statistically significant differences. The authors concluded that orthodontists need to inspect these four landmarks more closely when using digital cephalometry.

Bruntz (2004) also demonstrated that distortion occurs in digitally scanned and printed duplicates of tra-

ditional cephalograms. Initial and final cephalograms of thirty subjects were evaluated. In the process of scanning original films into digital images, the digital radiograph stretched 0.8 mm in the vertical direction and compressed 0.4 mm in the horizontal. The printing of the digital image to paper added a 0.3 mm and 0.8 mm enlargement in both the vertical and the horizontal dimensions. So the duplication of films with the computer produced a net maximum distortion of 1.1 mm in either direction. Cephalometric measurements using Po or Or were significantly different in both the scanned image and the printed cephalogram from the original film. However, superimpositions were not affected.

In contrast, Schulze and associates (2002) found that landmark recording from direct digital and conventional film cephalograms to be comparable. Six landmarks were traced from the monitor display of three direct digital and three film cephalograms. Landmark identification was repeated twice. The investigators found that the direct digital images were enlarged 11.5% in the vertical direction and 12.8% in the horizontal when compared to the corresponding film. The landmarks nasion, posterior nasal spine, sella, supraspinale, and orbitale all had

significant differences in position, but the average differences were all less than 1 mm. there was no difference between direct digital and film imaging for interobserver and intraobserver reproducibility.

Three-dimensional Cephalometry

Although it is possible to extract three-dimensional information from a pair of frontal and lateral cephalograms, most orthodontists tend to use each film separately. Grayson and colleagues (1988) developed the Broadbent-Bolton "Orientator" further to show how the location of the same landmark identified on both the lateral and frontal cephalogram can be combined into a single three-dimensional point. The method takes advantage of the layout of the cephalostat to coordinate the lateral and frontal films. After both films are aligned on a common Frankfort Horizontal plane, landmarks are identified on both films with the aid of a set of diverging rays intersecting at approximately 90°. The diverging rays represent the spread of the x-ray beams from the two sources of the cephalostat. Unfortunately, this technique cannot represent curved structures.

In 1991, Bookstein and fellow investigators used the technique developed by Grayson and colleagues to compare the location of landmarks derived with three-dimensional cephalometry to those from dry skulls. Six mandibular landmarks were located on ten dry skulls. Landmark locations on the skull were calculated from the distances between a given landmark and its fellows. Both the dry skull and three-dimensional cephalometric methods of locating landmarks had similar standard errors and precision. However, the investigators found the dry skull location for condylion was 10 mm medial and slightly forward from the three-dimensional cephalometric position. The dry skull position for gonion was an average of 1.6 mm behind the reconstructed cephalometric point. Both dry skull menton and lower incial edge were forward by approximately 1.4 mm. Landmarks with the lowest discrepancies were the ones that could be seen most clearly on the cephalometric films.

Dean and co-investigators (1998) tested the reliability and accuracy of locating landmarks with three-dimensional cephalometry. Four operators located fifty landmarks on the frontal and lateral cephalograms of three dry human skulls. Then metallic markers were at-

tached to the actual anatomic landmarks on the same skulls and one operator collected a new set of three-dimensional landmarks with the marked skulls. The locations of the metallic markers served as the "gold standard" for accuracy. The average interoperator variability for all operators, landmarks, and skulls was within 3.33 mm. The landmarks with the least variability were B point, lower incisal edge and anterior nasal spine. Accuracy was on average within 5.03 mm for all the operators, landmarks and skulls. The landmarks with the identified with the highest accuracy included B point, upper incisal edge and lower incisal edge. Each of these landmarks was identified within 2 mm of the metallic marker. In general, landmarks with well defined geometry exhibited the lowest variability and highest accuracy.

Adams and colleagues (2004) compared the accuracy of two-dimensional and three-dimensional cephalometry. Thirteen landmarks on nine dry skulls were used to determine craniometric, traditional two-dimensional cephalometric and three-dimensional cephalometric measurements. A calibration framework was placed on each skull just prior to taking three films: a frontal, a lateral and a 45° oblique. The calibration framework was used to coordinate

the three films and to generate three-dimensional coordinates. Craniometric measurements were taken with a digital caliper. The investigators found that measurements from the traditional two-dimensional cepalometric films deviated significantly from craniometric ones. Differences ranged from a -17.68 mm underestimation of Gn-Zyg R to a +15.52 mm overestimation of Zyg L-Zyg R. The three-dimensional cephalometric measurements were within approximately 1 mm of the craniometric ones.

Until recently, three-dimensional imaging of a patient could only be achieved by merging three sources of information since different physical media were needed to capture the teeth, the bony supporting structures and the facial surface. Data on the teeth were best captured with study casts, the bony structures with two-dimensional lateral and frontal cephalograms, and the facial surface features with two-dimensional facial photographs (Baumrind et al. 2003). Methods of capturing the outer surface of the face include stereophotogrammetry and the structured light technique. In stereophotogrammetry, two images are acquired of the subject. Corresponding points from both images are triangulated to produce three-dimensional coordinates for the subject (Hajeer et al.

2004). With the structured light technique, a light pattern is projected on the subject and only one image is taken. By comparing the light pattern in the captured image to that in the projection plane, three-dimensional coordinates are calculated (Nguyen et al. 2000). Combining the three-dimensional data from the photographs and the radiographs is possible with the photogrammetric "tie point" method, but the process is time-consuming and painstaking. Now volumetric scans can image the teeth, bones and face in a single registration, dispense with the merging process and capture more information than conventional records can (Baumrind et al. 2003).

Three-dimensional Imaging

The goal of imaging in medicine and dentistry is to create a faithful representation of the patient's anatomy. Although three-dimensional cephalometrics provides three-dimensional information about the subject, it is not a truly three-dimensional approach. It relies on locating the same landmarks on flat two-dimensional radiographs and mathematically calculating three-dimensional positions. Accuracy depends on locating landmarks on both the frontal and lateral cephalograms correctly and only points visible on both films can be used. Errors from co-

ordinating the films and head position remain. The frontal and lateral cephalograms are still two-dimensional images. In contrast, computed tomography (CT) and magnetic resonance imaging (MRI) provide genuine three-dimensional images. Gone are the problems of merging films and rotated heads, and any point - whether or not it is visible on the frontal or lateral cephalogram - is useable (Halazonetis 2005).

At present, plaster study casts are the only source of truly three-dimensional information that orthodontists use regularly. But merging the information from these casts and other diagnostic records is inaccurate (Harrell et al. 2002). Unfortunately, CT does not have enough resolution to capture detailed images of teeth and interferences from metal and other materials create artifacts. Accurate digital three-dimensional dental models are available through destructive scanning of plaster casts, laser scanning of impressions or direct imaging of the teeth. But these models only show the dental crowns and lack root and skeletal information. Researchers are developing ways of incorporating accurate digital dental crown images with CT scans (Enciso et al. 2003).

Visualizing the teeth and surrounding bone in three-dimensions is effortless with volumetric scans. The mesiodistal length and buccolingual width of the alveolar ridge become evident. Software tools let the clinician strip away tissue layers to reveal hidden anatomy. The clinician can verify the amount of cancellous bone available for retracting incisors or distalizing molars to avoid hitting the cortical plate. The position of supernumerary teeth and the nearness of dental roots to bony voids like the maxillary sinus or alveolar clefts in patients with craniofacial anomalies are also visible (Hatcher and Aboudara 2004). CT images can elucidate the location, long axis and root condition of impacted teeth more clearly than plain film radiography. Anatomy like the temporomandibular joint that is usually unclear in conventional films is discernible (Nakajima et al 2005). At present, CT machines do not have enough resolution to sense the early stages of root resorption, but they have the potential to do so in the future. In addition to the soft tissue profile, cheek thickness, cheek prominence, tongue size and posture may be assessed. The upper respiratory tract from the nasal passages to the pharynx is visible (Halazonetis 2005). By manipulating individual

anatomic parts, predictions of mandibular growth and surgical simulations are possible (Maki et al. 2003). We can already use the digital three-dimensional model of the head to simulate mandibular movement (Enciso et al. 2003).

The principal advantage of moving towards volumetric imaging is that diagnostic information typically scattered amongst conventional records is collected together. Instead of analyzing the cephalograms, the panoramic radiograph, the photographs and dental casts separately, having a single volume that includes all the same information allows a better appreciation of how structures relate to each other. But switching to three-dimensions does not force us to discard conventional cephalometric measurements. Volumetric scan information can be reformatted into a two-dimensional image similar to a cephalogram, or landmarks may be located simply in three-dimensions. The computer would be able to calculate the midpoint of bilateral landmarks (Halazonetis 2005). This backwards compatibility is useful since there is a lack of longitudinal data. It will take at least a decade to accumulate longitudinal volumetric data for studying treatment progress and outcomes in three-dimensions (Baumrind et al. 2003).

Cone Beam Computed Tomography

The usefulness and convenience of computed tomography in medicine has propelled its growth at an annual rate of 15-20%. Since its beginning, computed tomography was intended for craniofacial imaging, but it did not catch on until scanners with high resolution of 2 mm slice thickness were developed (Vannier 2003). Computer processor speeds and memory requirements for three-dimensional data have also impeded the clinical use of volumetric imaging. Assuming each voxel requires 1 byte, a volume of 1000^3 voxels would use 1 gigabyte of memory. Until recently, only computers dedicated for CT use would have possessed the computing power needed to handle volumetric data. For now, CT scanners usually deliver volumes with 256^3 or 512^3 voxels (Halazonetis 2005).

Once Hounsfield developed computed tomography in the early 1970s, diagnostic imaging could be done in three dimensions (Hounsfield 1973). Radon had proposed the concept for computed tomography earlier in 1917, stating that an infinite series of two-dimensional images taken from different positions can recreate a three-dimensional object (Helgason 1980). Both the x-ray source and the detector rotate around the subject in CT scanners. The

first generation of CT scanners was intended to image the head. The first "pencil beam" scanners captured a narrow beam of x-rays on a single detector. At a given position, the detector and x-ray source would translate horizontally to image the subject line by line before rotating 1° to the next position. In a single rotation, the CT machine could only capture one cross-sectional slice. The second "hybrid" generation had more than one detector and substituted a small fan beam for the pencil beam. But the scanners still needed to translate and rotate to capture a single slice. These scanners were still primarily used for the head since full body imaging was poor due to patient motion. The third "fan beam" generation of scanners increased the size of the fan beam and upgraded the detector to a large arc-shaped one. These scanners do not need to translate, but can image an entire slice by merely rotating. The fourth generation of scanners uses a ring of fixed detectors and a circling x-ray source to image the subject. But these fourth generation scanners are costly, yet experience more scatter, so at present the CT scanners of choice remain third generation. Modern

scanners have 16 rows of detectors and can capture multiple cross-sectional slices concurrently (Sukovic 2003).

Cone beam computed tomography (CBCT) was first developed to image the cardiopulmonary system. Motion artifacts marred conventional CT images of moving systems because it took too long to capture a volume. So the first CBCT scanner was designed to image an entire three-dimensional volume swiftly (Robb et al. 1983). The first dedicated craniofacial CBCT scanner was developed in the late 1990s (Mozzo et al. 1998) and by 2001 the Food and Drug Administration approved its sale in the United States (Vannier 2003).

There are differences between conventional CT and cone beam CT. Conventional CT scanners image a patient in a sequence of layered slices or an uninterrupted spiral, but cone beam CT uses a pyramidal beam and a two-dimensional detector to capture an entire volume in a single rotation. The volume captured in a single session contains information about both the maxilla and mandible and can be reformatted into the traditional cephalometric, panoramic and occlusal views. The x-ray beams with CBCT are almost parallel so the images should not suffer from the distortion of projection errors that plague tradi-

tional two-dimensional dental radiography. In addition, the computer software should factor out any magnification (Mah and Hatcher 2004). CBCT machines provide three-dimensional images from equipment that is small and cheap enough for orthodontists, oral surgeons and general practitioners to use in private practice (Vannier 2003).

Radiation

Patients have a lower absorbed dose with CBCT than with conventional CT because the cone shaped beam in CBCT uses x-ray emissions more efficiently than a fan shaped one. The majority of the emitted beam is wasted with the conventional fan beam since only a few thousandths of the beam is used for imaging (Mozzo et al. 1998).

In 2002, Cohnen and fellow investigators showed that the effective dose from CBCT was between those of conventional CT and panoramic radiography. Head phantoms with thermoluminescent dosimeters placed at thirteen anatomical sites were used to assess radiation exposure and noise. Noise was evaluated as the standard deviation of grey values, and was only used to compare CBCT and conventional CT. Effective doses for conventional CT were an average of five times higher than for CBCT. This result is similar to an earlier report which stated that the ra-

diation dose from CBCT was one sixth of spiral CT (Mozzo et al. 1998). But when using a low-dose protocol, conventional CT was only 35% higher than CBCT. Panoramic radiography had the lowest dose, being one tenth of CBCT and one thirteenth of low-dose CT. There was no difference between CBCT and conventional CT for image noise, but assessment of the soft tissue was only possible with conventional CT.

Another study found limited CBCT to have superior image quality yet lower skin dose when compared to conventional multirow CT for examining hard tissues. An Alderson Rando head phantom was used to evaluate image quality at the right maxillary central incisor and the left mandibular first molar. Skin dose was measured with a thermoluminescent dosimeter. Five operators subjectively compared printed images of the teeth at equal magnification and in 300 DPI full color mode. The operators used a five point scale to rate images twice for overall impression and for showing cortical bone, cancellous bone, enamel, dentin, pulp cavities, periodontal ligament spaces, and lamina dura. The limited CBCT images consistently rated higher than the multirow CT images in quality. Mean skin dose for limited CBCT was also much lower

at 1.19 mSv when compared to 458 mSv for multirow CT (Hashimoto et al. 2003).

Comparing doses for each imaging technique directly is not meaningful, since each method provides different information. Conventional records for a patient considering implant surgery in both arches would include panoramic and separate maxillary and mandibular CT radiographs. The combined dose from the three examinations (2.9-9.6 μSv for the panoramic, 17.6-656.9 μSv for the maxillary CT, and 124.9-250.3 μSv for the mandibular CT) amounts to 145.4-916.8 μSv (Mah and Hatcher 2004).

The areas of the head and neck receiving radiation might also be a factor to consider. Conventional radiography of the midface includes panoramic, orbital, modified Waters and submentovertex projections. Unlike the radiographs needed to plan for dental implants, these projections expose sensitive anatomy like the lens of the eye to radiation. Schulze and associates (2004) compared the dose and areas exposed to radiation in 4- and 16-slice CT, CBCT and conventional radiography of the midface. Thermoluminescent dosimeters were placed in an Alderson Rando head phantom at fifteen anatomic locations, including the thyroid and the lens of the eye. A pos-

teroanterior projection was substituted for the submentovertex view in conventional radiography, since imaging the phantom axially was impractical. Both 4-slice and 16-slice CT had almost the same dose when using modified protocols. CT had the highest dose and conventional radiography had the lowest. CBCT had 2-3 times the dose of conventional radiography. The highest dose for CT was recorded at the vitreous body of the eye. The mandibular corpus or the pterygoid muscles had the highest exposure with CBCT and the parotid area with conventional radiography.

Accuracy

Few studies have evaluated the accuracy of CBCT images. Araki and colleagues (2004) assessed the Hitachi CB MercuRay™ for resolving power, distortion of images, and noise. Distortion was measured with circularity values from the comparison of CBCT images of circular phantoms to computer generated circles of the same pixel dimensions. Noise was evaluated from the standard deviation of Hounsfield units for water. The investigators found the resolution of the 9″ mode was 1.3 lp/mm, the 6″ mode was 1.6 lp/mm, and the 4.5″ mode was 2.3 lp/mm. Distortion was less than 99.0% in the 9″ mode, 98.0% in the 6″ mode,

and 96.8% in the 4.5" mode. Noise was higher in CBCT images than in conventional CT, but the investigators still felt it was within acceptable limits. An earlier study had found a similar spatial resolution at 2.0 lp/mm and a similar level of distortion at less than 94.53%. It also found the resolution of three-dimensional images to be 1.25 lp/mm (Yamamoto et al. 2003).

Mozzo and associates (1998) evaluated the geometric accuracy of CBCT images. A geometric phantom with circular inserts of known dimensions was scanned horizontally and at a 30° tilt. CBCT images were measured three times and from three different angles. Results showed width and height measurements to be within 0.8-1% and 2.2% of the actual dimensions, respectively.

In a separate study, Marmulla and co-investigators (2005) scanned a cubical phantom with cylindrical bores perforating each face to evaluate geometric accuracy. The scanned image of the cubical phantom was rotated to its vertex and measurements were taken from slices in this new position. The distances measured between the cylindrical bores on the image slices were compared to expected dimensions. Since the measured distances were

within 0.3 mm of the expected values, the investigators concluded that CBCT images were geometrically accurate.

Kobayashi and co-workers (2004) demonstrated that limited CBCT was more accurate than spiral CT. Distances from the alveolar crest to reference holes placed in five cadaver mandibles were measured with spiral CT, limited CBCT and digital calipers. Discrepancies from caliper measurements ranged from 0-1.11 mm for spiral CT, and from 0.01-0.65 mm for limited CBCT. Measurement error was 2.2% for spiral CT, but only 1.4% for limited CBCT.

Lascala and colleagues (2004) evaluated the accuracy of CBCT linear measurements and found them to be consistently smaller than the actual object. Nineteen landmarks were used to determine thirteen linear distances on eight dry skulls. Distances were measured with digital calipers on the dry skulls and from two sections of the CBCT scan. CBCT measurements were taken from an axial section in addition to a sagittal or coronal view. The investigators found that caliper measurements were always larger than CBCT ones, but significant differences only existed for internal skull sites.

Hilgers and co-investigators (2005) also examined the accuracy of CBCT images. They compared linear meas-

urements of the temporomandibular joint from dry skulls, digital cephalograms, and CBCT scans. The investigators measured ten linear distances on 25 dry mandibles three times. Cephalometric measurements were determined from frontal, lateral and submentovertex views, while CBCT measurements were taken from custom reformatted projections. An analysis showed that most cephalometric measurements, regardless of the projection, and despite correcting for magnification, were statistically larger than dry skull measurements by 7.0-25.9%. In contrast, there was no statistical difference between CBCT and dry skull measurements. CBCT measurements also had the highest reliability, while cephalometric measurements had the lowest.

A more recent study also showed that limited CBCT was more accurate than conventional two-dimensional radiography for measuring caries depth. This study used limited CBCT, a PSP digital radiographic system, and plain film radiography to measure the depths of carious lesions from thirty unrestored human teeth. Actual depths were later measured from serial sections of the teeth. Results showed that interoperator correlation was high for all methods, but measurements from PSP and plain film radio-

graphs were significantly different from the histological sections. Since the limited CBCT measurements were not, the researchers concluded that limited CBCT could be useful for monitoring caries (Akdeniz et al. 2006).

STATEMENT OF PURPOSE

Cone beam computed tomography is becoming popular in the orthodontic community. The question arises of how does cone beam imaging compare with accepted radiographic tools in providing the orthodontist with useful quantitative measures?

The first objective of the present study is to compare linear measurements from craniometry to plain film cephalometry, three-dimensional cephalometry and cone beam computed tomography. The second objective is to compare angular measurements from traditional lateral cephalometry to three-dimensional cephalometry, cone beam computed tomography, and craniometry.

The null hypothesis is that there is no difference between any of the methods for linear and angular measures.

MANUSCRIPT

Linear and Angular Measurements from Plain Film Cephalometry, 3DCeph, and CBCT

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ABSTRACT

The advent of cone beam computed tomography (CBCT) in orthodontics raises the question of how it compares with existing diagnostic tools in providing useful quantitative measures. This study compared linear and angular measurements from craniometry (Cranio), plain film cephalometry (Ceph), three-dimensional cephalometry (3DCeph), and CBCT. Methods: Sixteen linear and fourteen angular measurements were taken using Cranio, Ceph, 3DCeph, and CBCT in 6", 9", and 12" field of views (FOV) from five dry skulls. Cranio values defined the "gold standard" for linear measurements, and Ceph values the angular. Paired t-tests and correlations were used for comparison. Results: For linear measurements, Ceph had the most significant differences, followed by 3DCeph and CBCT. All had high ($r>0.75$) correlations. Average discrepancies were 4.18 mm for Ceph, 1.32 mm for 3DCeph, and less than 1 mm for CBCT in all three FOVs. For angular measurements, CBCT(9) and CBCT(6) were not considered due to incompleteness. Cranio had 6 significant differences, CBCT had 5, and 3DCeph had 2. Cranio and CBCT had low correlations for FMA and FMIA. Average discrepancies were 2.7° for Cranio, 2.1° for CBCT, and 1.8° for 3DCeph. Conclusions: CBCT compared favorably with craniometry for linear measurements, but not with traditional cephalometrics for angular.

INTRODUCTION

With the increased use of computers in orthodontic practices, digital imaging has become a viable option and in some ways a superior alternative to conventional film imaging. Advantages of digital imaging over conventional film radiography include speed, environmental friendliness, reduced radiation exposure, image manipulation, ease of storage and communication [1-5].

