A COMPARISON OF SOFT TISSUE PROFILES MORPHED BY ORTHODONTISTS AND BY A SOFT TISSUE ARC

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There are many orthodontic cephalometric analyses available. The emphasis in treatment planning has traditionally been hard tissue focused. This study evaluates a Soft Tissue Arc used in treatment planning. 30 profile images were morphed by 5 orthodontic residents and 5 orthodontic faculty. No statistically significant difference was observed between the morphing of the orthodontic faculty and residents. These same images were changed to match ideal values from a Soft Tissue Arc drawn from nasion with the center at center "O". The Soft Tissue Arc changed the pictures differently than the orthodontic experts, however, there was no statistical difference in the final placement of soft tissue pogonion.

These pairs of images (expert morphing vs Soft Tissue Arc changes) were then rated as more attractive or less attractive on a visual analogue scale by 5 orthodontic residents, 5 dental school faculty and 5 laypersons. Across the board, the images morphed by the experts received better ratings than the images changed by the Soft Tissue Arc. Laypersons were considerably less critical in their judgments, and overall gave higher ratings.

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1.0 INTRODUCTION

Orthodontists have long sought out ways to quantify the characteristics of the face. Often they assign values to the different parts, lines, planes and angles of the facial skeleton so that they may treat these assigned numbers to a normal value. The Sassouni archial analysis is a cephalometric analysis that evaluates one's skeletal and dental relationships. It is unique in that it does not compare the position of an individual's bony landmarks to standards or theoretical population ideals, but rather to one's own facial pattern. The Sassouni analysis was envisioned in a time when hard tissue skeletal and dental effects were the focus of treatment. Orthodontics has now moved towards a soft tissue paradigm, in which the soft tissues of the face are given greater emphasis in treatment planning. The goal of this research is to evaluate a Soft Tissue Arc that can be used by orthodontists to assess soft tissue profiles.

Orthodontists will always diagnose and treatment plan with hard tissues in mind. Skeletal and dental relationships are the underlying foundation of the soft tissue. However, a foundation that is harmonious does not mean the overlying tissue of the face will be esthetic. Traditional cephalometric analysis often did not even recognize soft tissue existence. When an analysis did incorporate soft tissue, it was often simply an attempt to quantify lip protrusion. In the soft tissue paradigm, orthodontists now look for more tools and ways to analyze the soft tissue profile. The goal of this research is to propose a soft tissue appraisal that is partly determined by one's own facial profile.

2.0 LITERATURE REVIEW

2.1 HISTORY OF CEPHALOMETRIC DEVELOPMENT

> Our present standards compiled from measurements of skulls of children are largely a measure of defective material. A dead child is usually a defective one.
>
> –B. Holly Broadbent

It would surprise most orthodontists to find out that cephalometric analysis did not arise as a diagnostic tool to aid them in their treatment planning. Unknowingly, in just the second issue of the Angle Orthodontist journal, Holly Broadbent published an article that would forever change orthodontics.

Before 1931, anthropologists were using craniometrics to measure dried skulls in order to study growth and development. Direct cephalometric (not radiographic) measurements were being carried out on living beings. During this time, radiology was used as a diagnostic tool. Broadbent was the one who was able to bring these things together to measure structures in the heads of living individuals (Thurow, 1981).

Broadbent began his orthodontic education in 1920 under Edward Angle. He worked both in his orthodontic practice and with T. Wingate Todd in an Anatomy Laboratory at Western Reserve University. This allowed him to both practice orthodontics and study craniofacial growth. While in his orthodontic office, Broadbent began treatment on Charles Bingham Bolton, who was the son of Frances P Bolton, the Congresswoman. Broadbent's interest in facial growth lead to Bolton's interest in facial growth. The wealthy Bolton's added the Bolton Study of facial growth to the list of their philanthropies. Broadbent developed radiographic cephalometry in order to implement that study.

Broadbent published the first paper on cephalometrics titled "A New X-Ray Technique and its Application to Orthodontia" in 1931. He describes orthodontists who regularly measure dental and facial problems largely by the relations of the teeth and jaws. By using cephalometric methods, orthodontists can measure these changes in relation to the rest of the head. Broadbent claims the technique began as a way to measure hard tissue landmarks on the living, as accurately as it is done on a dead skull. The first hurdle was designing a head holder that would be similar to skull holders. With the help of a machinist, this was quickly accomplished. Next, they had to find a means of recording the landmarks of the living skull. Broadbent came up with a roentgenographic technique that did this accurately on film. In order to test accuracy, small pieces of lead were placed in dried skulls and measurements were taken directly. The skulls were then radiographed and the measurements scaled. The relationships confirmed the reliability of the technique. He adapted the Frankfort plane for horizontal orientation with nasion for stabilization. Ears were the basis for orientation. Five feet was selected as object to source distance. It is a testament to his design that the basics remain almost unchanged today. Broadbent advocated that this technique was a more scientific solution to orthodontic problems and that now orthodontists could finally make accurate changes due to growth and treatment.