Since Broadbent first developed the cephalometer in 1931, cephalometrics has become an integral part of orthodontics [6]. Cephalometrics allows orthodontists to evaluate bony structures beneath the soft tissues of the face. It plays a role in diagnosis, treatment planning and evaluating treatment progress. However, cephalometrics does have its limitations. A large source of error comes from landmark identification [7-9]. These errors persist in digital cephalometrics and errors in landmark location remain comparable between plain film and digital cephalograms [10]. Distortion and magnification are other factors to consider.[11, 12].

Three-dimensional cephalometrics has been proposed as a way to represent patients more accurately. Studies have shown that corresponding landmarks from lateral and frontal cephalograms can be combined into a three-dimensional point [13-16]. However, most orthodontists still tend to use each film separately.

Once Hounsfield developed computed tomography in the early 1970s, diagnostic imaging could be done in three dimensions [17]. New cone beam computed tomography (CBCT) scanners can capture an entire volume in a single rotation [18]. The first dedicated craniofacial CBCT machine was developed in the late 1990s [18] and by

2001 the FDA had approved their sale in the United States [19]. Software tools allow the clinician to separate tissue layers and view hidden anatomy [20]. The volumetric nature of CBCT scans lends itself to creating three-dimensional models of patients [21-23]. Impacted teeth, temporomandibular joints and other structures that are ordinarily difficult to visualize with conventional film radiography are revealed with CBCT imaging [22]. By manipulating individual anatomic parts, predictions of mandibular growth and surgical simulations are possible [23].

However, few studies have evaluated the accuracy CBCT images. A couple of studies examined resolution, distortion and noise [24, 25]. Others have examined geometric accuracy [18, 26]. In 2004, Kobayashi and co-workers [27] showed that distances measured with limited CBCT were within 0.65 mm of actual ones and measurement error was 1.4%. Lascala and colleagues [28] found that CBCT measurements were always smaller than real ones, but these differences were only significant for the internal skull base. More recent studies have shown CBCT to be accurate for linear temporomandibular joint measurements [29] and for measuring the depth of caries [30].

So the question is, "How does CBCT compare with accepted radiographic tools used in orthodontics?" The first objective of this study was to compare craniometric linear measurements to cephalometric, three-dimensional cephalometric and CBCT measurements. The second objective was to compare traditional angular cephalometric measures to three-dimensional cephalometrics, CBCT and craniometry. Cephalometrics was chosen as the standard for angular measures because the angular measurements we actually use in orthodontics originated from cephalometrics.

MATERIALS AND METHODS

A sample of five dry skulls was taken from the Bolton-Brush collection. Selection of skulls was based on the following inclusion criteria: 1) intact human adult skull; 2) sufficient dentition (≥ 14 teeth) to allow stable occlusion; and 3) maxillary first molars, a maxillary central and mandibular central incisor present. Twenty four landmarks (Figure 1) were identified with 1.5 mm metallic spheres and used to determine thirty measurements. Sixteen linear measurements were taken from the three planes of space (transverse, sagittal and vertical), and fourteen angular measurements taken from common cephalometric analyses (Downs, Steiner, Tweed and Reidel). Measurements involving bilateral structures were averaged to make a single one. Data was collected with six different methods: craniometric (Cranio), plain film cephalometric (Ceph), three-dimensional cephalometric (3DCeph), and three subgroups of CBCT for the different modes in the Hitachi CB MercuRay™ (Hitachi Medical Systems America, Inc., Twinsburg, OH).

Three-dimensional Cartesian coordinates were collected for all the methods, except Ceph. Use of these coordinates ensured that unobstructed measurements were obtained. In addition, measurements taken from a single slice may not account for the thickness of the cut, and measurement tools in viewing software may not always allow the operator to choose the exact pixel or voxel desired. Linear distances between landmarks were calculated with the Pythagorean Theorem:

$$l = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

where l is the linear distance, and x, y, and z are the landmark coordinates. Angular measurements were calculated with the Cosine Law:

$$a^2 = b^2 + c^2 - 2bc\cos A$$

where a, b, and c are the lengths for each side of a triangle and A is the angle opposite side a. For angular measurements, lines connecting landmarks can be used to form a triangle. Given the lengths for all three sides of a triangle, any angle within that triangle can be calculated.

Craniometric (Cranio)

Cranio data were determined with digital calipers and a craniostat from the Orthodontic Department, Case Western Reserve School of Dental Medicine. Rubber bands held the mandibles in centric occlusion while mounted in the craniostat to collect three-dimensional landmark coordinates. Linear measurements were taken with the calipers to the nearest $1/100^{th}$ of a millimeter and angular measurements were calculated from landmark coordinates. All measurements were adjusted to account for the size of the markers.

Plain Film Cephalometric (Ceph)

Lateral and frontal cephalograms were taken for each skull with the Bolton cephalometer located in Orthodontic Department at Case Western Reserve School of Dental Medicine. Again, the mandibles were held in centric occlusion while taking each film. ML and P+ values were recorded for each radiograph and used to calculate

magnification. The ten cephalograms were traced manually with a 0.5 mm lead pencil on acetate tracing paper and a standard light-box in a darkened room. Linear measurements were taken with a digital caliper to the nearest $1/100^{th}$ of a millimeter, and angular measurements with a 3M Unitek protractor (3M Unitek Dental Products, Monrovia, CA) to the nearest 0.5°.

Three-Dimensional Cephalometric (3DCeph)

The 3DCeph group used the same cephalograms taken for the Ceph group. Using a template described by Baumrind and Miller [31], four fiducials were punched into the corners of each film to control for enlargement and distortion while scanning the films. The films were scanned into the computer with Adobe Photoshop CS2 (Adobe Systems Inc., San Jose, CA) at the following settings: 1) Document Source: TPU for positive film; 2) Image Type: 24 bit color and 3) Resolution: 150 DPI. Scanning was performed with an EU-35 transparency unit adapter fitted on an Epson® Expression® 1600 scanner (Epson America Inc., Long Beach, CA). Images were saved as TIFF files and analyzed with the 3dCEPH program developed by Subramanyan and Dean [32]. The 3dCEPH program uses the Broadbent-Bolton "Orientator" method to generate three-dimensional coordinates for landmarks identified on both the lateral and frontal films (Figure 2). Linear and angular measurements were calculated from landmark coordinates.

Cone-Beam Computed Tomographic (CBCT)

CBCT scans were taken with the Hitachi CB MercuRay™ located in the Craniofacial Imaging Center, Case Western Reserve School of Dental Medicine. Scans

were taken at 10 mA and 120 kV. The CBCT group was subdivided into CBCT(6), CBCT(9) and CBCT(12) for each of the 3 field of view sizes in the Hitachi CB MercuRay™. Voxel sizes increase from 0.18 mm to 0.28 mm to 0.38 mm when going from 6" to 9" to 12" field of views. Figure 3 shows how Cartesian coordinates for each landmark were collected with the CBWorks™ viewing software (Cybermed Inc, Seoul, Korea). Again, both linear and angular measurements were calculated from landmark coordinates.

Method of Error

Landmark identification and measurements were repeated six times for all skulls and all methods. All procedures were performed by a single operator (GC). Measurements were recorded and saved in a Microsoft® Excel 2003 (Microsoft, Redmond, WA) spreadsheet for statistical analysis.

Statistics

Cranio and Ceph values were taken as the "gold standards" for linear and angular measurements, respectively (Figure 4). Means, standard deviations and frequencies of overestimation were calculated for each method. Frequencies of overestimation were determined by counting the number of times a given method was larger than the "gold standard" for equivalent measurements on the same skull and for the same repetition. Correlations and paired Student t-tests were also used to compare each method to the standards. Statistical significance was set at $p < 0.05$ and $r < 0.75$ was considered weak correlation. Intraclass correlations were calculated in SPSS 14.0 for Windows (SPSS Inc., Chicago, IL) to evaluate intraoperator reliability.

RESULTS

Table I shows the reliability of each method. All the methods had high intra-class correlation coefficients for the linear measurements, but Cranio had low correlation for the angular measurements L1/NB, IMPA and FMIA. 3DCeph also had low repeatability for FMIA.

Table II compares the actual linear measurements of each method to the linear "gold standard", Cranio. Means, standard deviations and frequencies each method overestimated Cranio are shown. Ceph tended to overestimate 4/16 possible measurements, 3DCeph overestimated 11/16, and CBCT(12) 5/16. But neither CBCT(9) nor CBCT(6) were able to capture all 16 measurements. CBCT(9) overestimated 5/15 captured measurements and CBCT(6) overestimated 4/11.

Table III also deals with linear measurements, but this table uses the paired absolute differences of each method compared to the linear "gold standard", Cranio. Means and standard deviations of the paired absolute differences, and correlations comparing each method to Cranio are shown. After Bonferroni correction, Ceph had the most measurements (11) significantly different from Cranio. 3DCeph and CBCT(12) both had 10. CBCT(9) had 6 and CBCT(6) had 3. However, all methods had high correlations.

Ceph had the highest average discrepancy (4.18 mm) and mean differences ranged from 0.38 mm to 15.10 mm. Bicondylar width, Bigonial width, Maxillary length, Mandibular height and Interincisal distance all had mean differences of less

than 1 mm. But Mandibular length had a difference of over 15 mm, and Mandibular corpus length had a difference close to 14 mm.

3DCeph had the next highest average discrepancy (1.32 mm). Mean differences for Mandibular length and Mandibular corpus length decreased when compared to Ceph, but increased for Biporionic width, Bicondylar width, Upper facial height and Mandibular height.

Average discrepancies for CBCT were less than 1 mm in all three FOVs. CBCT(12) had an average discrepancy of 0.80 mm, CBCT(9) dropped to 0.70 mm, but CBCT(6) rose again to 0.76 mm. Mean differences for Palatal width progressively decreased from 0.41 mm to 0.28 mm when going from CBCT(12) through to CBCT(6). But for Biporionic width, differences increased from 0.51 mm to 0.78 mm when going from CBCT(12) to CBCT(9). This measurement was too large to capture with CBCT(6). Bicoronoidal width also showed progressive increases from CBCT(12) through to CBCT(6).

Table IV compares the actual angular measurements of each method to the angular "gold standard", Ceph. Means, standard deviations and frequencies each method overestimated Ceph are shown. None of the methods showed a strong tendency to over- or underestimate Ceph values.

Table V deals with angular measurements too, but uses the paired absolute differences to compare each method to the angular "gold standard", Ceph. Means and standard deviations of the paired absolute differences, and correlations comparing each method to Ceph are shown. Note that CBCT(6) captured just 4 measurements

and CBCT(9) had two incomplete cephalometric analyses. So we will just consider CBCT(12) for the CBCT measurements. After Bonferroni correction, Cranio had 6 measurements significantly different from Ceph. 3DCeph had 2, and CBCT(12) had 5. After excluding measurements previously shown to have low repeatability, the measurements with low correlations included FMA in Cranio, and both FMA and FMIA in CBCT. Average discrepancies were 2.7° for Cranio, 2.1° for CBCT and 1.8° for 3DCeph. Even after eliminating measurements with low repeatability, Cranio still had the highest difference at 2.2°. 3DCeph continued to be the closest to Ceph at 1.6°.

DISCUSSION

The purpose of this study was to evaluate the radiographic methods available to orthodontists for measurement accuracy. Reliability for linear measures was high for all methods and craniometric values were taken as the standard for comparison.

Previous studies have shown Ceph values to be inaccurate. In 2004, Adams and co-workers [16] reported differences between cephalometric and craniometric measures that ranged from -17.68 mm underestimation to +15.52 mm overestimation. A more recent report claimed cephalometric measurements tended to overestimate actual ones by 7.0–25.9% [29]. In contrast, the results of this study showed Ceph measurements tended to underestimate real values. For Bicondylar width, Bigonial width, Maxillary length, Mandibular height and Interincisal distance, Ceph was accurate to within 1 mm of actual values. What seems to be the common factor for these measurements is that they are all close to the midline of either the lateral or frontal view. Indeed, the ML and P+ values used to correct for magnification are also taken from

the midlines. However, when looking at measurements that do not lie on the midline, there are large discrepancies. Mandibular length and Mandibular corpus length are on an oblique compared to the incoming x-ray. So they are foreshortened and the observed Ceph lengths are significantly smaller.

The 1.32 mm average linear discrepancy for 3DCeph in this study is similar to an earlier report. The previous study showed 3DCeph to be within approximately 1 mm of the gold standard [16]. Although 3DCeph corrects for projection errors, it provides no benefit over Ceph for midline structures. It is actually worse than Ceph for measurements close to the midline like Biporionic width, Bicondylar width, Upper facial height and Mandibular height. Of all the methods, only 3DCeph showed a tendency to overestimate measurements. Bruntz [11] showed that the conversion from film to digital image could cause a vertical enlargement of 0.8 mm and a horizontal reduction of 0.4 mm. So errors could have arisen during the scanning of the films. Another source of error could be the coordination of the two films.

Two previous studies did not find any significant differences between CBCT and actual measurements. The first one examined temporomandibular joint measurements [29] and the second looked at caries depth in teeth [30]. In both cases, the researchers examined smaller regions than the present study. The results in this study are closer to an earlier report that CBCT measurements were always smaller and differed significantly when examining the internal skull base [28]. The present study also showed CBCT had a tendency to underestimate. Interestingly, where a measurement is captured in a CBCT volume seems to affect accuracy. A larger measurement like

Bicoronoidal width can be captured near the centre of the 12" volume, but in the 6" volume it barely fits. Even though the field of view becomes smaller, the CBCT machine uses a charge coupled device sensor and still takes the same number of images as it goes around the patient. Although voxel size may decreases, it seems the closer a measurement is captured to the extremes of the volume the less accurate. On the other hand, a smaller measurement like Palatal width can be captured near the center of all the volumes and its accuracy improves as voxel size decreases. It is unknown whether this "extreme effect" is also found on CBCT machines with different types of sensors.

Previous studies have not compared angular measurements. Cephalometric values were chosen as the standard for angular measures because cephalometrics is the source of the angular measurements we use in orthodontics. The low reliability in Cranio angular measurements also justifies the use of Ceph values as the angular "gold standard". The Cranio measurements with low intraclass correlation coefficients all included the mandibular incisor. Since Cranio angular measurements were determined with craniostat, this low repeatability may reflect difficulties in positioning the pointer on the lower incisor because of overbite. The low repeatability of FMIA in 3DCeph may reflect cumulative errors in identifying Frankfort Horizontal and the long axis of mandibular incisor. Baumrind and Frantz [8] showed that measurement errors depend on errors in locating landmarks, distances separating landmarks, and the direction of spread for the envelopes of error. In addition, 3DCeph used scanned digital radiographs. Chen and fellow investigators [10] showed that Po, Ar,

ANS, and UM were more difficult to locate with digital cephalometry. Bruntz [11] also showed that measurements containing Po and Or had lower reliability.

Since both CBCT(9) and especially CBCT(6) had incomplete sets of angular measurements, CBCT(12) was the only CBCT group considered for comparison. Of all the methods, 3DCeph gave the most similar angular information to Ceph and it had the lowest average discrepancy. But this result is not surprising since 3DCeph used the exact same radiographs as Ceph. In contrast, both Cranio and CBCT had the most significant differences and had low correlations. The measurements with low correlation (FMA and FMIA) both used Frankfort Horizontal. So a possible explanation could be the difficulty of locating Po and Or on the cephalogram. Another reason could be the nature of Ceph values themselves. For both Cranio and CBCT, the three-dimensional coordinates of the landmarks were averaged to calculate the angular measurements. In contrast, Ceph angular measurements were taken by averaging planes visually. Ceph measurements involving bilateral landmarks could have differential magnification of the right and left sides, and any rotation of the skull in the cephalostat could cause projection errors. Indeed, the Ceph values in this study were different from both Cranio and CBCT values. Ceph values come from a flattened image as opposed to the three-dimensional coordinates in Cranio and CBCT. So the angular values we are accustomed to using in cephalometrics may not apply for CBCT.

CONCLUSIONS

1. Cephalometric measurements are accurate if landmarks are well-defined and in the midline.

2. 3DCeph corrects for projection errors, but provides no advantage over plain film cephalometrics for midline structures.
3. Cone beam computed tomography is more accurate than 3DCeph and traditional plain film cephalometry.
4. When CBCT measurements can be captured near the centre of the volume, accuracy improves as voxel size decreases. But measurements are not as accurate when they are captured near the extremes of the volume. It is not known if this "extreme effect" is applicable to other machines.
5. 3DCeph gives the most similar angular information to cephalograms. But CBCT and craniometry do not compare as favorably.

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Figure 1. Lateral and frontal views of landmarks: menton (Me), pogonion (Pg), B point (B), infradentale (Id), mandibular incisor tip (L1) maxillary incisor tip (U1), supradentale (Sd), A point (A), anterior nasal spine (ANS), posterior nasal spine (PNS), sella (S), nasion (N), mesiobuccal cusp of left maxillary molar (L_U6), left orbitale (L_Or), left coronoid (L_C), left condylion (L_Co), left porion (L_Po), left gonion (L_Go), mesiobuccal cusp of right maxillary molar (R_U6), right orbitale (R_Or), right coronoid (R_C), right condylion (R_Co), right porion (R_Po), and right gonion (R_Go).

Figure 2. Landmark identification screen in 3dCEPH where coordinates from both the lateral and the frontal films are collected to generate a single three-dimensional location.

Figure 3. Collection of Cartesian coordinates in CBWorks™ viewing software from axial, coronal and sagittal slices.

Figure 4. Experimental design of the study showing Cranio as the "gold standard" for linear measurements, and Ceph for the angular.

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Table II. Means, standard deviations and frequencies each method overestimated linear measurements compared to Cranio.

Table III. Means of paired absolute differences, standard deviations and correlations of linear measurements for each method compared to Cranio.

Table IV. Means, standard deviations and frequencies each method overestimated angular measurements compared to Ceph.

Table V. Means of paired absolute differences, standard deviations and correlations of angular measurements for each method compared to Ceph.

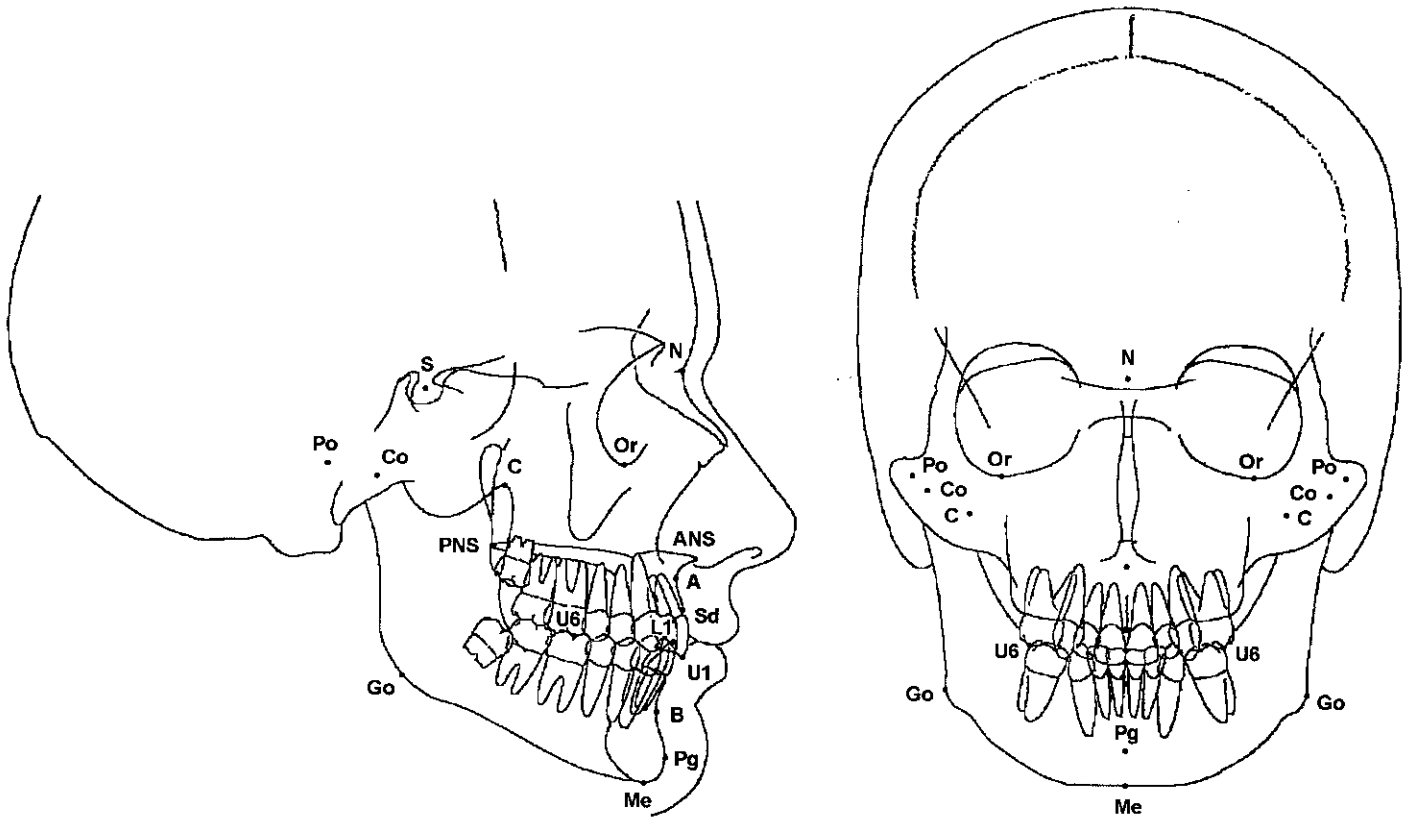


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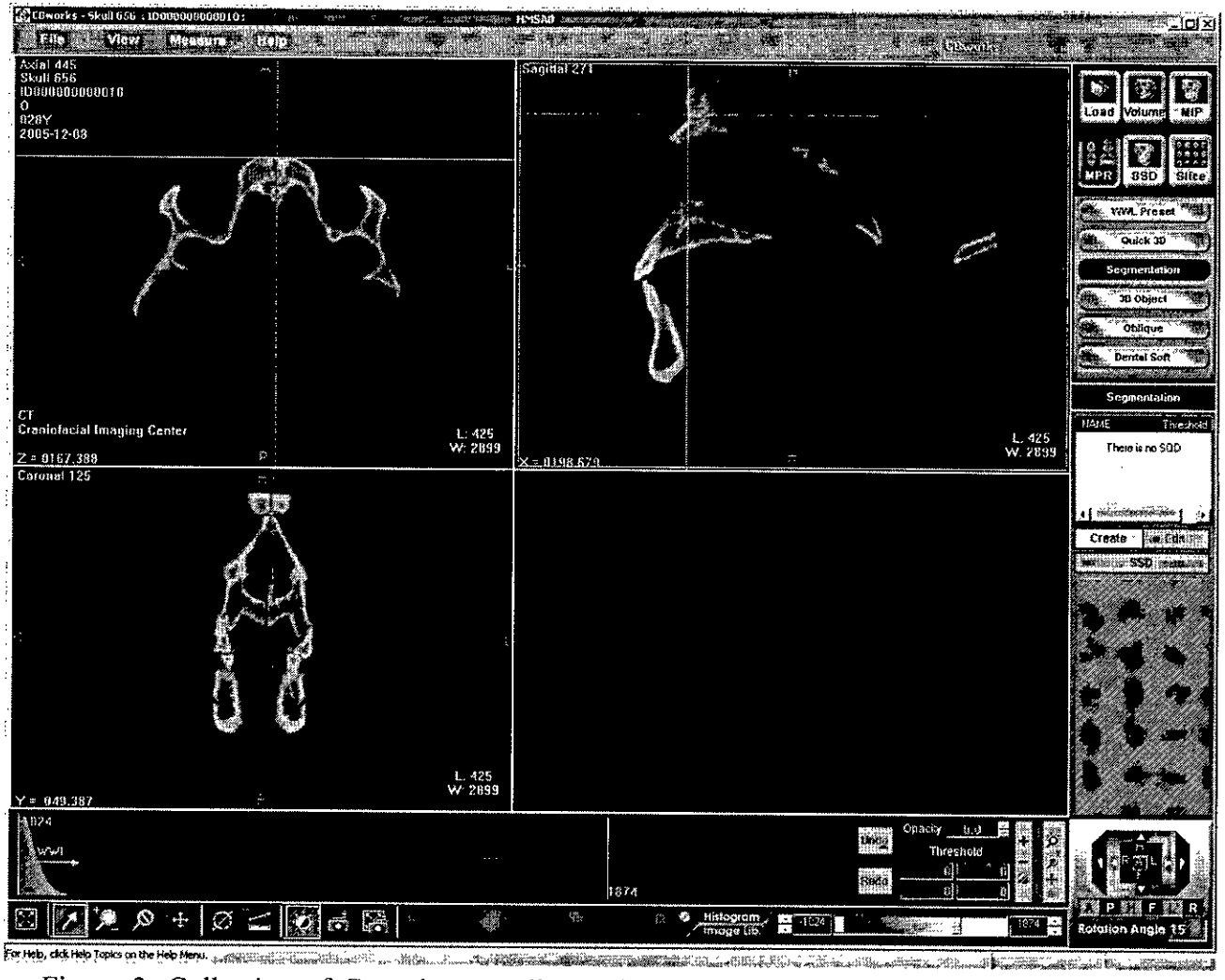


Figure 3. Collection of Cartesian coordinates in CBWorks™ viewing software from axial, coronal and sagittal slices.

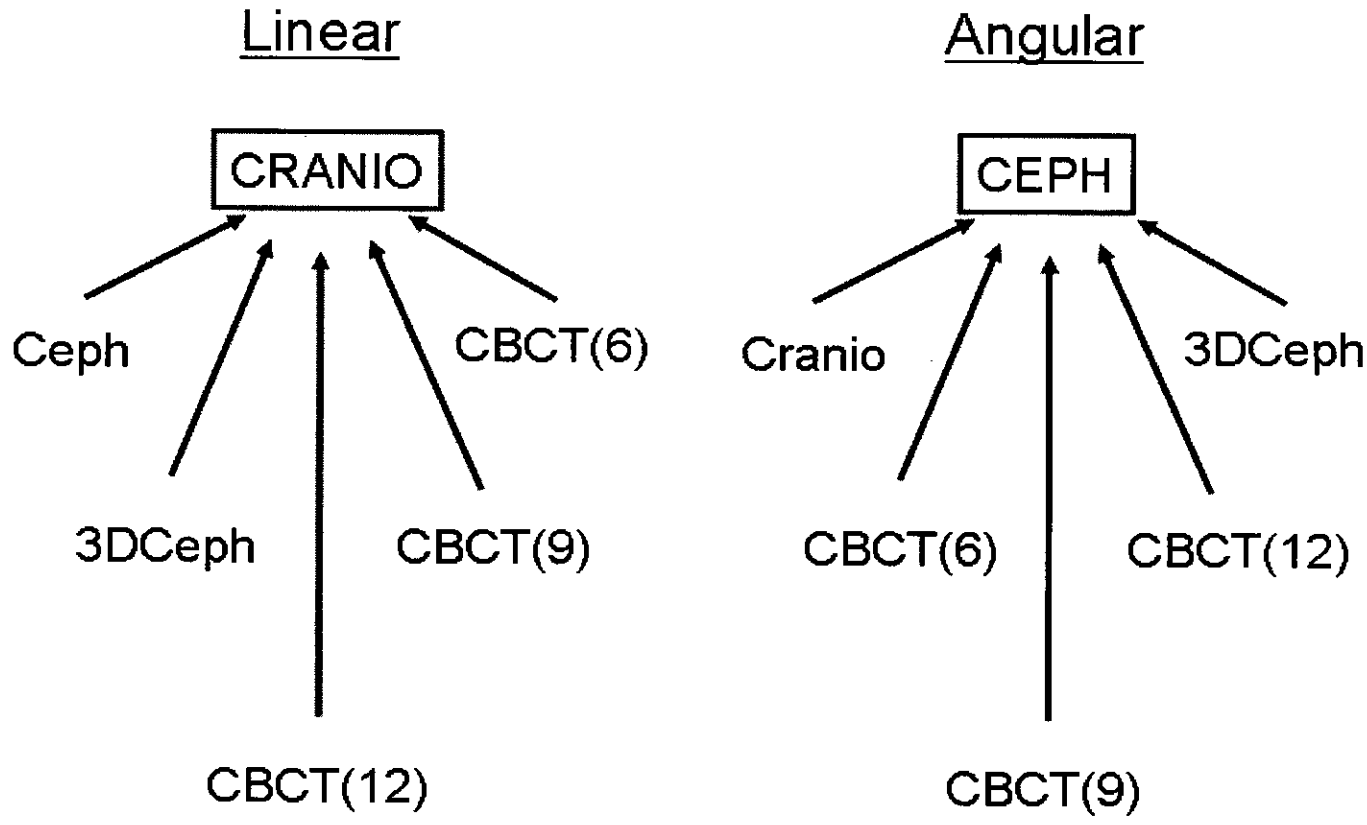


Figure 4. Experimental design of the study showing Cranio as the "gold standard" for linear measurements, and Ceph for the angular.

Table 1.--Intra-operator Error of Linear and Angular Measurements for Cranio, Ceph, 3DCeph, CBCT(12), CBCT(9) and CBCT(6).

			Cranio	Ceph	3DCeph	CBCT(12)	CBCT(9)	CBCT(6)
			r-value *	r-value	r-value	r-value	r-value	r-value
Linear	Transverse	Biporionic width (Po – Po)	0.9982	0.9992	0.9991	0.9991	0.9917	--
		Biorbital width (Or – Or)	0.9979	0.9956	0.9762	0.9924	0.9980	0.9896
		Bicondylar width (Co – Co)	0.9998	0.9996	0.9998	0.9993	0.9926	--
		Bicoronoidal width (C – C)	0.9976	0.9983	0.9511	0.9992	0.9993	0.9284
		Bigonial width (Go – Go)	0.9991	0.9995	0.9995	0.9995	0.9956	--
		Palatal width (U6 – U6)	0.9761	0.9934	0.8797	0.9777	0.9896	0.9971
	Sagittal	Anterior cranial base (S – N)	0.9660	0.9957	0.9970	0.9925	0.9979	0.9958
		Maxillary length (ANS – PNS)	0.9989	0.9804	0.9991	0.9978	0.9986	0.9996
		Mandibular length (Co – Pg)	0.9994	0.9991	0.9989	0.9967	--	--
		Mandibular corpus length (Go – Pg)	0.9995	0.9339	0.9998	0.9923	0.9986	0.9876
	Vertical	Upper facial height (N – ANS)	0.9956	0.9491	0.9878	0.9980	0.9978	0.9930
		Lower facial height (ANS – Me)	0.9988	0.9878	0.9965	0.9995	0.9996	0.9996
		Anterior facial height (N – Me)	0.9980	0.9835	0.9995	0.9969	0.9989	--
		Posterior facial height (S – Go)	0.9796	0.9976	0.9995	0.9982	0.9964	0.9889
		Mandibular height (Co – Go)	0.9790	0.9454	0.9955	0.9791	0.9043	0.8770
		Interincisal distance (U1 – L1)	0.9580	0.9917	0.9903	0.9953	0.9976	0.9989
Angular	Downs	Facial plane angle	0.9813	0.9828	0.9736	0.9960	--	--
		Angle of convexity	0.9695	0.9949	0.9956	0.9829	0.9904	--
		A-B plane to Na-Pogonion	0.9792	0.9853	0.9923	0.9801	0.9915	--
		Interincisal angle	0.8850	0.9662	0.9426	0.9802	0.9917	0.9965
	Steiner	Upper incisor to Nasion/A-point (U1/NA)	0.8731	0.9843	0.9706	0.9362	0.9859	0.9933
		Lower incisor to Nasion/B-point (L1/NB)	0.7162	0.9781	0.8433	0.9394	0.9756	0.9846
	Tweed	Mandibular Plane Angle (FMA)	0.8807	0.9873	0.9618	0.9887	--	--
		Lower Incisor to Mandibular Plane (IMPA)	0.5522	0.9564	0.8457	0.9719	0.9879	--
		Frankfort Horizontal to Mandibular Incisor (FMIA)	0.5046	0.9364	0.5899	0.9666	0.9843	--
	Reidel	SNA	0.8565	0.9723	0.9986	0.9957	0.9954	0.9900
		SNB	0.8136	0.9922	0.9990	0.9941	0.9971	--
		ANB	0.9814	0.9800	0.9929	0.9904	0.9917	--
		Upper Incisor to Frankfort Horizontal	0.9130	0.9803	0.9789	0.9784	0.9885	--
		Frankfort Horizontal to Nasion/A-point	0.9864	0.9885	0.9858	0.9977	0.9922	--

* Intraclass correlation coefficient
-- Measurement not possible

Table 2.--Means, Standard Deviations and Frequencies Each Method Overestimated Linear Measurements Compared to Cranio.

			Cranio		Ceph			3DCeph			CBCT(12)			CBCT(9)			CBCT(6)		
			Mean (mm)	SD (mm)	Mean (mm)	SD (mm)	% Ceph > Cranio	Mean (mm)	SD (mm)	% 3DCeph > Cranio	Mean (mm)	SD (mm)	% CBCT(12) > Cranio	Mean (mm)	SD (mm)	CBCT(9) > Cranio	Mean (mm)	SD (mm)	% CBCT(6) > Cranio
Linear	Transverse	Biporionic width (Po – Po)	119.0	7.2	120.3	6.9	93	121.8	6.9	100	118.6	6.9	27	119.3	7.3	67	–	–	–
		Biorbital width (Or – Or)	76.7	2.8	75.4	4.5	20	76.7	5.3	20	76.8	2.7	60	76.8	2.6	70	76.8	2.7	47
		Bicondylar width (Co – Co)	120.7	7.4	120.3	7.3	20	121.8	7.4	100	118.9	7.4	0	119.7	7.7	10	–	–	–
		Bicoronoidal width (C – C)	97.2	5.0	95.5	4.3	0	97.6	4.5	37	96.2	4.9	0	96.2	4.9	0	96.0	4.6	23
		Bigonial width (Go – Go)	95.4	7.1	95.0	6.7	27	96.2	6.7	93	94.7	6.9	17	95.2	7.3	30	–	–	–
		Palatal width (U6 – U6)	53.1	1.3	51.4	1.3	0	52.1	1.8	10	53.1	1.6	53	53.0	1.3	50	53.1	1.3	63
	Sagittal	Anterior cranial base (S – N)	69.5	2.5	70.0	2.7	70	70.0	2.8	70	68.7	2.7	30	68.8	2.8	30	68.9	2.7	27
		Maxillary length (ANS – PNS)	53.0	3.7	53.8	3.7	100	53.5	3.6	90	52.8	3.7	37	52.9	3.8	43	52.9	3.8	50
		Mandibular length (Co – Pg)	124.7	5.5	109.5	5.0	0	124.8	5.2	73	123.5	5.3	0	--	–	--	–	–	–
		Mandibular corpus length (Go – Pg)	89.1	5.6	75.2	4.5	0	89.5	5.6	93	88.2	5.5	0	88.8	5.9	13	88.7	5.6	17
	Vertical	Upper facial height (N – ANS)	50.6	3.2	51.4	3.1	77	52.9	3.0	100	51.2	3.1	77	51.2	3.1	70	51.3	3.3	67
		Lower facial height (ANS – Me)	70.8	6.7	64.4	6.5	0	67.8	6.3	0	70.6	6.5	37	70.7	6.4	43	70.7	6.4	30
		Anterior facial height (N – Me)	121.0	4.0	116.2	4.3	0	119.4	3.9	0	120.6	3.8	27	120.6	3.7	17	–	–	–
		Posterior facial height (S – Go)	91.7	4.6	78.1	4.1	0	91.8	4.2	53	90.4	4.0	10	90.6	4.0	17	90.7	4.0	13
		Mandibular height (Co – Go)	57.4	1.2	56.9	2.0	50	58.6	1.7	100	57.5	1.4	57	57.8	1.4	83	57.6	1.7	63
		Interincisal distance (U1 – L1)	4.4	3.1	4.1	3.0	43	4.6	2.7	63	4.8	2.5	57	4.8	2.6	63	4.9	2.6	67
Fraction of measurements overestimated							4 / 16			11 / 16			5 / 16			5 / 15			4 / 11

– Measurement not possible

Table 3.--Means of Paired Absolute Differences, Standard Deviations and Correlations of Linear Measurements for Each Method Compared to Cranio.

			Ceph vs. Cranio			3DCeph vs. Cranio			CBCT(12) vs. Cranio			CBCT(9) vs. Cranio			CBCT(6) vs. Cranio		
			Absolute Differences (mm)		Correlation	Absolute Differences (mm)		Correlation	Absolute Differences (mm)		Correlation	Absolute Differences (mm)		Correlation	Absolute Differences (mm)		Correlation
			Mean	SD	r-value	Mean	SD	r-value	Mean	SD	r-value	Mean	SD	r-value	Mean	SD	r-value
Linear	Transverse	Biporionic width (Po – Po)	1.27 †	0.57	0.9976	2.82 †	0.52	0.9983	0.51 †	0.44	0.9977	0.78	0.69	0.9906	–	–	--
		Biorbital width (Or – Or)	2.52 *	0.55	0.9134	2.33	2.03	0.8733	0.32	0.23	0.9914	0.26 *	0.19	0.9977	0.32	0.24	0.9906
		Bicondylar width (Co – Co)	0.38 †	0.24	0.9993	1.11 †	0.41	0.9985	1.70 †	0.23	0.9995	1.13 †	0.55	0.9946	–	–	--
		Bicoronoidal width (C – C)	1.70 †	0.82	0.9967	1.33	1.45	0.9216	1.03 †	0.40	0.9973	1.05 †	0.41	0.9971	1.60 †	1.08	0.9545
		Bigonial width (Go – Go)	0.63 †	0.39	0.9976	0.74 †	0.46	0.9984	0.82 †	0.43	0.9972	0.56 *	0.38	0.9966	–	–	--
		Palatal width (U6 – U6)	1.69 †	0.49	0.9267	1.04 †	0.64	0.9182	0.41	0.30	0.9647	0.32	0.28	0.9488	0.28	0.21	0.9644
	Sagittal	Anterior cranial base (S – N)	1.21 *	0.65	0.8855	1.17 *	0.55	0.9029	0.94 †	0.89	0.9145	0.87 *	0.88	0.9307	0.86 *	0.89	0.9054
		Maxillary length (ANS – PNS)	0.73 †	0.61	0.9866	0.48 †	0.24	0.9974	0.44 *	0.36	0.9911	0.38	0.30	0.9924	0.34	0.23	0.9944
		Mandibular length (Co – Pg)	15.10 †	1.75	0.9493	0.36	0.22	0.9986	1.16 †	0.43	0.9976	–	–	--	–	–	--
		Mandibular corpus length (Go – Pg)	13.93 †	2.14	0.9328	0.37 †	0.24	0.9991	0.92 †	0.56	0.9951	0.48 †	0.25	0.9986	0.72 *	0.51	0.9906
	Vertical	Upper facial height (N – ANS)	1.47 *	0.88	0.8780	2.24 †	1.03	0.9466	0.70 †	0.59	0.9760	0.76 †	0.62	0.9666	0.94 †	0.68	0.9540
		Lower facial height (ANS – Me)	6.40 †	2.84	0.9087	2.99 †	1.03	0.9897	0.43	0.29	0.9978	0.44	0.27	0.9981	0.44	0.30	0.9977
		Anterior facial height (N – Me)	4.77 †	1.76	0.9140	1.64 †	0.51	0.9921	0.63 †	0.40	0.9888	0.70 *	0.37	0.9869	–	–	--
		Posterior facial height (S – Go)	13.58 †	2.12	0.8890	0.65	0.49	0.9884	1.40 †	1.08	0.9709	1.30 †	1.03	0.9724	1.31 †	0.87	0.9747
		Mandibular height (Co – Go)	0.87 *	0.71	0.9245	1.18 †	0.59	0.9767	0.34	0.28	0.9608	0.50 †	0.40	0.9319	0.63	0.45	0.9344
		Interincisal distance (U1 – L1)	0.69	0.57	0.9617	0.68	0.62	0.9618	0.97	0.60	0.9535	0.96 *	0.59	0.9501	0.89 *	0.59	0.9600
Average discrepancy for all measurements			4.18			1.32			0.80			0.70			0.76		

* Significant at $p < 0.05$ for a paired t-test between the Methods
† Significant at $p < 0.002$ after Bonferroni correction for a paired t-test between the Methods
-- Measurement not possible

Table 4.--Means, Standard Deviations and Frequencies Each Method Overestimated Angular Measurements Compared to Ceph.