A very important result of the study was the creation of the "Bolton Standards." These cephalometric tracings depicted normal craniofacial growth. There was one tracing for each year, age 1-18 for lateral cephs and age 3-18 for frontal cephs. The tracings were androgynous, there was not a separate male and female tracing for each year. In 1973 they were presented at the

Third International Orthodontic Congress in London. After they were further refined, they were published in 1975. A major tool for analyzing and assessing growth was now available (Behrents and Broadbent, 1984).

For 20 years (and well beyond), Broadbent's technique was an instrument in the Bolton study, however clinician's were not routinely using it (Thurow, 1981). In 1938, Allen Brodie was the first to appraise orthodontic results using cephalometric analysis. Down's analysis published in 1952 (almost 20 years after Broadbent's article) finally opened the door of cephalometric analysis to clinical practice. In 1949, Alton Moore held the first course in cephalometrics (Wahl, 2002). A myriad of analyses soon followed.

2.2 CEPHALOMETRIC ANALYSES

> I am now almost certain that we need more radiation for better health.
> -John Cameron

W.B. Downs proposed the first useful analysis for clinicians in 1948. He derived his normal values from 20 white subjects age 12 to 17 years old. He studied ten boys and ten girls. They all possessed excellent occlusions. He used the Frankfort horizontal as his reference plane. Downs described four basic facial types in his article. The retrognathic facial type had a recessive mandible. The mesognathic (orthognathic) profile had a mandible that was ideal. He also described a prognathic and true prognathic facial profile. In a prognathic facial type, the mandible alone was protrusive. In true prognathism the entire lower face had pronounced protrusion.

Downs used a number of measures to assess the skeletal pattern. Facial angle (nasion-pogonion intersecting the Frankfort horizontal) indicated the protrustion or retrusion of the chin. The range was 82 to 95 degrees. A prominent chin increased the angle while a weak chin decreased this. The angle of convexity (formed by the intersection of nasion-point A to point A-pogonion) measured the amount of maxillary protrusion or retrusion relative to the face. If the point A-pogonion line is extended and lies anterior to the nasion-point A line, the angle is positive (suggesting a prominent maxilla). The normal range is -8.5 to 10 degrees. If the line lies behind the nasion-point A line, the angle is negative (suggesting prognathism). The A-B plane is also read in a mannor similar to the angle of convexity. A line from point A-point B forms an angle with nasion-pogonion. This measures the maxillary and mandibular dental bases relative to each other and to the profile. Normal range is 0 to -9 degrees with a more negative value suggesting a class II pattern. Mandibular plane angle is based on a line tangent to the gonial angle and the lowest point of the symphasis intersecting Frankfort horizontal. The normal range is 17 to 28 degrees and a high angle indicates a hyperdivergent growth pattern and increased difficulty in treating the case. Y-axis is an angle formed by the intersection of sella turcica-gnathion and Frankfort horizontal. Downs describes Y-axis as the expression of the downward and forward growth of the face. The normal range is 53 to 66 degrees. A decrease may mean horizontal growth while an increase may mean vertical growth.

Downs also used a number of measures to relate the teeth to the skeletal pattern. The slope of the occlusal plane (bisecting first molars and incisors) is measured with regard to Frankfort horizontal. The range is 1.5 to 14 degrees. A larger angle is found in class II, while a more parallel reading approaches class III. The interincisal angle is measured by passing lines through the root apices and the incisal edge of the maxillary and mandibular incisors. More proclination creates a smaller angle. Incisor-occlusal plane angle refers to the angle formed by the occlusal plane and the mandibular incisors. It is the inferior inside angle and is read as the complement (deviation from a right angle). The range is 3.5 to 20 degrees and a more positive angle indicates proclination. A further test of the mandibular incisor proclination is the incisor-mandibular plane angle, formed by the intersection of the mandibular plane with a line through the incisal edge and root apex of mandibular incisors. This is also measured as a deviation from a right angle. Its range is -8.5 to 7 degrees, with more positive numbers indicating proclination. The last measure is the protrusion of the maxillary incisors. It is measured as a distance from the incisal edge of maxillary incisors to the point A-pogonion line. The range is -1mm to 5mm, with more positive readings suggesting protruded maxillary incisors.

Down's analysis focused on skeletal and dental aspects. It helped to identify when the maxilla or mandible was too protrusive or retrusive. It would identify incisors with proclination or retroclination. Downs also tried to identify harder cases by looking at the mandibular plane angle and evaluate the direction of facial growth with the Y-axis.

Cecil Steiner described his analysis in 1953. He was determined to make an analysis that would be more useful for the clinician and vowed to use "shop talk" in his article. He envisioned a tracing and analysis that would take up less of a clinician's time by requiring fewer calculations, while at the same time producing highly useful measurements. How Steiner derived his ideal values is still a bit of a mystery. The rumor mill has speculated it may have been based on one single harmonious profile and many speculate this may have been his son. Since he practiced near Hollywood, some believe it may have been a beautiful Hollywood starlet. Unlike Downs, Steiner choose not to use the Frankfort horizontal as his reference plane. He instead proposed using the patient's cranial base as the reference plane.