			Ceph		Cranio			3DCeph			CBCT(12)			CBCT(9)			CBCT(6)		
			Mean (°)	SD (°)	Mean (°)	SD (°)	% Cranio > Ceph	Mean (°)	SD (°)	% 3DCeph > Ceph	Mean (°)	SD (°)	% CBCT(12) > Ceph	Mean (°)	SD (°)	CBCT(9) > Ceph	Mean (°)	SD (°)	% CBCT(6) > Ceph
Angular	Downs	Facial plane angle	90.7	2.9	88.4	3.5	17	90.8	2.9	47	89.1	3.7	40	–	–	–	–	–	–
		Angle of convexity	7.1	3.6	7.4	3.6	67	7.2	3.6	60	8.0	3.2	83	7.7	3.2	67	–	–	–
		A-B plane to Na-Pogonion	-4.9	2.4	-5.0	2.5	47	-5.0	2.7	40	-5.2	2.1	33	-5.3	2.2	20	–	–	–
		Interincisal angle	142.2	10.8	141.2	9.8	43	143.7	8.4	57	144.5	9.9	73	143.9	10.5	70	143.3	10.8	60
	Steiner	Upper incisor to Nasion/A-point (U1/NA)	11.5	6.3	9.8	5.5	23	11.9	5.6	60	10.2	4.8	33	10.7	6.0	33	10.9	5.7	37
		Lower incisor to Nasion/B-point (L1/NB)	23.1	5.5	25.6	6.2	67	20.8	5.2	27	22.9	3.6	60	22.6	4.1	50	22.7	4.8	40
	Tweed	Mandibular Plane Angle (FMA)	21.1	3.2	24.2	2.4	93	20.1	2.4	27	22.8	2.6	63	–	–	–	–	–	–
		Lower Incisor to Mandibular Plane (IMPA)	91.2	6.4	92.9	4.7	57	89.7	5.3	50	90.7	5.5	50	90.4	6.6	47	–	–	–
		Frankfort Horizontal to Mandibular Incisor (FMIA)	67.8	5.0	62.8	4.9	13	70.2	3.9	63	66.4	5.0	30	67.0	5.6	27	–	–	–
	Riedel	SNA	79.4	3.5	80.6	4.2	77	80.9	3.4	100	79.9	3.5	87	80.1	3.5	83	80.0	3.8	83
		SNB	75.9	3.2	76.8	4.0	70	77.3	3.1	100	76.0	3.0	47	76.1	2.9	73	–	–	–
		ANB	3.6	1.6	3.8	1.7	80	3.6	1.7	60	4.0	1.4	77	4.0	1.5	83	–	–	–
		Upper Incisor to Frankfort Horizontal	105.6	8.4	101.6	7.2	7	106.5	6.6	50	102.0	8.3	10	103.1	8.6	20	–	–	–
		Frankfort Horizontal to Nasion/A-point	94.6	4.2	92.3	5.0	17	94.5	4.2	43	93.3	4.8	40	93.5	4.6	40	–	–	–
Fraction of measurements overestimated							7 / 14			7 / 14			6 / 14			5 / 12			2 / 4

– Measurement not possible

Table 5.--Means of Paired Absolute Differences, Standard Deviations and Correlations of Angular Measurements for Each Method Compared to Ceph.

			Cranio vs. Ceph			3DCeph vs. Ceph			CBCT(12) vs. Ceph			CBCT(9) vs. Ceph			CBCT(6) vs. Ceph		
			Absolute Differences (°)		Correlation	Absolute Differences (°)		Correlation	Absolute Differences (°)		Correlation	Absolute Differences (°)		Correlation	Absolute Differences (°)		Correlation
			Mean	SD	r-value	Mean	SD	r-value	Mean	SD	r-value	Mean	SD	r-value	Mean	SD	r-value
Angular	Downs	Facial plane angle	2.5 †	1.83	0.7980	1.3	0.91	0.8497	2.5 †	1.36	0.7644	–	–	–	–	–	–
		Angle of convexity	0.7	0.66	0.9691	0.4	0.31	0.9894	1.0 †	0.65	0.9764	0.8 †	0.62	0.9720	–	–	–
		A-B plane to Na-Pogonion	0.5	0.37	0.9686	0.4	0.29	0.9831	0.7 *	0.52	0.9496	0.5 †	0.42	0.9787	–	–	–
		Interincisal angle	4.4	3.20	0.8657	3.7	3.01	0.9188	3.6 *	2.69	0.9345	3.1 *	2.73	0.9388	2.5	2.31	0.9546
	Steiner	Upper incisor to Nasion/A-point (U1/NA)	2.4 *	2.39	0.8827	1.2	1.12	0.9724	2.4 *	1.42	0.9322	1.7 *	1.21	0.9498	1.1 *	0.68	0.9865
		Lower incisor to Nasion/B-point (L1/NB)	4.2 *	2.66	0.7106	3.1 *	3.08	0.7595	2.4	1.66	0.8768	2.4	1.87	0.8398	1.8	1.07	0.9276
	Tweed	Mandibular Plane Angle (FMA)	3.3 †	2.22	0.6553	1.4 *	1.20	0.8744	2.9 *	1.70	0.5362	–	–	–	–	–	–
		Lower Incisor to Mandibular Plane (IMPA)	4.0 *	3.00	0.6810	2.8 *	2.85	0.8148	2.4	2.06	0.8688	2.3	2.18	0.8852	–	–	–
		Frankfort Horizontal to Mandibular Incisor (FMIA)	6.1 †	3.39	0.4964	3.7 *	2.96	0.5895	4.4	2.88	0.4674	4.1	3.11	0.5365	–	–	–
	Reidel	SNA	1.6 †	1.60	0.8964	1.5 †	0.76	0.9768	0.6 †	0.64	0.9807	0.8 †	0.71	0.9761	0.7 †	0.70	0.9778
		SNB	1.4 *	1.60	0.8824	1.4 †	0.37	0.9931	0.5	0.35	0.9832	0.5 *	0.33	0.9861	–	–	–
		ANB	0.4 *	0.28	0.9736	0.3	0.24	0.9703	0.5 †	0.34	0.9741	0.4 †	0.29	0.9812	–	–	–
		Upper Incisor to Frankfort Horizontal	4.3 †	3.25	0.9069	2.2	2.39	0.9383	4.0 †	2.22	0.9444	3.1 †	2.41	0.9390	–	–	–
		Frankfort Horizontal to Nasion/A-point	2.5 †	1.85	0.8972	1.2	0.88	0.9321	2.2 *	1.18	0.8930	2.1 *	1.04	0.8878	–	–	–
Average discrepancy for all measurements			2.7			1.8			2.1			1.8			1.5		

* Significant at $p < 0.05$ for a paired t-test between the Methods
† Significant at $p < 0.002$ after Bonferroni correction for a paired t-test between the Methods
– Measurement not possible

Table 6.--Raw Data of Cranio Measurements.

			Measurement 1					Measurement 2					Measurement 3				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	114.40	129.28	122.51	119.54	108.72	114.70	129.62	122.68	118.94	109.15	114.48	129.88	122.39	119.03	109.37
		Biorbital width (Or – Or)	74.38	79.98	73.17	75.70	79.83	74.41	80.15	73.49	76.09	80.21	74.45	79.82	73.21	75.72	79.75
		Bicondylar width (Co – Co)	110.58	128.83	128.20	121.58	114.50	110.54	128.77	128.36	121.00	114.54	110.51	128.75	128.29	121.33	114.41
		Bicoronoidal width (C – C)	90.81	104.98	100.03	96.13	93.53	91.05	105.11	100.24	96.38	93.39	91.21	104.80	100.06	97.14	93.44
		Bigonial width (Go – Go)	90.57	107.75	96.28	95.04	87.58	90.61	107.77	96.44	94.34	87.35	90.65	107.93	96.40	95.43	87.45
		Palatal width (U6 – U6)	53.73	55.01	52.71	51.08	52.98	53.90	54.77	52.19	51.11	52.96	54.04	54.94	52.59	51.58	53.02
	Sagittal	Anterior cranial base (S – N)	70.47	72.80	67.19	66.13	70.90	70.25	72.76	67.59	66.11	70.63	71.20	72.86	67.22	65.61	70.88
		Maxillary length (ANS – PNS)	49.88	57.35	48.37	52.81	57.25	49.76	57.44	48.45	52.96	57.13	49.71	57.47	48.34	52.17	57.01
		Mandibular length (Co – Pg)	118.15	134.53	124.13	122.65	124.15	118.39	134.69	123.89	122.08	123.93	118.43	134.71	123.89	122.51	123.85
		Mandibular corpus length (Go – Pg)	86.15	99.68	87.29	85.98	85.87	86.34	100.34	87.26	85.95	86.15	86.45	100.30	87.28	85.81	86.01
	Vertical	Upper facial height (N – ANS)	51.89	44.64	53.23	53.41	50.45	51.93	44.50	53.20	53.08	50.43	51.98	44.88	53.77	52.61	50.16
		Lower facial height (ANS – Me)	63.08	82.77	66.66	70.56	70.18	62.76	83.19	67.13	70.53	70.76	62.58	82.60	67.16	70.33	70.86
		Anterior facial height (N – Me)	116.14	127.00	118.67	123.27	120.71	115.40	127.16	118.36	123.39	120.78	115.34	127.06	118.50	123.19	120.40
		Posterior facial height (S – Go)	90.30	96.68	87.66	96.97	86.33	92.21	96.29	87.13	97.72	87.14	90.29	95.35	88.91	98.40	85.94
		Mandibular height (Co – Go)	57.90	56.66	56.21	59.52	57.01	57.96	56.83	56.26	58.93	57.04	58.12	56.40	55.80	59.28	56.55
		Interincisal distance (U1 – L1)	1.61	2.82	3.29	5.15	11.53	1.79	2.71	2.54	4.11	10.20	3.10	2.13	3.07	3.73	10.44
Angular	Downs	Facial plane angle	86.50	94.29	91.08	85.80	85.65	84.59	94.41	90.09	85.42	86.43	85.11	94.68	89.77	85.23	85.53
		Angle of convexity	1.49	7.74	12.70	6.39	8.39	2.60	8.19	13.02	6.97	8.55	1.52	8.48	12.78	6.61	8.89
		A-B plane to Na-Pogonion	-0.77	-3.40	-7.38	-5.79	-7.88	-1.38	-3.54	-7.72	-5.49	-7.01	-0.96	-3.67	-7.28	-4.80	-7.85
		Interincisal angle	131.82	137.74	127.34	143.94	156.65	129.11	143.75	133.94	147.54	155.14	130.60	133.67	138.74	148.27	154.34
	Steiner	Upper incisor to Nasion/A-point	19.06	9.90	14.89	10.86	1.42	15.89	5.26	11.31	10.53	3.49	18.44	7.12	7.66	7.95	2.07
		Lower incisor to Nasion/B-point	28.49	28.40	31.89	21.47	17.14	33.91	26.75	28.71	18.20	23.86	30.25	34.82	27.82	20.41	18.67
	Tweed	Mandibular Plane Angle (FMA)	23.71	20.57	26.69	21.95	24.75	25.99	21.05	27.84	22.02	23.55	25.63	22.16	29.03	22.06	25.18
		Lower Incisor to Mandibular Plane (IMPA)	98.18	92.94	93.50	94.23	87.23	103.15	90.65	90.22	90.97	93.99	99.47	97.34	88.32	93.15	88.31
		Frankfort Horizontal to Mandibular Incisor (FMIA)	58.11	66.50	59.80	63.82	68.02	50.86	68.30	61.93	67.01	62.46	54.90	60.51	62.65	64.79	66.51
	Reidel	SNA	79.18	83.62	85.62	75.47	76.67	82.49	84.68	85.31	74.20	78.01	80.57	84.04	86.56	74.79	77.29
		SNB	78.56	79.66	79.74	71.73	71.88	81.41	80.45	79.28	70.47	73.52	79.87	79.66	80.79	71.42	72.37
		ANB	0.62	3.96	5.88	3.74	4.79	1.09	4.24	6.03	3.73	4.49	0.70	4.39	5.77	3.37	4.92
		Upper Incisor to Frankfort Horizontal	106.29	108.75	112.46	99.88	91.37	101.74	104.55	107.99	99.47	87.32	104.30	106.83	103.91	96.52	92.17
		Frankfort Horizontal to Nasion/A-point	87.22	98.85	97.57	89.02	89.95	85.85	99.28	96.68	88.95	90.81	85.85	99.72	96.24	88.57	90.10

Table 6.--Raw Data of Cranio Measurements (cont.).

			Measurement 4					Measurement 5					Measurement 6				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	114.25	129.80	122.60	119.17	108.76	114.48	129.52	123.61	119.30	108.66	114.08	129.87	123.35	119.08	108.71
		Biorbital width (Or – Or)	74.41	80.13	73.36	75.91	79.74	74.53	80.14	72.92	76 00	79.69	74.43	79.95	73.12	76.07	80.09
		Bicondylar width (Co – Co)	110.49	128.55	128.24	121.31	114.45	110.46	128.74	128.26	121.35	114.40	110.55	128.59	128.23	121.43	114.30
		Bicoronoidal width (C – C)	90.68	104.59	100.34	97.09	93.39	90.71	104.47	100 38	96.68	93.42	90.87	104.88	100.45	97.20	93.17
		Bigonial width (Go – Go)	90.45	107.84	96.46	94.80	87 79	90.43	107.92	96.50	94.35	87 84	90.68	107.85	96.27	95.12	87.56
		Palatal width (U6 – U6)	53.87	54.91	52.34	51 60	52.63	53.77	54.87	52.60	50.69	53.09	53.78	54.90	52.18	51.47	52.79
	Sagittal	Anterior cranial base (S – N)	69.65	72.81	68.45	65 94	70.70	69.20	72.61	68.17	65.90	70.78	70.77	72.67	68.62	66.04	70.76
		Maxillary length (ANS – PNS)	49.74	57.29	48.39	52.60	56 85	49.70	57.43	48.32	52.36	56.94	49.73	57.36	48.35	52.57	57.14
		Mandibular length (Co – Pg)	118.48	134.82	123.94	122.31	123 88	118.40	134 79	124.05	122.33	123.77	118.31	134.61	124.07	122.13	123.74
		Mandibular corpus length (Go – Pg)	86.36	100.31	87.31	85.83	86.25	86.26	99.93	87.18	85.93	85.99	86.30	100.30	87.32	85.96	86.00
	Vertical	Upper facial height (N – ANS)	51.71	44.92	53.03	53.03	50.73	51.52	44.78	53.28	52.79	50.35	51.75	44.62	53.24	53.12	50.19
		Lower facial height (ANS – Me)	63.21	82.75	67.45	70.40	70.93	63.05	82.71	66.98	70.46	71.40	62.98	82.84	67.12	70.30	70.59
		Anterior facial height (N – Me)	115.52	126.79	118.20	123.37	120.74	115.40	126.85	118.37	123.37	120.96	115.39	126.83	118.69	123.51	120.88
		Posterior facial height (S – Go)	89.84	95.88	88.23	98.31	86.98	89.42	95.33	88.27	97.66	85.50	89.51	96.18	87.67	98.77	86.22
		Mandibular height (Co – Go)	57.89	56.70	56.18	59.49	57.12	57.72	56.66	56.32	59.60	56.71	57.85	56.67	56.06	59.36	56.96
		Interincisal distance (U1 – L1)	2.30	2.51	2.95	3.88	9 67	2.23	2 20	3.33	4.32	10.10	3.78	1.09	2.95	2.37	10.10
Angular	Downs	Facial plane angle	85.29	93.35	90 50	85.90	86 36	85.79	94.48	90.04	86 12	86.78	86.34	94.52	90.33	85.52	85.38
		Angle of convexity	2.03	7.97	12.55	6.82	7.60	2.52	8.46	12.69	7.32	7.64	1.27	8.78	12.30	3.49	7.41
		A-B plane to Na-Pogonion	-1.22	-3.53	-7.31	-5.14	-7.76	-1.47	-3.86	-7.61	-5 38	-7.93	-0.70	-4.13	-7.16	-4.13	-6.57
		Interincisal angle	136.06	132.73	135.87	150.07	163.04	130.56	133.17	133.66	138.21	153.92	137.52	138.51	135.77	149.55	155.75
	Steiner	Upper incisor to Nasion/A-point	14.88	9.50	10.61	12.65	0.79	15.36	9.40	12.32	12.77	0.76	19.55	3.61	13.30	9.45	2.83
		Lower incisor to Nasion/B-point	28.13	33.54	27.77	13.78	13 18	32.96	32.87	28.09	25.20	20.64	22.37	33.23	25.33	18.31	22.99
	Tweed	Mandibular Plane Angle (FMA)	26.16	24.15	27.67	21.59	24.00	24 90	23.12	28.53	21.34	24.13	23.60	22.26	26.98	20.38	25.18
		Lower Incisor to Mandibular Plane (IMPA)	96.61	95.52	88 99	86 38	83 50	102.17	94.77	88 99	97.80	90.50	92.36	95.91	87.40	93.20	92.72
		Frankfort Horizontal to Mandibular Incisor (FMIA)	57.23	60.33	63.34	72 03	72 50	52 93	62.11	62.48	60.86	65.36	64.04	61.83	65.61	66.41	62.10
	Reidel	SNA	80.53	84.62	86 28	74.19	77 38	79.16	84.58	85.86	75.46	78 56	78.12	83.78	85.92	82.39	78.10
		SNB	79.81	80.39	80 53	70.68	72.81	78.04	80.01	79.92	71.64	71.88	77.56	79.13	80.33	79.70	72.02
		ANB	0.92	4.23	5.75	3.50	4.58	1.12	4.56	5.93	3.82	4.68	0.56	4.65	5.60	2.69	4.09
		Upper Incisor to Frankfort Horizontal	101.17	107.60	107.47	101.96	89 46	102.37	108.94	108.82	102 65	91.45	106.51	103.32	109.84	96.86	86.35
		Frankfort Horizontal to Nasion/A-point	86.28	98.10	96.86	89.31	90.25	87.01	99 54	96.50	89.88	90.69	86.96	99.71	96.54	87.41	89.18

Table 7.--Raw Data of Ceph Measurements.

			Measurement 1					Measurement 2					Measurement 3				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	115.59	130.76	123.48	120.71	111.20	115.80	130.66	123.39	120.74	110.59	115.92	130.35	123.65	120.89	110.28
		Biorbital width (Or – Or)	71.62	83.21	71.48	73.01	77.78	71.62	83.13	71.11	73.29	77.64	71.44	82.22	71.36	72.97	77.73
		Bicondylar width (Co – Co)	110.13	128.15	127.46	121.12	114.67	109.79	128.14	127.63	121.32	114.50	110.03	128.08	128.12	121.15	114.42
		Bicoronoidal width (C – C)	90.06	102.19	98.29	95.48	91.92	90.00	101.81	98.18	95.49	92.10	90.39	102.07	98.39	95.05	91.96
		Bigonial width (Go – Go)	91.02	106.67	95.89	94.69	87.29	90.97	106.84	95.79	94.46	87.13	91.21	106.59	95.15	94.43	86.99
		Palatal width (U6 – U6)	52.82	52.68	50.51	49.88	51.41	52.84	52.58	50.44	49.54	51.30	52.99	52.57	50.58	49.67	51.13
	Sagittal	Anterior cranial base (S – N)	70.22	74.13	66.38	68.24	71.30	70.12	73.75	66.45	68.00	71.36	69.94	73.80	66.22	68.12	71.97
		Maxillary length (ANS – PNS)	50.84	58.37	48.57	53.81	57.46	50.49	58.36	48.81	53.37	57.16	49.97	58.01	48.62	53.79	57.46
		Mandibular length (Co – Pg)	105.74	118.92	106.59	106.72	110.10	105.29	118.73	106.20	106.86	110.44	105.50	118.76	106.28	106.84	110.54
		Mandibular corpus length (Go – Pg)	73.84	85.29	73.29	71.56	74.55	73.84	80.25	73.20	71.46	74.64	73.66	80.82	73.11	71.46	74.46
	Vertical	Upper facial height (N – ANS)	53.52	46.13	51.57	53.76	53.08	53.65	45.99	51.55	53.21	53.49	53.57	45.94	51.41	53.78	53.19
		Lower facial height (ANS – Me)	56.75	74.81	61.60	67.89	60.38	56.83	74.92	61.64	67.78	60.43	56.73	74.61	61.10	67.87	60.54
		Anterior facial height (N – Me)	110.40	120.88	113.29	120.40	113.73	110.52	120.91	113.32	120.43	113.44	110.78	120.93	112.70	120.76	113.64
		Posterior facial height (S – Go)	77.75	79.36	73.51	84.98	75.32	77.12	78.84	73.62	85.00	75.48	77.83	78.88	73.60	85.15	75.13
		Mandibular height (Co – Go)	58.55	56.89	54.34	59.82	55.54	57.64	54.02	54.45	60.01	55.87	58.15	56.76	54.49	59.87	56.02
		Interincisal distance (U1 – L1)	1.56	1.73	3.50	3.50	9.48	1.93	2.10	3.40	3.54	10.43	1.67	2.42	3.47	3.53	8.88
Angular	Downs	Facial plane angle	86.0	94.0	93.5	91.0	86.0	88.5	93.0	93.5	91.0	86.5	89.0	94.0	93.0	90.5	86.5
		Angle of convexity	1.5	8.0	12.0	7.0	8.5	1.0	8.0	12.0	6.5	8.5	1.0	7.5	11.5	7.0	8.0
		A-B plane to Na-Pogonion	-1.5	-3.5	-7.0	-5.5	-7.5	-1.5	-3.0	-7.5	-5.5	-8.0	-1.0	-3.5	-6.5	-5.0	-7.5
		Interincisal angle	131.0	130.0	140.5	144.5	161.5	130.0	134.0	141.5	149.0	161.5	129.5	139.0	138.5	146.0	157.0
	Steiner	Upper incisor to Nasion/A-point	19.5	12.0	13.0	11.5	1.5	21.0	11.5	12.0	10.0	1.5	20.5	10.0	14.5	11.0	2.0
		Lower incisor to Nasion/B-point	29.0	31.0	21.0	20.0	14.5	28.5	30.0	21.5	19.0	15.0	29.0	28.0	20.5	20.5	16.5
	Tweed	Mandibular Plane Angle (FMA)	20.5	21.5	24.0	15.0	24.0	20.5	22.5	24.0	15.5	23.0	20.0	22.0	24.5	15.5	24.0
		Lower Incisor to Mandibular Plane (IMPA)	100.0	98.0	82.5	94.5	84.0	99.5	93.5	82.0	93.0	85.0	99.5	92.0	83.0	95.0	85.5
		Frankfort Horizontal to Mandibular Incisor (FMIA)	59.5	60.5	73.5	70.5	72.0	60.0	64.0	74.0	71.5	72.0	60.5	66.0	72.5	69.5	70.5
	Reidel	SNA	77.5	83.0	84.0	75.5	77.5	77.5	83.5	85.0	75.5	77.5	77.0	83.0	84.5	75.5	77.0
		SNB	76.5	79.5	79.0	72.0	73.0	76.5	79.5	79.0	72.0	73.0	76.5	79.0	79.0	72.0	72.5
		ANB	1.0	3.5	5.0	3.5	4.5	1.0	4.0	6.0	3.5	4.5	0.5	4.0	5.5	3.5	4.5
		Upper Incisor to Frankfort Horizontal	108.5	110.5	112.5	106.0	90.0	110.0	109.0	111.5	103.5	90.5	111.0	108.0	116.0	104.5	92.5
		Frankfort Horizontal to Nasion/A-point	89.0	99.0	99.5	95.0	91.0	89.5	98.0	100.5	94.0	91.0	90.0	99.0	99.0	94.0	91.0

Table 7.--Raw Data of Ceph Measurements (cont.).

			Measurement 4					Measurement 5					Measurement 6				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	115.93	130.52	123.38	120.76	110.35	115.88	130.84	123.51	120.42	110.83	115.89	130.72	123.32	120.91	110.60
		Biorbital width (Or – Or)	71.68	82.24	71.84	73.09	77.67	71.75	83.40	71.29	73.20	77.74	71.73	83.85	71.27	73.22	77.55
		Bicondylar width (Co – Co)	110.26	128.19	127.65	121.13	114.30	110.20	128.24	127.82	121.16	114.56	110.03	127.96	127.79	121.43	114.45
		Bicoronoidal width (C – C)	90.22	101.75	98.59	95.34	91.63	90.25	101.46	98.34	95.25	91.93	90.20	101.66	98.29	95.48	92.01
		Bigonial width (Go – Go)	91.36	106.98	95.57	94.75	87.20	90.70	106.66	95.52	94.39	87.05	91.01	106.57	95.87	94.61	87.20
		Palatal width (U6 – U6)	52.86	52.53	50.32	49.63	51.35	52.63	52.56	50.37	49.59	51.34	52.94	52.90	50.34	49.63	51.40
	Sagittal	Anterior cranial base (S – N)	70.00	74.11	66.41	67.99	71.43	69.89	74.15	66.78	68.22	71.60	70.06	74.24	66.61	67.89	71.76
		Maxillary length (ANS – PNS)	50.18	58.40	48.62	53.66	57.04	50.41	58.31	51.49	53.58	57.03	50.40	58.24	48.67	53.83	57.69
		Mandibular length (Co – Pg)	105.44	118.84	106.36	106.78	110.23	105.45	118.82	106.49	106.55	110.26	105.26	118.65	106.36	106.71	110.73
		Mandibular corpus length (Go – Pg)	73.62	85.05	69.88	71.74	74.45	73.57	85.26	73.33	71.29	74.47	73.50	85.00	73.34	71.49	74.74
	Vertical	Upper facial height (N – ANS)	53.87	45.75	51.11	53.82	53.20	53.66	45.71	51.57	53.80	53.32	51.84	44.63	52.44	53.78	49.60
		Lower facial height (ANS – Me)	56.56	74.78	61.49	67.71	60.32	56.76	74.95	61.44	67.96	60.40	56.99	74.78	65.79	68.25	60.20
		Anterior facial height (N – Me)	110.81	120.76	112.86	120.45	113.61	110.63	120.84	113.30	120.82	113.83	113.68	124.84	116.57	121.05	117.11
		Posterior facial height (S – Go)	77.51	79.52	73.30	85.26	75.21	77.79	78.98	73.49	85.23	75.26	77.75	78.83	73.58	85.32	75.18
		Mandibular height (Co – Go)	58.07	56.65	54.42	59.77	55.73	58.30	56.73	54.50	59.94	55.86	58.44	56.74	54.24	60.01	55.94
		Interincisal distance (U1 – L1)	1.64	2.04	3.40	3.52	9.95	1.50	2.10	3.50	3.55	9.87	2.12	2.76	3.50	3.38	10.21
Angular	Downs	Facial plane angle	89.0	94.0	93.5	91.0	86.5	89.5	94.0	93.5	90.5	86.0	89.0	95.0	94.0	90.5	86.5
		Angle of convexity	1.0	8.0	12.5	6.5	8.0	1.0	7.5	12.0	7.0	8.0	1.0	7.0	12.0	6.5	7.5
		A-B plane to Na-Pogonion	-2.0	-3.5	-7.0	-6.0	-8.0	-0.5	-3.0	-7.0	-6.0	-7.5	-1.0	-2.5	-6.5	-5.0	-7.0
		Interincisal angle	128.0	134.0	141.0	145.0	159.0	129.5	134.0	139.5	146.0	158.0	134.5	133.0	140.5	146.0	164.0
	Steiner	Upper incisor to Nasion/A-point	21.5	9.5	12.5	10.0	1.5	21.0	11.0	14.0	10.5	1.0	21.0	13.0	13.5	11.5	1.0
		Lower incisor to Nasion/B-point	29.0	31.0	20.0	21.0	17.0	29.5	30.0	20.5	20.0	18.0	28.0	29.5	20.5	19.0	16.0
	Tweed	Mandibular Plane Angle (FMA)	20.5	22.0	24.5	15.5	24.0	19.5	21.5	24.0	15.5	23.5	20.5	21.0	23.5	15.5	24.0
		Lower Incisor to Mandibular Plane (IMPA)	99.5	94.5	83.0	95.5	87.5	101.0	95.0	83.0	94.5	88.0	94.5	93.0	82.5	94.0	83.0
		Frankfort Horizontal to Mandibular Incisor (FMIA)	60.0	63.5	72.5	69.0	68.5	59.5	63.5	73.0	70.0	68.5	65.0	68.0	74.0	70.5	73.0
	Reidel	SNA	77.5	83.5	81.5	76.0	76.5	77.5	83.0	84.0	75.5	76.5	77.5	82.5	84.5	75.5	76.5
		SNB	76.5	80.0	79.0	72.0	72.0	77.0	79.0	78.5	72.0	72.5	77.0	79.0	79.0	72.0	72.5
		ANB	1.0	3.5	5.5	4.0	4.5	0.5	4.0	5.5	3.5	4.0	0.5	3.5	5.5	3.5	4.0
		Upper Incisor to Frankfort Horizontal	111.0	108.5	112.5	104.0	90.0	111.0	110.0	113.5	104.5	89.0	110.0	112.5	113.5	105.0	89.5
		Frankfort Horizontal to Nasion/A-point	90.0	98.5	100.0	94.0	91.0	89.5	98.5	99.0	93.5	90.0	90.0	99.0	100.0	94.0	90.0

Table 8.--Raw Data of 3DCeph Measurements.

			Measurement 1					Measurement 2					Measurement 3				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	117.26	131.96	125.58	122.18	111.79	117.16	131.63	125.88	121.63	112.24	117.18	131.74	125.77	122.30	112.19
		Biorbital width (Or – Or)	72.37	87.50	72.17	74.15	78.60	73.23	88.97	72.32	74.21	78.60	72.51	84.12	72.06	74.33	78.58
		Bicondylar width (Co – Co)	111.48	129.19	130.13	122.49	115.81	111.45	129.25	129.81	122.41	115.84	111.28	129.38	130.07	122.50	115.87
		Bicoronoidal width (C – C)	91.28	103.45	99.59	96.37	92.77	95.94	106.31	99.54	96.43	90.88	94.04	104.60	99.73	96.55	92.74
		Bigonial width (Go – Go)	91.82	108.13	97.01	95.77	88.51	91.74	108.10	96.45	95.74	88.46	91.98	107.63	97.01	95.73	88.34
		Palatal width (U6 – U6)	53.42	53.60	51.11	50.81	53.37	53.52	54.16	51.08	49.80	52.10	53.36	53.82	50.97	49.14	50.46
	Sagittal	Anterior cranial base (S – N)	70.23	74.38	66.22	67.67	71.50	69.48	74.13	66.38	67.67	71.62	69.90	74.24	66.37	67.74	71.52
		Maxillary length (ANS – PNS)	50.62	57.80	48.93	53.42	56.99	50.26	57.79	49.03	53.15	57.02	50.41	58.03	48.66	53.18	57.05
		Mandibular length (Co – Pg)	118.95	134.30	124.23	122.73	123.20	118.70	134.32	124.24	122.85	124.19	118.51	134.28	124.21	122.85	123.97
		Mandibular corpus length (Go – Pg)	86.89	100.64	87.77	85.98	86.56	86.79	100.61	87.62	86.05	86.53	86.58	100.41	87.65	86.02	86.46
	Vertical	Upper facial height (N – ANS)	53.43	47.20	53.74	56.31	52.72	53.94	48.97	53.76	56.44	52.80	53.97	47.01	53.96	56.03	52.96
		Lower facial height (ANS – Me)	61.79	79.84	64.90	66.52	66.92	61.37	77.88	64.95	66.47	67.02	61.19	79.92	64.82	66.76	66.94
		Anterior facial height (N – Me)	114.56	125.53	116.74	121.65	118.24	114.64	125.28	116.86	121.77	118.41	114.49	125.35	116.95	121.65	118.44
		Posterior facial height (S – Go)	90.23	95.80	87.92	97.52	87.33	90.51	95.82	87.84	97.44	87.28	90.30	95.49	88.05	97.50	87.36
		Mandibular height (Co – Go)	59.34	57.76	56.85	61.52	57.07	59.26	57.76	56.86	61.43	57.61	59.18	57.75	56.85	61.47	57.63
		Interincisal distance (U1 – L1)	2.52	2.94	3.99	3.84	8.92	2.78	2.83	3.60	4.02	10.22	2.59	2.96	3.93	3.94	9.69
Angular	Downs	Facial plane angle	87.88	94.80	93.03	88.59	87.82	88.00	96.45	93.00	89.08	88.83	89.84	95.13	93.10	88.59	88.63
		Angle of convexity	1.33	7.01	12.53	7.07	8.23	1.36	6.68	12.62	6.87	8.40	1.90	7.44	12.12	6.67	8.77
		A-B plane to Na-Pogonion	-1.01	-2.97	-7.08	-6.04	-7.78	-0.59	-2.71	-7.45	-5.96	-7.85	-1.12	-3.52	-7.11	-5.61	-8.17
		Interincisal angle	139.14	137.75	142.48	147.43	155.66	140.26	138.62	138.85	146.14	164.58	139.79	135.72	138.94	145.44	157.94
	Steiner	Upper incisor to Nasion/A-point	19.09	12.31	13.11	7.88	1.00	19.99	10.66	13.60	11.24	3.02	19.73	12.12	15.35	10.81	1.91
		Lower incisor to Nasion/B-point	21.09	26.66	18.91	20.92	18.65	19.23	27.74	21.85	18.91	7.66	19.63	28.51	20.27	20.22	15.21
	Tweed	Mandibular Plane Angle (FMA)	20.50	19.75	23.94	16.64	21.66	20.49	18.30	23.89	16.32	20.78	18.63	19.62	23.67	16.67	20.81
		Lower Incisor to Mandibular Plane (IMPA)	92.76	91.41	81.21	95.98	89.66	90.61	92.23	84.35	93.84	78.52	91.09	93.18	82.90	95.21	86.26
		Frankfort Horizontal to Mandibular Incisor (FMIA)	66.75	68.84	74.86	67.38	68.68	68.91	69.47	71.76	69.84	80.71	70.28	67.20	73.43	68.12	72.94
	Reidel	SNA	78.93	83.66	86.10	77.33	78.54	79.13	83.70	86.10	77.23	78.59	79.24	84.02	85.66	77.18	78.65
		SNB	78.24	80.38	80.59	73.56	73.85	78.61	80.72	80.41	73.52	73.85	78.39	80.37	80.22	73.65	73.71
		ANB	0.68	3.28	5.50	3.77	4.69	0.52	2.98	5.69	3.72	4.74	0.85	3.65	5.44	3.53	4.94
		Upper Incisor to Frankfort Horizontal	107.61	111.09	112.38	99.95	93.02	108.65	110.85	112.90	103.70	96.13	110.49	111.48	114.49	102.68	95.00
		Frankfort Horizontal to Nasion/A-point	88.52	98.78	99.27	92.07	92.02	88.66	100.18	99.30	92.46	93.11	90.76	98.35	99.14	91.87	93.09

Table 8.--Raw Data of 3DCeph Measurements (cont.).

			Measurement 4					Measurement 5					Measurement 6				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	117.34	131.77	125.61	122.42	111.79	117.15	131.75	125.67	122.61	112.10	117.30	131.89	125.56	122.77	112.34
		Biorbital width (Or – Or)	72.71	85.05	72.11	74.35	78.45	72.57	83.87	72.37	74.30	78.65	72.75	86.16	72.14	74.19	78.60
		Bicondylar width (Co – Co)	111.31	129.34	129.86	122.38	115.72	111.28	129.11	129.42	122.46	115.78	111.63	129.25	129.98	122.52	115.78
		Bicoronoidal width (C – C)	94.42	105.07	99.61	96.43	93.21	95.70	106.38	99.42	96.46	92.80	95.21	102.67	99.91	96.43	92.97
		Bigonial width (Go – Go)	92.18	107.95	97.04	95.64	88.31	91.79	107.71	96.95	95.79	88.20	91.94	107.89	96.95	95.71	88.23
		Palatal width (U6 – U6)	53.47	55.63	51.38	50.24	51.74	53.54	53.84	51.32	49.26	52.30	53.53	55.26	51.22	49.75	50.56
	Sagittal	Anterior cranial base (S – N)	69.95	73.79	66.50	67.82	71.53	70.03	74.24	66.40	67.71	71.43	70.12	74.36	66.55	67.67	71.53
		Maxillary length (ANS – PNS)	50.41	57.73	48.72	53.27	57.11	50.32	57.98	48.84	53.24	57.05	50.44	57.80	48.67	53.30	57.05
		Mandibular length (Co – Pg)	118.80	134.28	124.16	122.74	123.82	118.88	134.50	124.14	122.76	124.04	118.91	134.15	124.25	122.71	124.11
		Mandibular corpus length (Go – Pg)	86.91	100.51	87.67	85.97	86.48	86.83	100.48	87.79	85.91	86.38	86.92	100.43	87.72	85.93	86.43
	Vertical	Upper facial height (N – ANS)	54.05	47.29	53.86	56.42	52.87	53.93	47.13	53.80	56.32	52.97	54.24	47.12	53.98	56.30	52.82
		Lower facial height (ANS – Me)	61.35	79.91	64.74	66.44	66.95	61.15	79.88	64.67	66.53	66.83	60.91	79.93	64.62	66.41	66.90
		Anterior facial height (N – Me)	114.75	125.56	116.83	121.73	118.38	114.45	125.44	116.65	121.70	118.38	114.53	125.46	116.81	121.55	118.33
		Posterior facial height (S – Go)	90.46	95.63	88.01	97.46	87.37	90.22	95.77	88.02	97.50	87.45	90.39	95.66	87.98	97.50	87.32
		Mandibular height (Co – Go)	59.18	57.83	56.89	61.47	57.41	59.23	57.94	56.82	61.47	57.63	59.26	57.64	56.93	61.46	57.65
		Interincisal distance (U1 – L1)	2.24	2.73	3.85	3.84	10.07	2.41	1.99	3.75	3.99	9.34	2.54	2.85	3.90	4.13	10.21
Angular	Downs	Facial plane angle	88.48	96.01	93.01	88.92	88.65	88.70	94.19	92.97	88.47	87.90	88.26	95.11	93.00	88.86	89.20
		Angle of convexity	0.88	7.37	12.49	6.79	8.28	1.30	6.96	12.48	6.92	8.38	1.73	7.22	12.31	6.98	8.16
		A-B plane to Na-Pogonion	-0.80	-2.75	-7.09	-5.87	-7.85	-0.88	-2.91	-7.34	-5.74	-7.91	-1.65	-3.00	-7.18	-5.80	-7.59
		Interincisal angle	136.91	139.18	139.31	145.22	156.29	136.80	130.58	138.66	144.85	153.41	137.31	135.59	140.16	146.31	161.37
	Steiner	Upper incisor to Nasion/A-point	19.71	11.37	14.36	10.50	6.15	20.51	12.16	14.33	11.62	4.47	20.87	13.03	13.89	10.75	2.53
		Lower incisor to Nasion/B-point	22.86	26.20	20.82	20.63	12.83	22.06	34.03	21.40	19.90	17.36	20.79	28.03	20.42	19.27	11.49
	Tweed	Mandibular Plane Angle (FMA)	20.19	18.64	23.67	16.29	20.91	19.79	20.50	23.70	16.80	21.52	20.16	19.61	23.77	16.32	20.23
		Lower Incisor to Mandibular Plane (IMPA)	94.27	90.62	83.42	95.73	83.78	93.57	98.62	84.12	94.85	88.43	92.57	92.56	83.03	94.33	82.50
		Frankfort Horizontal to Mandibular Incisor (FMIA)	65.54	70.73	72.91	67.98	75.31	66.64	60.88	72.19	68.35	70.05	67.27	67.83	73.20	69.35	77.28
	Ricket	SNA	78.83	83.57	85.85	77.14	78.62	79.04	83.81	86.02	77.23	78.60	79.26	83.83	85.87	77.31	78.46
		SNB	78.32	80.33	80.35	73.48	73.88	78.41	80.57	80.42	73.61	73.85	78.23	80.48	80.34	73.64	73.85
		ANB	0.51	3.25	5.51	3.66	4.73	0.63	3.23	5.61	3.62	4.76	1.03	3.34	5.53	3.67	4.61
		Upper Incisor to Frankfort Horizontal	108.62	111.56	113.60	102.76	99.02	109.84	110.30	113.53	103.49	96.64	109.97	112.24	113.04	103.04	95.90
		Frankfort Horizontal to Nasion/A-point	88.91	100.19	99.24	92.26	92.87	89.33	98.14	99.20	91.87	92.17	89.10	99.21	99.15	92.29	93.37

Table 9.--Raw Data of CBCT(12) Measurements.

			Measurement 1					Measurement 2					Measurement 3				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	114.253	129.006	121.856	118.799	108.991	114.253	129.014	121.855	118.799	108.614	115.000	129.005	122.218	119.180	109.005
		Biorbital width (Or – Or)	75.126	80.355	73.647	75.826	79.583	74.732	80.348	73.602	75.834	79.593	74.732	79.978	73.251	75.815	79.594
		Bicondylar width (Co – Co)	108.600	126.683	126.270	119.604	112.769	109.374	127.065	126.660	119.596	112.383	108.986	127.065	126.270	119.590	112.750
		Bicoronoidal width (C – C)	90.144	103.693	98.941	95.848	92.028	90.528	104.064	98.931	95.833	92.035	90.521	103.686	98.941	95.848	92.044
		Bigonial width (Go – Go)	90.873	106.726	95.082	94.314	86.812	90.500	106.740	95.082	93.949	86.453	90.892	107.106	95.082	94.324	86.830
		Palatal width (U6 – U6)	54.347	55.121	52.126	51.344	52.890	53.956	55.397	52.126	50.958	52.890	53.594	55.514	52.115	50.930	52.916
	Sagittal	Anterior cranial base (S – N)	69.234	72.898	65.849	66.645	70.404	68.503	72.545	65.252	66.287	70.766	68.962	72.545	65.491	66.300	69.936
		Maxillary length (ANS – PNS)	49.801	57.424	47.696	52.520	56.255	49.801	57.424	47.696	52.862	56.629	49.801	57.058	47.696	52.902	56.255
		Mandibular length (Co – Pg)	117.682	133.608	122.586	121.263	122.885	117.504	133.784	122.812	121.493	122.434	117.648	132.623	122.586	121.356	122.761
		Mandibular corpus length (Go – Pg)	85.800	99.634	86.216	84.743	85.369	85.743	99.770	86.216	84.993	85.016	85.842	97.884	86.216	85.324	85.326
	Vertical	Upper facial height (N – ANS)	53.505	45.619	53.086	53.622	50.503	53.546	45.732	53.184	53.685	50.503	53.505	45.732	53.086	53.231	50.549
		Lower facial height (ANS – Me)	63.504	82.208	66.597	70.512	70.288	63.130	82.585	66.566	70.548	70.288	63.504	82.208	66.597	70.193	69.738
		Anterior facial height (N – Me)	116.176	126.377	117.929	123.052	119.628	115.791	126.791	117.982	123.052	119.628	116.176	126.458	117.929	122.313	119.512
		Posterior facial height (S – Go)	89.043	95.015	86.836	95.019	86.116	88.798	95.161	86.496	94.781	85.842	88.573	95.318	86.810	94.745	86.607
		Mandibular height (Co – Go)	58.386	56.699	55.979	60.035	56.604	57.918	57.052	56.067	60.049	56.389	58.045	57.194	55.979	59.423	56.754
		Interincisal distance (U1 – L1)	3.132	3.713	3.596	3.393	9.575	3.455	3.881	3.954	3.577	9.641	3.063	3.596	4.095	3.496	9.523
Angular	Downs	Facial plane angle	85.932	95.754	90.514	86.463	87.030	85.977	96.015	90.703	86.511	86.838	85.932	95.268	90.367	86.405	87.342
		Angle of convexity	3.082	7.254	12.736	8.048	8.185	3.461	7.685	13.109	7.687	8.548	3.078	8.844	12.736	6.461	7.822
		A-B plane to Na-Pogonion	-2.528	-3.417	-7.349	-5.608	-7.339	-2.702	-3.385	-7.539	-5.791	-7.737	-2.528	-2.286	-7.349	-5.020	-6.938
		Interincisal angle	133.807	141.246	143.130	143.890	163.496	133.799	140.301	140.704	143.890	163.496	133.807	144.009	140.130	147.894	161.565
	Steiner	Upper incisor to Nasion/A-point	16.538	9.570	9.065	10.828	3.814	18.579	10.085	11.119	10.828	3.814	16.551	7.121	11.491	6.724	3.814
		Lower incisor to Nasion/B-point	27.981	25.302	22.000	21.289	15.806	25.789	25.625	22.221	21.289	15.573	27.980	25.145	22.574	21.940	17.989
	Tweed	Mandibular Plane Angle (FMA)	23.083	19.615	26.889	20.877	23.601	23.087	19.625	26.777	21.164	23.750	23.228	19.417	27.036	20.822	22.194
		Lower Incisor to Mandibular Plane (IMPA)	99.131	89.497	83.964	93.881	85.500	96.863	89.403	84.076	93.728	85.357	98.986	88.958	84.537	94.874	88.713
		Frankfort Horizontal to Mandibular Incisor (FMIA)	57.786	70.888	69.147	65.242	70.899	60.050	70.971	69.147	65.108	70.894	57.786	71.625	68.426	64.304	69.093
	Reidel	SNA	77.709	83.338	84.717	76.300	77.321	77.933	83.664	84.570	76.198	77.407	77.316	83.555	84.615	75.698	77.529
		SNB	76.034	79.456	78.912	72.307	72.808	76.100	79.674	78.613	72.205	72.662	75.653	79.828	78.809	72.256	73.249
		ANB	1.674	3.882	5.805	3.993	4.513	1.833	3.990	5.957	3.993	4.746	1.663	3.726	5.805	3.442	4.280
		Upper incisor to Frankfort Horizontal	103.979	109.642	106.017	101.352	87.404	106.251	110.671	108.443	101.217	87.398	103.979	107.617	108.296	96.410	87.528
		Frankfort Horizontal to Nasion/A-point	87.441	100.072	96.952	90.523	91.218	87.672	100.586	97.325	90.389	91.212	87.428	100.496	96.805	89.686	91.342

Table 9.--Raw Data of CBCT(12) Measurements (cont.).

			Measurement 4					Measurement 5					Measurement 6				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	114.253	129.024	122.232	118.799	109.001	114.254	128.619	121.870	119.176	109.005	114.630	129.006	121.485	119.185	108.614
		Biorbital width (Or – Or)	75.115	80.000	73.641	75.807	79.583	73.979	80.753	73.620	75.834	79.583	74.601	80.000	73.620	75.421	79.583
		Bicondylar width (Co – Co)	108.995	127.065	126.639	119.578	112.760	108.600	127.074	126.639	119.967	112.760	108.620	127.064	126.270	119.979	112.760
		Bicoronoidal width (C – C)	90.144	103.693	98.961	95.848	92.044	90.521	103.681	98.961	95.848	92.412	90.521	103.316	98.941	95.848	92.035
		Bigonial width (Go – Go)	90.128	106.357	95.065	94.314	86.436	90.581	106.734	95.068	94.604	86.812	90.865	107.111	95.082	94.324	86.812
		Palatal width (U6 – U6)	53.956	55.904	52.105	50.952	52.890	54.364	55.528	51.352	50.952	53.164	54.347	55.533	52.126	50.930	53.267
	Sagittal	Anterior cranial base (S – N)	68.411	72.539	65.133	66.414	69.938	69.234	72.412	65.133	66.845	70.556	69.234	72.545	65.491	66.287	70.043
		Maxillary length (ANS – PNS)	49.801	57.058	47.696	52.538	55.860	49.801	57.703	47.724	52.902	55.881	49.821	57.424	47.671	52.912	55.881
		Mandibular length (Co – Pg)	118.001	132.367	122.804	121.247	122.294	117.682	133.470	122.804	121.213	122.527	117.087	133.462	122.586	121.462	122.763
		Mandibular corpus length (Go – Pg)	86.305	97.672	86.404	84.810	84.874	84.671	99.377	86.362	85.135	85.062	85.915	99.221	86.216	84.882	85.369
	Vertical	Upper facial height (N – ANS)	53.172	45.619	53.184	53.216	50.550	53.505	45.375	53.184	53.622	50.128	53.522	45.732	53.086	53.671	50.503
		Lower facial height (ANS – Me)	63.504	82.585	66.630	70.495	70.288	63.504	82.208	66.590	70.621	70.285	63.553	82.594	66.635	70.565	70.285
		Anterior facial height (N – Me)	115.791	126.791	117.929	122.686	119.610	116.176	126.042	117.960	123.073	119.249	116.185	126.850	117.914	123.052	119.626
		Posterior facial height (S – Go)	88.876	95.217	86.635	95.365	86.342	88.775	95.340	86.794	94.949	86.426	88.886	95.443	86.810	95.031	86.132
		Mandibular height (Co – Go)	58.095	57.347	56.029	59.990	56.615	58.296	57.071	56.207	59.633	56.574	57.819	56.967	55.979	60.237	56.574
		Interincisal distance (U1 – L1)	3.393	3.596	4.008	3.577	9.641	3.330	3.713	4.095	3.063	9.523	3.496	3.596	3.954	2.821	9.523
Angular	Downs	Facial plane angle	86.183	94.912	90.673	86.011	87.023	85.796	95.847	90.703	86.328	86.972	85.797	95.737	90.514	86.793	87.030
		Angle of convexity	3.075	8.857	13.109	7.684	8.958	3.082	7.760	13.109	7.320	8.573	3.090	7.254	12.736	7.687	8.185
		A-B plane to Na-Pogonion	-2.895	-2.472	-7.539	-5.054	-7.923	-2.508	-3.218	-7.539	-5.608	-7.150	-2.510	-2.978	-7.349	-6.365	-7.339
		Interincisal angle	131.455	140.935	140.704	143.578	160.907	132.951	139.916	141.733	140.517	161.565	131.655	143.715	141.733	146.497	161.565
	Steiner	Upper incisor to Nasion/A-point	20.908	10.512	11.119	10.535	4.194	17.394	10.993	10.089	11.196	3.840	17.394	8.321	10.462	5.878	3.814
		Lower incisor to Nasion/B-point	25.790	24.669	22.221	22.194	18.395	27.980	25.145	22.221	24.445	17.733	29.276	24.301	22.000	23.416	17.736
	Tweed	Mandibular Plane Angle (FMA)	23.123	19.475	27.121	21.148	23.607	23.711	19.534	26.810	21.258	23.470	23.413	19.595	27.002	20.777	23.601
		Lower Incisor to Mandibular Plane (IMPA)	96.815	88.900	83.761	94.828	88.089	98.639	89.089	84.043	97.007	87.430	100.233	88.315	83.851	98.178	87.430
		Frankfort Horizontal to Mandibular Incisor (FMIA)	60.062	71.625	69.117	64.027	68.304	57.650	71.376	69.147	61.735	69.099	56.354	72.090	69.147	63.045	68.969
	Reidel	SNA	78.254	83.235	84.884	76.576	77.909	77.709	84.054	84.884	75.932	78.020	77.709	83.233	84.615	76.198	77.233
		SNB	76.408	79.352	78.928	72.883	73.016	76.034	80.108	78.928	72.090	73.479	76.034	79.570	78.809	71.989	72.720
		ANB	1.846	3.883	5.957	3.693	4.893	1.675	3.946	5.957	3.842	4.541	1.675	3.663	5.805	4.209	4.513
		Upper Incisor to Frankfort Horizontal	108.607	110.690	108.413	100.449	87.397	104.698	111.460	107.414	101.217	87.534	104.698	108.375	107.414	96.548	87.404
		Frankfort Horizontal to Nasion/A-point	87.699	100.178	97.295	89.914	91.592	87.305	100.467	97.325	90.022	91.374	87.305	100.054	96.952	90.670	91.218

Table 10.--Raw Data of CBCT(9) Measurements.

			Measurement 1					Measurement 2					Measurement 3				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	114.521	132.859	122.139	118.617	109.577	114.836	130.323	121.871	119.631	108.923	115.118	130.507	122.481	119.245	109.257
		Biorbital width (Or – Or)	74.830	80.043	73.636	75.986	79.772	74.826	80.043	73.636	75.986	79.772	74.843	80.051	73.636	75.684	79.772
		Bicondylar width (Co – Co)	108.956	130.643	127.055	119.238	113.636	109.829	127.749	126.842	120.543	112.709	109.828	128.903	127.162	119.876	113.034
		Bicoronoidal width (C – C)	90.259	103.405	99.083	95.867	92.053	90.270	103.405	99.074	95.867	92.053	90.278	103.705	98.782	95.867	92.053
		Bigonial width (Go – Go)	90.551	109.316	95.555	93.939	86.869	90.551	107.190	95.579	95.262	87.158	90.249	107.953	95.614	94.733	86.565
		Palatal width (U6 – U6)	53.787	54.660	51.727	51.745	52.648	54.078	54.952	51.721	51.453	52.940	54.078	54.962	51.712	51.453	52.940
	Sagittal	Anterior cranial base (S – N)	69.280	72.877	65.563	66.029	70.281	69.025	73.172	65.381	66.222	70.271	69.186	73.120	65.471	66.307	70.281
		Maxillary length (ANS – PNS)	49.977	57.512	47.757	52.749	56.248	49.977	57.512	47.488	52.788	56.538	49.685	57.512	48.048	53.045	56.501
		Mandibular length (Co – Pg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Mandibular corpus length (Go – Pg)	85.668	100.800	87.130	85.123	85.633	85.668	100.045	86.803	85.501	85.624	85.741	100.480	86.610	85.320	85.523
	Vertical	Upper facial height (N – ANS)	53.463	45.677	53.308	53.712	50.307	53.612	45.607	52.669	53.374	50.344	53.358	45.607	52.745	53.672	50.344
		Lower facial height (ANS – Me)	63.349	82.265	66.522	70.662	70.379	63.641	82.265	66.813	70.951	70.425	63.600	82.265	67.103	70.662	70.425
		Anterior facial height (N – Me)	115.931	126.429	118.016	123.079	119.533	116.381	126.417	117.705	123.074	119.531	116.127	126.417	118.016	123.086	119.533
		Posterior facial height (S – Go)	88.931	95.463	87.407	95.201	86.543	88.940	94.935	87.351	95.048	86.481	88.735	95.240	86.468	95.185	86.590
		Mandibular height (Co – Go)	58.972	56.809	57.063	60.043	56.760	59.207	56.557	56.594	59.705	57.859	58.675	56.560	56.181	60.340	57.026
		Interincisal distance (U1 – L1)	3.131	3.265	4.292	3.380	9.949	3.265	3.467	4.341	3.564	9.949	3.131	3.199	4.380	3.291	9.824
Angular	Downs	Facial plane angle	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Angle of convexity	2.671	7.586	12.527	8.201	8.375	2.681	7.217	12.880	7.096	7.799	3.363	7.055	12.883	7.096	7.799
		A-B plane to Na-Pogonion	-2.103	-3.394	-7.597	-5.606	-8.050	-2.084	-3.270	-7.502	-5.574	-7.662	-2.532	-3.785	-7.468	-5.574	-7.600
		Interincisal angle	126.585	140.202	142.350	144.263	160.640	131.269	141.311	143.249	144.263	162.178	125.976	139.527	140.732	145.379	162.072
	Steiner	Upper incisor to Nasion/A-point	20.424	10.132	11.670	8.736	2.717	20.404	11.143	11.603	9.281	2.421	22.645	11.081	12.468	7.400	3.853
		Lower incisor to Nasion/B-point	29.584	25.766	20.150	23.006	17.207	26.904	23.810	19.273	22.670	15.667	29.632	25.404	20.924	23.436	17.207
	Tweed	Mandibular Plane Angle (FMA)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Lower Incisor to Mandibular Plane (IMPA)	100.702	89.525	82.708	95.151	87.095	97.794	87.883	81.421	94.379	85.403	100.404	89.690	82.096	95.650	87.205
		Frankfort Horizontal to Mandibular Incisor (FMIA)	56.819	70.908	71.173	63.912	69.445	59.859	72.357	71.985	64.150	71.305	56.764	70.409	70.684	63.450	69.538
	Riedel	SNA	77.636	83.613	84.670	76.800	77.974	77.471	83.239	85.223	76.573	77.679	78.093	83.347	84.980	76.333	77.679
		SNB	76.229	79.713	78.840	72.806	73.105	76.048	79.503	79.348	72.788	73.103	76.345	79.359	79.104	72.548	73.105
		ANB	1.407	3.901	5.830	3.994	4.870	1.423	3.736	5.876	3.785	4.576	1.748	3.988	5.876	3.785	4.574
		Upper Incisor to Frankfort Horizontal	108.234	110.706	108.823	99.649	88.805	108.590	111.046	108.736	99.887	89.126	110.788	110.882	109.952	98.072	87.466
		Frankfort Horizontal to Nasion/A-point	87.810	100.574	97.154	90.913	91.522	88.186	99.903	97.134	90.606	91.548	88.144	99.801	97.484	90.672	91.319

Table 10.--Raw Data of CBCT(9) Measurements (cont.).

			Measurement 4					Measurement 5					Measurement 6				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	115.100	129.132	122.823	118.950	110.461	114.516	130.785	122.178	118.267	109.496	114.550	131.237	122.216	119.958	109.817
		Biorbital width (Or – Or)	74.818	80.043	73.636	75.976	79.772	74.835	80.043	73.636	76.268	79.772	74.818	79.759	73.636	76.268	79.480
		Bicondylar width (Co – Co)	109.515	127.384	127.462	119.856	114.269	108.957	128.603	127.062	119.163	113.619	108.973	129.399	127.149	120.562	113.362
		Bicoronoidal width (C – C)	90.270	103.705	98.785	95.867	92.053	90.562	103.697	98.782	95.855	92.069	90.270	103.705	99.366	95.867	92.345
		Bigonial width (Go – Go)	90.551	107.174	96.082	95.014	87.161	90.551	108.438	95.284	94.165	87.158	90.551	108.636	95.603	95.582	87.158
		Palatal width (U6 – U6)	54.078	55.264	51.734	51.453	52.648	54.078	54.952	51.727	51.453	52.648	54.078	54.695	51.721	51.442	52.940
	Sagittal	Anterior cranial base (S – N)	68.966	73.176	65.381	65.940	70.281	69.072	72.918	65.583	66.218	70.281	69.258	73.218	65.194	65.944	70.001
		Maxillary length (ANS – PNS)	49.685	57.512	47.757	53.085	56.538	49.977	57.512	47.769	53.077	56.211	49.679	57.563	47.779	52.788	56.538
		Mandibular length (Co – Pg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Mandibular corpus length (Go – Pg)	85.668	99.973	87.166	85.510	85.710	85.668	100.838	86.860	85.130	85.624	85.910	100.502	86.797	85.871	85.624
	Vertical	Upper facial height (N – ANS)	53.526	45.890	52.745	53.423	50.344	53.892	45.677	53.027	53.414	50.344	53.492	45.607	52.824	53.374	50.382
		Lower facial height (ANS – Me)	63.600	81.954	66.813	70.662	70.137	63.351	82.265	66.813	70.951	70.425	63.310	82.246	66.813	70.619	70.425
		Anterior facial height (N – Me)	116.314	126.429	117.725	122.787	119.241	116.378	126.429	118.016	123.067	119.533	116.026	126.429	117.747	122.775	119.521
		Posterior facial height (S – Go)	88.940	95.671	86.780	95.042	86.613	88.940	95.060	86.668	95.294	86.481	88.951	95.069	86.551	95.734	86.481
		Mandibular height (Co – Go)	58.619	57.377	55.244	59.332	57.777	59.214	56.670	56.005	59.637	56.927	58.039	56.671	56.231	59.420	57.423
		Interincisal distance (U1 – L1)	3.380	3.199	4.341	3.355	9.949	3.318	3.407	4.341	2.978	10.005	3.455	3.576	4.428	3.158	9.777
Angular	Downs	Facial plane angle	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Angle of convexity	3.331	7.291	12.883	7.380	7.799	2.687	7.393	12.816	8.217	7.799	2.414	7.291	13.172	7.367	8.094
		A-B plane to Na-Pogonion	-2.517	-3.287	-7.468	-5.715	-7.662	-2.105	-3.566	-7.445	-6.014	-7.150	-1.949	-3.646	-7.614	-5.713	-7.745
		Interincisal angle	130.359	140.202	143.915	146.255	160.640	130.359	141.986	143.249	145.379	160.640	129.391	141.986	142.725	146.144	162.072
	Steiner	Upper incisor to Nasion/A-point	20.061	10.406	11.603	5.208	2.421	20.403	10.068	11.670	6.855	2.421	20.676	10.406	12.180	7.115	4.149
		Lower incisor to Nasion/B-point	27.841	25.594	18.607	24.635	17.205	27.824	23.982	19.229	23.604	17.387	28.627	23.620	19.102	22.838	17.387
	Tweed	Mandibular Plane Angle (FMA)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Lower Incisor to Mandibular Plane (IMPA)	98.703	90.228	80.137	96.488	87.316	98.927	87.841	81.136	95.716	86.942	99.971	87.454	80.511	95.272	86.942
		Frankfort Horizontal to Mandibular Incisor (FMIA)	58.341	70.747	72.233	62.112	70.451	59.024	72.439	71.862	62.972	69.914	56.888	72.846	72.712	63.301	70.363
	Reidel	SNA	77.852	83.462	85.223	76.781	77.679	77.225	83.450	84.670	77.119	77.679	77.293	83.624	85.189	76.781	77.908
		SNB	76.113	79.664	79.348	72.879	73.103	75.811	79.486	78.818	72.956	73.285	75.987	79.636	79.196	72.879	73.218
		ANB	1.739	3.798	5.876	3.902	4.576	1.414	3.964	5.852	4.162	4.394	1.306	3.988	5.992	3.902	4.689
		Upper Incisor to Frankfort Horizontal	107.982	110.545	108.318	95.857	89.811	108.664	110.452	108.613	97.594	89.274	107.497	110.859	109.987	97.157	88.291
		Frankfort Horizontal to Nasion/A-point	87.920	100.139	96.715	90.648	92.232	88.261	100.384	96.943	90.739	91.696	86.821	100.453	97.807	90.042	92.440

Table 11.--Raw Data of CBCT(6) Measurements.

			Measurement 1					Measurement 2					Measurement 3				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Biorbital width (Or – Or)	74.732	80.096	73.111	75.796	79.974	75.307	80.007	73.027	75.889	79.940	75.027	80.008	73.597	75.590	79.148
		Bicondylar width (Co – Co)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Bicoronoidal width (C – C)	90.454	103.951	100.183	95.282	90.266	91.334	102.441	97.466	95.661	91.788	90.974	102.562	99.148	93.950	90.082
		Bigonial width (Go – Go)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Palatal width (U6 – U6)	53.869	55.137	52.033	51.679	52.915	53.669	55.137	52.033	51.679	53.110	53.869	55.137	52.028	51.679	53.103
	Sagittal	Anterior cranial base (S – N)	69.002	72.354	65.441	66.882	71.437	69.094	72.729	65.495	68.718	70.597	69.093	72.806	65.424	66.784	70.617
		Maxillary length (ANS – PNS)	49.849	57.619	47.904	52.625	56.073	49.850	57.619	47.915	52.673	56.492	49.849	57.619	47.902	52.668	56.519
		Mandibular length (Co – Pg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Mandibular corpus length (Go – Pg)	86.259	100.221	86.937	85.550	83.850	85.850	99.679	86.217	85.781	84.847	86.260	100.080	86.725	85.014	84.867
	Vertical	Upper facial height (N – ANS)	53.498	45.448	52.743	53.961	50.404	53.561	45.489	52.658	53.596	50.057	53.449	45.390	52.908	53.672	49.565
		Lower facial height (ANS – Me)	63.783	82.482	66.523	70.199	70.466	63.783	82.313	66.501	70.389	70.530	63.783	82.511	66.899	70.414	70.333
		Anterior facial height (N – Me)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Posterior facial height (S – Go)	89.634	94.195	87.146	95.720	87.611	89.006	94.992	86.503	95.476	87.366	89.370	94.299	86.695	95.313	86.992
		Mandibular height (Co – Go)	58.254	55.903	56.364	60.427	58.396	57.656	57.115	55.694	60.131	57.933	58.105	56.057	55.875	59.886	57.331
		Interincisal distance (U1 – L1)	3.493	3.382	4.055	3.493	9.916	3.544	3.280	4.243	3.805	10.356	3.493	3.187	4.010	3.611	10.002
Angular	Downs	Facial plane angle	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Angle of convexity	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		A-B plane to Na-Pogonion	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Interincisal angle	131.017	139.312	141.039	144.011	162.639	131.017	138.951	141.158	143.143	162.741	131.017	138.951	139.795	142.706	162.383
	Steiner	Upper incisor to Nasion/A-point	19.380	9.876	11.375	11.078	2.466	19.599	10.529	12.619	10.456	1.910	19.391	10.683	12.905	10.906	1.584
		Lower incisor to Nasion/B-point	27.771	26.922	21.730	21.420	15.405	27.644	26.780	20.361	22.828	14.447	27.646	26.698	21.458	22.814	14.692
	Tweed	Mandibular Plane Angle (FMA)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Lower Incisor to Mandibular Plane (IMPA)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Frankfort Horizontal to Mandibular Incisor (FMIA)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Reidel	SNA	78.599	84.386	85.213	75.383	76.142	78.218	83.794	85.057	75.849	77.119	78.425	84.174	84.928	75.674	77.434
		SNB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		ANB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Upper Incisor to Frankfort Horizontal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Frankfort Horizontal to Nasion/A-point	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 11.--Raw Data of CBCT(6) Measurements (cont.).

			Measurement 4					Measurement 5					Measurement 6				
			Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E	Skull A	Skull B	Skull C	Skull D	Skull E
Linear	Transverse	Biporionic width (Po – Po)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Biorbital width (Or – Or)	75.307	79.809	73.119	76.203	79.678	75.022	80.014	73.356	75.990	79.177	75.220	79.815	72.832	75.684	80.187
		Bicondylar width (Co – Co)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Bicoronoidal width (C – C)	91.329	101.797	98.865	98.977	90.588	90.984	102.648	98.499	97.739	92.783	90.789	101.462	98.075	98.532	91.368
		Bigonial width (Go – Go)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Palatal width (U6 – U6)	53.669	55.137	52.028	51.480	53.115	53.869	55.137	52.028	51.475	53.110	53.869	55.137	52.028	51.675	53.098
	Sagittal	Anterior cranial base (S – N)	69.226	72.584	65.494	66.608	70.638	69.170	72.624	65.411	66.900	70.647	69.181	72.603	65.463	66.477	70.630
		Maxillary length (ANS – PNS)	49.842	57.619	47.909	52.815	56.492	49.842	57.606	47.909	52.820	56.470	49.842	57.606	47.909	52.673	56.522
		Mandibular length (Co – Pg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Mandibular corpus length (Go – Pg)	86.226	98.955	86.853	87.548	84.750	86.079	99.453	86.508	86.999	85.585	86.148	99.084	86.601	86.739	85.344
	Vertical	Upper facial height (N – ANS)	54.200	45.652	52.772	54.654	49.901	54.301	45.597	53.059	54.290	50.462	53.881	45.405	52.928	53.797	51.033
		Lower facial height (ANS – Me)	63.783	82.482	66.918	70.215	70.333	63.783	82.277	66.914	70.207	70.530	63.783	82.475	66.918	70.399	70.135
		Anterior facial height (N – Me)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Posterior facial height (S – Go)	89.292	94.862	86.819	95.745	86.254	89.403	94.731	86.750	96.332	86.883	89.364	95.066	86.154	95.950	85.600
		Mandibular height (Co – Go)	57.702	57.104	56.054	60.477	56.429	57.946	56.940	55.845	61.211	57.202	58.081	57.357	55.230	60.863	55.503
		Interincisal distance (U1 – L1)	3.406	3.280	4.200	3.464	10.002	3.493	3.280	4.055	3.382	10.002	3.493	3.280	3.965	3.650	10.094
Angular	Downs	Facial plane angle	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Angle of convexity	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		A-B plane to Na-Pogonion	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Interincisal angle	131.634	137.771	140.893	142.275	163.370	131.017	139.337	139.795	145.297	162.383	131.017	138.132	140.080	143.143	163.387
	Steiner	Upper incisor to Nasion/A-point	19.820	10.306	12.848	10.624	2.618	19.600	8.788	12.704	9.815	1.488	19.814	9.945	12.657	9.894	2.738
		Lower incisor to Nasion/B-point	26.907	28.076	20.502	23.438	14.726	27.653	28.168	21.700	21.409	14.544	27.521	28.068	21.434	23.154	14.721
	Tweed	Mandibular Plane Angle (FMA)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Lower Incisor to Mandibular Plane (IMPA)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Frankfort Horizontal to Mandibular Incisor (FMIA)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Reidel	SNA	77.781	83.535	85.149	75.858	77.749	77.944	83.709	84.857	75.437	77.249	77.955	83.557	85.161	76.317	77.188
		SNB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		ANB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Upper Incisor to Frankfort Horizontal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Frankfort Horizontal to Nasion/A-point	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Cranio Reliability

MeasurementID = 1, Measurement = Biporionic width (Po - Po)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.994	1.000	3365.976	4	20	.000
Average Measures	1.000	.999	1.000	3365.976	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 1, Measurement = Biporionic width (Po – Po)

MeasurementID = 2, Measurement = Biorbital width (Or - Or)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.993	1.000	2839.110	4	20	.000
Average Measures	1.000	.999	1.000	2839.110	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 2, Measurement = Biorbital width (Or – Or)

MeasurementID = 3, Measurement = Bicondylar width (Co - Co)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	1.000[b]	.999	1.000	31706.787	4	20	.000
Average Measures	1.000	1.000	1.000	31706.787	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 3, Measurement = Bicondylar width (Co – Co)

MeasurementID = 4, Measurement = Bicoronoidal width (C - C)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.991	1.000	2445.282	4	20	.000
Average Measures	1.000	.999	1.000	2445.282	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 4, Measurement = Bicoronoidal width (C – C)

MeasurementID = 5, Measurement = Bigonial width (Go - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.997	1.000	6797.678	4	20	.000
Average Measures	1.000	.999	1.000	6797.678	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 5, Measurement = Bigonial width (Go – Go)

MeasurementID = 6, Measurement = Palatal width (U6 - U6)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.976[b]	.920	.987	245.963	4	20	.000
Average Measures	.936	.986	1.000	245.963	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 6, Measurement = Palatal width (U6 – U6)

MeasurementID = 7, Measurement = Anterior cranial base (S - N)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.966[b]	.868	.996	171.464	4	20	.000
Average Measures	.994	.980	.999	171.464	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 7, Measurement = Anterior cranial base (S – N)

MeasurementID = 8, Measurement = Maxillary length (ANS - PNS)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.996	1.000	5536.101	4	20	.000
Average Measures	1.000	.999	1.000	5536.101	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 8, Measurement = Maxillary length (ANS – PNS)

MeasurementID = 9, Measurement = Mandibular length (Co - Pg)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.998	1.000	9968.656	4	20	.000
Average Measures	1.000	1.000	1.000	9968.656	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 9, Measurement = Mandibular length (Co – Pg)

MeasurementID = 10, Measurement = Mandibular corpus length (Go - Pg)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	1.000[b]	.998	1.000	12872.910	4	20	.000
Average Measures	1.000	1.000	1.000	12872.910	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 10, Measurement = Mandibular corpus length (Go – Pg)

MeasurementID = 11, Measurement = Upper facial height (N - ANS)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.995	.999	1364.605	4	20	.000
Average Measures	.999	.997	1.000	1364.605	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 11, Measurement = Upper facial height (N – ANS)

MeasurementID = 12, Measurement = Lower facial height (ANS - Me)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.996	1.000	5060.796	4	20	.000
Average Measures	1.000	.999	1.000	5060.796	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 12, Measurement = Lower facial height (ANS – Me)

MeasurementID = 13, Measurement = Anterior facial height (N - Me)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.993	1.000	3030.584	4	20	.000
Average Measures	1.000	.998	1.000	3030.584	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 13, Measurement = Anterior facial height (N – Me)

MeasurementID = 14, Measurement = Posterior facial height (S - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.960[b]	.931	.986	268.593	4	20	.000
Average Measures	.997	.986	1.000	268.593	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 14, Measurement = Posterior facial height (S – Go)

MeasurementID = 15, Measurement = Mandibular height (Co - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.979[b]	.929	.996	280.077	4	20	.000
Average Measures	.996	.987	1.000	280.077	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 15, Measurement = Mandibular height (Co – Go)

MeasurementID = 16, Measurement = Interincisal distance (U1 - L1)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.958[b]	.864	.995	137.802	4	20	.000
Average Measures	.993	.974	.999	137.802	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 16, Measurement = Interincisal distance (U1 – L1)

MeasurementID = 17, Measurement = Facial plane angle

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.981[b]	.957	.998	316.228	4	20	.000
Average Measures	.997	.989	1.000	316.228	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 17, Measurement = Facial plane angle

MeasurementID = 18, Measurement = Angle of convexity

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.969[b]	.899	.998	191.448	4	20	.000
Average Measures	.996	.982	.999	191.448	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 18, Measurement = Angle of convexity

MeasurementID = 19, Measurement = A-B plane to Na-Pogonion

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.979[b]	.930	.998	283.908	4	20	.000
Average Measures	.996	.988	1.000	283.908	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 19, Measurement = A-B plane to Na-Pogonion

MeasurementID = 20, Measurement = Interincisal angle

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.856[b]	.674	.965	47.172	4	20	.000
Average Measures	.979	.926	.998	47.172	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 20, Measurement = Interincisal angle

MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.873[b]	.648	.964	42.269	4	20	.000
Average Measures	.976	.917	.997	42.269	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.716[b]	.376	.958	16.142	4	20	.000
Average Measures	.938	.782	.995	16.142	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

MeasurementID = 23, Measurement = Mandibular Plane Angle (FMA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.881[b]	.668	.965	45.312	4	20	.000
Average Measures	.978	.922	.997	45.312	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 23, Measurement = Mandibular Plane Angle (FMA)

MeasurementID = 24, Measurement = Lower Incisor to Mandibular Plane (IMPA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.552[b]	.188	.922	8.400	4	20	.000
Average Measures	.881	.582	.966	8.400	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 24, Measurement = Lower Incisor to Mandibular Plane (IMPA)

MeasurementID = 25, Measurement = Frankfort Horizontal to Mandibular Incisor (FMIA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.506[b]	.146	.909	7.112	4	20	.001
Average Measures	.669	.206	.964	7.112	4	20	.001

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 25, Measurement = Frankfort Horizontal to Mandibular Incisor (FMIA)

MeasurementID = 26, Measurement = SNA

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.857[b]	.612	.981	36.824	4	20	.000
Average Measures	.973	.905	.997	36.824	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 26, Measurement = SNA

MeasurementID = 27, Measurement = SNB

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.814[b]	.529	.975	27.183	4	20	.000
Average Measures	.963	.871	.996	27.183	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 27, Measurement = SNB

MeasurementID = 28, Measurement = ANB

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.951[b]	.837	.998	318.138	4	20	.000
Average Measures	.987	.969	1.000	318.138	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 28, Measurement = ANB

MeasurementID = 29, Measurement = Upper Incisor to Frankfort Horizontal

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.913[b]	.741	.989	63.956	4	20	.000
Average Measures	.964	.945	.998	63.956	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 29, Measurement = Upper Incisor to Frankfort Horizontal

MeasurementID = 30, Measurement = Frankfort Horizontal to Nasion/A-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.968[b]	.963	.986	436.404	4	20	.000
Average Measures	.998	.992	1.000	436.404	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 30, Measurement = Frankfort Horizontal to Nasion/A-point

Ceph Reliability

MeasurementID = 1, Measurement = Biporionic width (Po - Po)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.997	1.000	7214.918	4	20	.000
Average Measures	1.000	1.000	1.000	7214.918	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 1, Measurement = Biporionic width (Po – Po)

MeasurementID = 2, Measurement = Biorbital width (Or - Or)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.995	.999	1361.658	4	20	.000
Average Measures	.999	.997	1.000	1361.658	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 2, Measurement = Biorbital width (Or – Or)

MeasurementID = 3, Measurement = Bicondylar width (Co - Co)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	1.000[b]	.998	1.000	13945.646	4	20	.000
Average Measures	1.000	1.000	1.000	13945.646	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 3, Measurement = Bicondylar width (Co – Co)

MeasurementID = 4, Measurement = Bicoronoidal width (C - C)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.994	1.000	3501.796	4	20	.000
Average Measures	1.000	.999	1.000	3501.796	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 4, Measurement = Bicoronoidal width (C – C)

MeasurementID = 5, Measurement = Bigonial width (Go - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.996	1.000	11726.366	4	20	.000
Average Measures	1.000	1.000	1.000	11726.366	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 5, Measurement = Bigonial width (Go – Go)

MeasurementID = 6, Measurement = Palatal width (U6 - U6)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.993[b]	.977	.999	904.897	4	20	.000
Average Measures	.999	.996	1.000	904.897	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 6, Measurement = Palatal width (U6 – U6)

MeasurementID = 7, Measurement = Anterior cranial base (S - N)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.996[b]	.965	.999	1377.014	4	20	.000
Average Measures	.999	.997	1.000	1377.014	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 7, Measurement = Anterior cranial base (S – N)

MeasurementID = 8, Measurement = Maxillary length (ANS - PNS)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.960[b]	.934	.978	301.740	4	20	.000
Average Measures	.997	.986	1.000	301.740	4	20	.000

Two-way random effects model where both people effects and measures effects are random

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 8, Measurement = Maxillary length (ANS – PNS)

MeasurementID = 9, Measurement = Mandibular length (Co - Pg)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.997	1.000	6384.061	4	20	.000
Average Measures	1.000	.999	1.000	6384.061	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 9, Measurement = Mandibular length (Co – Pg)

MeasurementID = 10, Measurement = Mandibular corpus length (Go - Pg)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.934[b]	.796	.992	85.770	4	20	.000
Average Measures	.966	.959	.999	85.770	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 10, Measurement = Mandibular corpus length (Go – Pg)

MeasurementID = 11, Measurement = Upper facial height (N - ANS)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.949[b]	.838	.994	112.904	4	20	.000
Average Measures	.991	.969	.999	112.904	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 11, Measurement = Upper facial height (N – ANS)

MeasurementID = 12, Measurement = Lower facial height (ANS - Me)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.968[b]	.958	.999	485.822	4	20	.000
Average Measures	.996	.993	1.000	485.822	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 12, Measurement = Lower facial height (ANS – Me)

MeasurementID = 13, Measurement = Anterior facial height (N - Me)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.964[b]	.944	.986	369.256	4	20	.000
Average Measures	.997	.990	1.000	369.256	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 13, Measurement = Anterior facial height (N – Me)

MeasurementID = 14, Measurement = Posterior facial height (S - Go)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.992	1.000	2483.194	4	20	.000
Average Measures	1.000	.999	1.000	2483.194	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 14, Measurement = Posterior facial height (S – Go)

MeasurementID = 15, Measurement = Mandibular height (Co - Go)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.946[b]	.828	.993	104.796	4	20	.000
Average Measures	.990	.966	.999	104.796	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 15, Measurement = Mandibular height (Co – Go)

MeasurementID = 16, Measurement = Interincisal distance (U1 - L1)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.992[b]	.971	.999	715.563	4	20	.000
Average Measures	.999	.995	1.000	715.563	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 16, Measurement = Interincisal distance (U1 – L1)

MeasurementID = 17, Measurement = Facial plane angle

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.983[b]	.942	.998	344.028	4	20	.000
Average Measures	.997	.990	1.000	344.028	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 17, Measurement = Facial plane angle

MeasurementID = 18, Measurement = Angle of convexity

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.982	.999	1167.626	4	20	.000
Average Measures	.999	.997	1.000	1167.626	4	20	.000

Two-way random effects model where both people effects and measures effects are random

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 18, Measurement = Angle of convexity

MeasurementID = 19, Measurement = A-B plane to Na-Pogonion

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.989[b]	.950	.998	402.620	4	20	.000
Average Measures	.996	.991	1.000	402.620	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 19, Measurement = A-B plane to Na-Pogonion

MeasurementID = 20, Measurement = Interincisal angle

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.969[b]	.889	.996	172.465	4	20	.000
Average Measures	.984	.960	.998	172.465	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 20, Measurement = Interincisal angle

MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.964[b]	.947	.998	376.906	4	20	.000
Average Measures	.987	.991	1.000	376.906	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.976[b]	.936	.997	268.715	4	20	.000
Average Measures	.998	.987	1.000	268.715	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

MeasurementID = 23, Measurement = Mandibular Plane Angle (FMA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.967[b]	.957	.999	467.579	4	20	.000
Average Measures	.998	.992	1.000	467.579	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 23, Measurement = Mandibular Plane Angle (FMA)

MeasurementID = 24, Measurement = Lower Incisor to Mandibular Plane (IMPA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.958[b]	.860	.995	132.656	4	20	.000
Average Measures	.992	.974	.999	132.656	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not

c. MeasurementID = 24, Measurement = Lower Incisor to Mandibular Plane (IMPA)

MeasurementID = 25, Measurement = Frankfort Horizontal to Mandibular Incisor (FMIA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.996[b]	.993	.998	89.411	4	20	.000
Average Measures	.999	.998	.999	89.411	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 25, Measurement = Frankfort Horizontal to Mandibular Incisor (FMIA)

MeasurementID = 26, Measurement = SNA

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.972[b]	.908	.997	211.928	4	20	.000
Average Measures	.996	.983	.999	211.928	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 26, Measurement = SNA

MeasurementID = 27, Measurement = SNB

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.992[b]	.973	.999	769.602	4	20	.000
Average Measures	.998	.995	1.000	769.602	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 27, Measurement = SNB

MeasurementID = 28, Measurement = ANB

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.960[b]	.933	.998	296.000	4	20	.000
Average Measures	.997	.966	1.000	296.000	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 28, Measurement = ANB

MeasurementID = 29, Measurement = Upper Incisor to Frankfort Horizontal

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.960[b]	.933	.998	299.422	4	20	.000
Average Measures	.997	.966	1.000	299.422	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 29, Measurement = Upper Incisor to Frankfort Horizontal

MeasurementID = 30, Measurement = Frankfort Horizontal to Nasion/A-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.989[b]	.961	.999	617.797	4	20	.000
Average Measures	.998	.993	1.000	617.797	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 30, Measurement = Frankfort Horizontal to Nasion/A-point

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MeasurementID = 1, Measurement = Biporionic width (Po - Po)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.997	1.000	6717.631	4	20	.000
Average Measures	1.000	.999	1.000	6717.631	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 1, Measurement = Biporionic width (Po – Po)

MeasurementID = 2, Measurement = Biorbital width (Or - Or)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.976[b]	.920	.997	247.520	4	20	.000
Average Measures	.996	.986	1.000	247.520	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 2, Measurement = Biorbital width (Or – Or)

MeasurementID = 3, Measurement = Bicondylar width (Co - Co)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	1.000[b]	.999	1.000	24777.397	4	20	.000
Average Measures	1.000	1.000	1.000	24777.397	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 3, Measurement = Bicondylar width (Co – Co)

MeasurementID = 4, Measurement = Bicoronoidal width (C - C)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.951[b]	.844	.994	117.762	4	20	.000
Average Measures	.992	.970	.999	117.762	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 4, Measurement = Bicoronoidal width (C – C)

MeasurementID = 5, Measurement = Bigonial width (Go - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.996	1.000	11663.045	4	20	.000
Average Measures	1.000	1.000	1.000	11663.045	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 5, Measurement = Bigonial width (Go – Go)

MeasurementID = 6, Measurement = Palatal width (U6 - U6)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.880[b]	.662	.966	44.855	4	20	.000
Average Measures	.978	.922	.997	44.855	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 6, Measurement = Palatal width (U6 – U6)

MeasurementID = 7, Measurement = Anterior cranial base (S - N)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.897[b]	.990	1.000	2001.696	4	20	.000
Average Measures	1.000	.998	1.000	2001.696	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 7, Measurement = Anterior cranial base (S – N)

MeasurementID = 8, Measurement = Maxillary length (ANS - PNS)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.997	1.000	6850.469	4	20	.000
Average Measures	1.000	.999	1.000	6850.469	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 8, Measurement = Maxillary length (ANS – PNS)

MeasurementID = 9, Measurement = Mandibular length (Co - Pg)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.996	1.000	5272.794	4	20	.000
Average Measures	1.000	.999	1.000	5272.794	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 9, Measurement = Mandibular length (Co – Pg)

MeasurementID = 10, Measurement = Mandibular corpus length (Go - Pg)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	1.000[b]	.999	1.000	35019.225	4	20	.000
Average Measures	1.000	1.000	1.000	35019.225	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 10, Measurement = Mandibular corpus length (Go – Pg)

MeasurementID = 11, Measurement = Upper facial height (N - ANS)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.968[b]	.958	.999	488.613	4	20	.000
Average Measures	.996	.993	1.000	488.613	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 11, Measurement = Upper facial height (N – ANS)

MeasurementID = 12, Measurement = Lower facial height (ANS - Me)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.997[b]	.988	1.000	1711.918	4	20	.000
Average Measures	.999	.996	1.000	1711.918	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 12, Measurement = Lower facial height (ANS – Me)

MeasurementID = 13, Measurement = Anterior facial height (N - Me)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	1.000[b]	.998	1.000	12718.136	4	20	.000
Average Measures	1.000	1.000	1.000	12718.136	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 13, Measurement = Anterior facial height (N – Me)

MeasurementID = 14, Measurement = Posterior facial height (S - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	1.000[b]	.998	1.000	13126.382	4	20	.000
Average Measures	1.000	1.000	1.000	13126.382	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 14, Measurement = Posterior facial height (S – Go)

MeasurementID = 15, Measurement = Mandibular height (Co - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.995[b]	.984	.999	1324.542	4	20	.000
Average Measures	.999	.997	1.000	1324.542	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 15, Measurement = Mandibular height (Co – Go)

MeasurementID = 16, Measurement = Interincisal distance (U1 - L1)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.990[b]	.967	.999	614.957	4	20	.000
Average Measures	.998	.994	1.000	614.957	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 16, Measurement = Interincisal distance (U1 – L1)

MeasurementID = 17, Measurement = Facial plane angle

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.972[b]	.912	.997	222.600	4	20	.000
Average Measures	.996	.984	.999	222.600	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 17, Measurement = Facial plane angle

MeasurementID = 18, Measurement = Angle of convexity

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.985	.999	1348.640	4	20	.000
Average Measures	.999	.997	1.000	1348.640	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 18, Measurement = Angle of convexity

MeasurementID = 19, Measurement = A-B plane to Na-Pogonion

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.992[b]	.973	.999	773.666	4	20	.000
Average Measures	.999	.995	1.000	773.666	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 19, Measurement = A-B plane to Na-Pogonion

MeasurementID = 20, Measurement = Interincisal angle

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.943[b]	.820	.993	99.602	4	20	.000
Average Measures	.990	.965	.999	99.602	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 20, Measurement = Interincisal angle

MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.971[b]	.903	.996	199.177	4	20	.000
Average Measures	.995	.982	.999	199.177	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.843[b]	.565	.979	33.293	4	20	.000
Average Measures	.970	.894	.996	33.293	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

MeasurementID = 23, Measurement = Mandibular Plane Angle (FMA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.962[b]	.876	.995	152.244	4	20	.000
Average Measures	.993	.977	.999	152.244	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 23, Measurement = Mandibular Plane Angle (FMA)

MeasurementID = 24, Measurement = Lower Incisor to Mandibular Plane (IMPA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.846[b]	.690	.960	33.696	4	20	.000
Average Measures	.970	.898	.997	33.696	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 24, Measurement = Lower Incisor to Mandibular Plane (IMPA)

MeasurementID = 25, Measurement = Frankfort Horizontal to Mandibular Incisor (FMIA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.890[b]	.225	.991	9.630	4	20	.000
Average Measures	.896	.635	.966	9.630	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 25, Measurement = Frankfort Horizontal to Mandibular Incisor (FMIA)

MeasurementID = 26, Measurement = SNA

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.995	1.000	4326.415	4	20	.000
Average Measures	1.000	.999	1.000	4326.415	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 26, Measurement = SNA

MeasurementID = 27, Measurement = SNB

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.996	1.000	5804.931	4	20	.000
Average Measures	1.000	.999	1.000	5804.931	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 27, Measurement = SNB

MeasurementID = 28, Measurement = ANB

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.993[b]	.976	.999	845.215	4	20	.000
Average Measures	.999	.996	1.000	845.215	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 28, Measurement = ANB

MeasurementID = 29, Measurement = Upper Incisor to Frankfort Horizontal

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.979[b]	.929	.997	279.109	4	20	.000
Average Measures	.996	.987	1.000	279.109	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 29, Measurement = Upper Incisor to Frankfort Horizontal

MeasurementID = 30, Measurement = Frankfort Horizontal to Nasion/A-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.986[b]	.952	.996	418.672	4	20	.000
Average Measures	.998	.992	1.000	418.672	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 30, Measurement = Frankfort Horizontal to Nasion/A-point

CBCT(12) Reliability

MeasurementID = 1, Measurement = Biporionic width (Po - Po)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.997	1.000	6866.073	4	20	.000
Average Measures	1.000	.999	1.000	6866.073	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 1, Measurement = Biporionic width (Po – Po)

MeasurementID = 2, Measurement = Biorbital width (Or - Or)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.992[b]	.974	.999	782.789	4	20	.000
Average Measures	.999	.996	1.000	782.789	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 2, Measurement = Biorbital width (Or – Or)

MeasurementID = 3, Measurement = Bicondylar width (Co - Co)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.997	1.000	8333.965	4	20	.000
Average Measures	1.000	1.000	1.000	8333.965	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 3, Measurement = Bicondylar width (Co – Co)

MeasurementID = 4, Measurement = Bicoronoidal width (C - C)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.997	1.000	7496.374	4	20	.000
Average Measures	1.000	1.000	1.000	7496.374	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 4, Measurement = Bicoronoidal width (C – C)

MeasurementID = 5, Measurement = Bigonial width (Go - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.998	1.000	11227.604	4	20	.000
Average Measures	1.000	1.000	1.000	11227.604	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 5, Measurement = Bigonial width (Go – Go)

MeasurementID = 6, Measurement = Palatal width (U6 - U6)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.978[b]	.926	.997	264.629	4	20	.000
Average Measures	.996	.987	1.000	264.629	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 6, Measurement = Palatal width (U6 – U6)

MeasurementID = 7, Measurement = Anterior cranial base (S - N)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.993[b]	.974	.999	797.199	4	20	.000
Average Measures	.999	.996	1.000	797.199	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 7, Measurement = Anterior cranial base (S – N)

MeasurementID = 8, Measurement = Maxillary length (ANS - PNS)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.992	1.000	2719.851	4	20	.000
Average Measures	1.000	.999	1.000	2719.851	4	20	.000

Two-way random effects model where both people effects and measures effects are random

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 8, Measurement = Maxillary length (ANS – PNS)

MeasurementID = 9, Measurement = Mandibular length (Co - Pg)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.997[b]	.989	1.000	1626.036	4	20	.000
Average Measures	.999	.996	1.000	1626.036	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 9, Measurement = Mandibular length (Co – Pg)

MeasurementID = 10, Measurement = Mandibular corpus length (Go - Pg)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.992[b]	.973	.999	769.398	4	20	.000
Average Measures	.999	.995	1.000	769.398	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 10, Measurement = Mandibular corpus length (Go – Pg)

MeasurementID = 11, Measurement = Upper facial height (N - ANS)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.995	1.000	3038.825	4	20	.000
Average Measures	1.000	.999	1.000	3038.825	4	20	.000

Two-way random effects model where both people effects and measures effects are random

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 11, Measurement = Upper facial height (N – ANS)

MeasurementID = 12, Measurement = Lower facial height (ANS - Me)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	1.000[b]	.998	1.000	13116.158	4	20	.000
Average Measures	1.000	1.000	1.000	13116.158	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 12, Measurement = Lower facial height (ANS – Me)

MeasurementID = 13, Measurement = Anterior facial height (N - Me)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.997[b]	.989	1.000	1933.361	4	20	.000
Average Measures	.999	.998	1.000	1933.361	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 13, Measurement = Anterior facial height (N – Me)

MeasurementID = 14, Measurement = Posterior facial height (S - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.994	1.000	3342.169	4	20	.000
Average Measures	1.000	.999	1.000	3342.169	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 14, Measurement = Posterior facial height (S – Go)

MeasurementID = 15, Measurement = Mandibular height (Co - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.979[b]	.930	.998	261.973	4	20	.000
Average Measures	.996	.988	1.000	261.973	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 15, Measurement = Mandibular height (Co – Go)

MeasurementID = 16, Measurement = Interincisal distance (U1 - L1)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.995[b]	.984	.999	1263.829	4	20	.000
Average Measures	.999	.997	1.000	1263.829	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 16, Measurement = Interincisal distance (U1 – L1)

MeasurementID = 17, Measurement = Facial plane angle

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.996	1.000	1497.190	4	20	.000
Average Measures	.999	.998	1.000	1497.190	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 17, Measurement = Facial plane angle

MeasurementID = 18, Measurement = Angle of convexity

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.983[b]	.942	.998	345.366	4	20	.000
Average Measures	.997	.990	1.000	345.366	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 18, Measurement = Angle of convexity

MeasurementID = 19, Measurement = A-B plane to Na-Pogonion

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.969[b]	.933	.996	296.151	4	20	.000
Average Measures	.997	.988	1.000	296.151	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 19, Measurement = A-B plane to Na-Pogonion

MeasurementID = 20, Measurement = Interincisal angle

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.969[b]	.933	.996	297.913	4	20	.000
Average Measures	.997	.988	1.000	297.913	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 20, Measurement = Interincisal angle

MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.936[b]	.602	.992	66.963	4	20	.000
Average Measures	.969	.961	.999	66.963	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.939[b]	.811	.993	93.969	4	20	.000
Average Measures	.969	.963	.999	93.969	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

MeasurementID = 23, Measurement = Mandibular Plane Angle (FMA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.989[b]	.961	.999	525.990	4	20	.000
Average Measures	.998	.993	1.000	525.990	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 23, Measurement = Mandibular Plane Angle (FMA)

MeasurementID = 24, Measurement = Lower Incisor to Mandibular Plane (IMPA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.972[b]	.907	.997	208.371	4	20	.000
Average Measures	.995	.963	.999	208.371	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 24, Measurement = Lower Incisor to Mandibular Plane (IMPA)

MeasurementID = 25, Measurement = Frankfort Horizontal to Mandibular Incisor (FMIA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.987[b]	.950	.998	174.652	4	20	.000
Average Measures	.994	.980	.999	174.652	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 25, Measurement = Frankfort Horizontal to Mandibular Incisor (FMIA)

MeasurementID = 26, Measurement = SNA

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.996	.999	1374.390	4	20	.000
Average Measures	.999	.997	1.000	1374.390	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 26, Measurement = SNA

MeasurementID = 27, Measurement = SNB

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.994[b]	.979	.999	1009.113	4	20	.000
Average Measures	.999	.997	1.000	1009.113	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 27, Measurement = SNB

MeasurementID = 28, Measurement = ANB

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.990[b]	.967	.999	618.241	4	20	.000
Average Measures	.998	.994	1.000	618.241	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 28, Measurement = ANB

MeasurementID = 29, Measurement = Upper Incisor to Frankfort Horizontal

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.976[b]	.927	.997	272.505	4	20	.000
Average Measures	.996	.987	1.000	272.505	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 29, Measurement = Upper Incisor to Frankfort Horizontal

MeasurementID = 30, Measurement = Frankfort Horizontal to Nasion/A-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.992	1.000	2660.376	4	20	.000
Average Measures	1.000	.999	1.000	2660.376	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 30, Measurement = Frankfort Horizontal to Nasion/A-point

CBCT(9) Reliability

MeasurementID = 1, Measurement = Biporionic width (Po - Po)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.992[b]	.971	.999	716.129	4	20	.000
Average Measures	.999	.995	1.000	716.129	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 1, Measurement = Biporionic width (Po – Po)

MeasurementID = 2, Measurement = Biorbital width (Or - Or)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.993	1.000	3009.897	4	20	.000
Average Measures	1.000	.999	1.000	3009.897	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 2, Measurement = Biorbital width (Or – Or)

MeasurementID = 3, Measurement = Bicondylar width (Co - Co)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.974	.999	808.462	4	20	.000
Average Measures	.999	.996	1.000	808.462	4	20	.000

Two-way random effects model where both people effects and measures effects are random

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 3, Measurement = Bicondylar width (Co – Co)

MeasurementID = 4, Measurement = Bicoronoidal width (C - C)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.997	1.000	8174.163	4	20	.000
Average Measures	1.000	1.000	1.000	8174.163	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 4, Measurement = Bicoronoidal width (C – C)

MeasurementID = 5, Measurement = Bigonial width (Go - Go)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.995	.999	1364.268	4	20	.000
Average Measures	.999	.997	1.000	1364.268	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 5, Measurement = Bigonial width (Go – Go)

MeasurementID = 6, Measurement = Palatal width (U6 - U6)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.990[b]	.964	.999	672.636	4	20	.000
Average Measures	.995	.994	1.000	672.636	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 6, Measurement = Palatal width (U6 – U6)

MeasurementID = 7, Measurement = Anterior cranial base (S - N)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.993	1.000	2665.825	4	20	.000
Average Measures	1.000	.999	1.000	2665.825	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 7, Measurement = Anterior cranial base (S – N)

MeasurementID = 8, Measurement = Maxillary length (ANS - PNS)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.995	1.000	4189.790	4	20	.000
Average Measures	1.000	.999	1.000	4189.790	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 8, Measurement = Maxillary length (ANS – PNS)

MeasurementID = 10, Measurement = Mandibular corpus length (Go - Pg)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.995	1.000	4267.652	4	20	.000
Average Measures	1.000	.999	1.000	4267.652	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 10, Measurement = Mandibular corpus length (Go – Pg)

MeasurementID = 11, Measurement = Upper facial height (N - ANS)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.992	1.000	2668.637	4	20	.000
Average Measures	1.000	.999	1.000	2668.637	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 11, Measurement = Upper facial height (N – ANS)

MeasurementID = 12, Measurement = Lower facial height (ANS - Me)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	1.000[b]	.999	1.000	16063.001	4	20	.000
Average Measures	1.000	1.000	1.000	16063.001	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 12, Measurement = Lower facial height (ANS – Me)

MeasurementID = 13, Measurement = Anterior facial height (N - Me)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.996	1.000	5691.136	4	20	.000
Average Measures	1.000	.999	1.000	5691.136	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 13, Measurement = Anterior facial height (N – Me)

MeasurementID = 14, Measurement = Posterior facial height (S - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.997	1.000	1655.734	4	20	.000
Average Measures	.999	.998	1.000	1655.734	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 14, Measurement = Posterior facial height (S – Go)

MeasurementID = 15, Measurement = Mandibular height (Co - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.904[b]	.720	.968	67.716	4	20	.000
Average Measures	.983	.939	.998	67.716	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 15, Measurement = Mandibular height (Co – Go)

MeasurementID = 16, Measurement = Interincisal distance (U1 - L1)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.992	1.000	2602.304	4	20	.000
Average Measures	1.000	.999	1.000	2602.304	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 16, Measurement = Interincisal distance (U1 – L1)

MeasurementID = 18, Measurement = Angle of convexity

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.990[b]	.967	.999	622.761	4	20	.000
Average Measures	.998	.994	1.000	622.761	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 18, Measurement = Angle of convexity

MeasurementID = 19, Measurement = A-B plane to Na-Pogonion

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.991[b]	.970	.999	696.846	4	20	.000
Average Measures	.999	.995	1.000	696.846	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 19, Measurement = A-B plane to Na-Pogonion

MeasurementID = 20, Measurement = Interincisal angle

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.992[b]	.971	.999	713.621	4	20	.000
Average Measures	.999	.995	1.000	713.621	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 20, Measurement = Interincisal angle

MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.968[b]	.952	.986	419.335	4	20	.000
Average Measures	.998	.992	1.000	419.335	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.976[b]	.919	.997	241.184	4	20	.000
Average Measures	.996	.985	1.000	241.184	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

MeasurementID = 24, Measurement = Lower Incisor to Mandibular Plane (IMPA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.968[b]	.956	.989	469.920	4	20	.000
Average Measures	.998	.993	1.000	469.920	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 24, Measurement = Lower Incisor to Mandibular Plane (IMPA)

MeasurementID = 25, Measurement = Frankfort Horizontal to Mandibular Incisor (FMIA)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.964[b]	.947	.988	377.514	4	20	.000
Average Measures	.997	.991	1.000	377.514	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 25, Measurement = Frankfort Horizontal to Mandibular Incisor (FMIA)

MeasurementID = 26, Measurement = SNA

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.998[b]	.984	.999	1302.767	4	20	.000
Average Measures	.999	.997	1.000	1302.767	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 26, Measurement = SNA

MeasurementID = 27, Measurement = SNB

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.997[b]	.990	1.000	2043.367	4	20	.000
Average Measures	1.000	.998	1.000	2043.367	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 27, Measurement = SNB

MeasurementID = 28, Measurement = ANB

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.992[b]	.971	.999	713.705	4	20	.000
Average Measures	.999	.995	1.000	713.705	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 28, Measurement = ANB

MeasurementID = 29, Measurement = Upper Incisor to Frankfort Horizontal

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.988[b]	.960	.999	515.991	4	20	.000
Average Measures	.996	.990	1.000	515.991	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 29, Measurement = Upper Incisor to Frankfort Horizontal

MeasurementID = 30, Measurement = Frankfort Horizontal to Nasion/A-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.992[b]	.975	.999	760.617	4	20	.000
Average Measures	.999	.995	1.000	760.617	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 30, Measurement = Frankfort Horizontal to Nasion/A-point

CBCT(6) Reliability

MeasurementID = 2, Measurement = Biorbital width (Or - Or)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.990[b]	.964	.999	673.134	4	20	.000
Average Measures	.996	.994	1.000	673.134	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 2, Measurement = Biorbital width (Or – Or)

MeasurementID = 4, Measurement = Bicoronoidal width (C - C)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.928[b]	.751	.991	78.815	4	20	.000
Average Measures	.987	.955	.999	78.815	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 4, Measurement = Bicoronoidal width (C – C)

MeasurementID = 6, Measurement = Palatal width (U6 - U6)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.997[b]	.990	1.000	2045.888	4	20	.000
Average Measures	1.000	.998	1.000	2045.888	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 6, Measurement = Palatal width (U6 – U6)

MeasurementID = 7, Measurement = Anterior cranial base (S - N)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.985	1.000	1430.969	4	20	.000
Average Measures	.999	.996	1.000	1430.969	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 7, Measurement = Anterior cranial base (S – N)

MeasurementID = 8, Measurement = Maxillary length (ANS - PNS)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	1.000[b]	.999	1.000	14861.697	4	20	.000
Average Measures	1.000	1.000	1.000	14861.697	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 8, Measurement = Maxillary length (ANS – PNS)

MeasurementID = 10, Measurement = Mandibular corpus length (Go - Pg)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.968[b]	.957	.999	476.307	4	20	.000
Average Measures	.998	.993	1.000	476.307	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 10, Measurement = Mandibular corpus length (Go – Pg)

MeasurementID = 11, Measurement = Upper facial height (N - ANS)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.993[b]	.976	.999	846.581	4	20	.000
Average Measures	.999	.996	1.000	846.581	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 11, Measurement = Upper facial height (N – ANS)

MeasurementID = 12, Measurement = Lower facial height (ANS - Me)

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	1.000[b]	.999	1.000	14688.667	4	20	.000
Average Measures	1.000	1.000	1.000	14688.667	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 12, Measurement = Lower facial height (ANS – Me)

MeasurementID = 14, Measurement = Posterior facial height (S - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.969[b]	.962	.999	634.952	4	20	.000
Average Measures	.996	.993	1.000	634.952	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 14, Measurement = Posterior facial height (S - Go)

MeasurementID = 15, Measurement = Mandibular height (Co - Go)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.877[b]	.656	.964	43.786	4	20	.000
Average Measures	.977	.920	.997	43.786	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 15, Measurement = Mandibular height (Co - Go)

MeasurementID = 16, Measurement = Interincisal distance (U1 - L1)

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.996	1.000	5481.074	4	20	.000
Average Measures	1.000	.999	1.000	5481.074	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 16, Measurement = Interincisal distance (U1 - L1)

MeasurementID = 20, Measurement = Interincisal angle

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.997[b]	.968	1.000	1717.282	4	20	.000
Average Measures	.999	.998	1.000	1717.282	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 20, Measurement = Interincisal angle

MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.999[b]	.977	.999	893.795	4	20	.000
Average Measures	.999	.996	1.000	893.795	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 21, Measurement = Upper incisor to Nasion/A-point

MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.995[b]	.948	.998	386.321	4	20	.000
Average Measures	.997	.991	1.000	386.321	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 22, Measurement = Lower incisor to Nasion/B-point

MeasurementID = 26, Measurement = SNA

Intraclass Correlation Coefficient[c]

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.990[b]	.966	.999	596.508	4	20	.000
Average Measures	.998	.994	1.000	596.508	4	20	.000

Two-way random effects model where both people effects and measures effects are random.

a. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. MeasurementID = 26, Measurement = SNA

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