Steiner first described certain skeletal relationships. The angle formed by the intersection of sella-nasion and nasion-point A measures the relative position of the maxilla, with ideal being 82 degrees. The angle formed by the intersection of sella-nasion and nasion-point B measures the protrusion or retrusion of the mandible relative to the cranial base, with ideal being 80 degrees. Of real interest to Steiner was the difference between these two, or point A-nasion-point B, which compared the jaws to each other. Steiner proposed a normal of 2 degrees. Greater readings indicated class II, lesser indicated class III. The angle formed between the occlusal plane and sella-nasion is also appraised and should be 14 degrees. The mandibular plane should be 32 degrees when intersected with SN. High or low values may mean unfavorable growth and difficult treatment.

Steiner next described dental relationships. The maxillary incisors were related to the line nasion-point A. The most anterior part of the crown should be 4 mm in front of NA and the line should intersect the tooth at a 22 degree angle. The mandibular incisor is compared to the nasion-point B line. Once again, the most labial portion of the crown should be 4mm in front of this line. The tooth should be angled 25 degrees to this line. Interincisal angle is also assessed to see the relative inclinations of the maxillary and mandibular incisors to each other.

Whereas Downs did not quantify the soft tissue at all, Steiner attempted to do this. He advocated drawing a line from the chin to a midpoint of the lower border of the nose. He advocated that lips in front of this line were protrusive, whereas lips behind this line were retrusive. Despite this being Steiner's opinion and not backed by any evidence, many orthodontists still analyze lips this way.

Robert Ricketts developed a computer cephalometric analysis in 1969. It was a complex analysis that utilized both lateral cephalograms and an AP film. He attempted to use the analysis to predict growth to maturity. Like Downs and Steiner, Rickett's analysis evaluated both upper and lower jaw position along with dental positions. Like Steiner, Ricketts attempted to evaluate the lips of the profile. He proposed an E-line (E for esthetic) that would run from the chin to the tip of the nose. He stipulated that the lower lip should be 2mm (+ or – 2mm) behind this line at 9 years old or it was out of harmony.

In 1975, Alexander Jacobson identified several shortcomings of Steiner's proposed ANB angle. Variations in nasion's anteriorposterior relationship to the jaws may not give a true picture of the skeletal classification. A nasion that is positioned forward will decrease the ANB, making the relationship more class III. A nasion that is positioned back will increase the ANB, making the relationship look more class II. Rotation of the occlusal plane relative to the cranial reference planes may affect the true picture of the skeletal classification. Jaws that are rotated counterclockwise produce a more class III relationship and jaws that are rotated clockwise produce a more class II relationship. To overcome these deficiencies, Jacobson proposed the "Wits" appraisal. It is not an analysis but rather an appraisal. It analyzes the jaws relative to each other to identify the jaw disharmony (class II vs class III). Perpendicular lines are drawn from point A and B on the maxilla and mandible to the occlusal plane. These points are labeled AO and BO. Jacobson noted that in 21 adult males (with excellent occlusion), BO was about 1mm in front of AO. In 25 females, AO and BO generally coincided. In class II relationships, the BO is well behind AO and the number is more positive. A more negative number indicates and class III relationship.

Charles H. Tweed described his diagnostic facial triangle in his 1966 book. The triangle is composed of the Frankfort-mandibular plane angle (FMA), the Frankfort-mandibular incisor angle (FMIA) and the incisor-mandibular plane angle (IMPA). The FMIA normal value is 68 degrees. This indicates the balance of the lower face and anterior limit of the dentition. The FMA normal range is 22 to 28 degrees. A greater value indicates vertical growth. An increase of FMA during treatment indicates possible unfavorable orthodontic mechanics. IMPA indicates the position of the mandibular incisors with respect to the mandibular plane. The ideal angle is 87 degrees. Tweed did not have a soft tissue component.

James McNamara proposed a method for cephalometric evaluation in 1984. He evaluated the position of the maxilla to the cranial base, the maxilla to the mandible, the mandible to the cranial base, the dentition, and the airway. Though not described here, it is unique that McNamara places so much emphasis on the airway and the upper and lower pharynx widths.

First McNamara evaluated maxilla to the cranial base. He believed that the nasolabial angle should be 102 degrees. A more acute angle may indicate dentoaveolar protrusion. To further evaluate the maxilla's position, a perpendicular line is dropped from nasion and measured the distance to A point. Point A should lie on this line in the mixed dentition and lie 1 mm anterior in adults.

Next, McNamara evaluated the maxilla to the mandible. The midface is measured as condylion to point A and the length of the mandible is measured from condylion to anatomic gonion. The differences of these values is the maxillomandibular differential. In small individuals is should be 20 to 24 mm, in medium-sized individuals it should be 25 to 28 mm and in large individuals, it should be between 30 and 33 mm. Comparing findings to the position of the maxilla gives an indication of which jaw is at fault. The vertical relationship is measured from the anterior nasal spine to menton. A well balanced face should have this measurement approximate with the length of the midface. McNamara proposed the mandibular plane angle between Frankfort horizontal and a line drawn along the lower border of the mandible should be

22 degrees. The facial axis is formed as a line from the pterygomaxillary fissure to anatomic gnathion and a line perpendicular from basion-nasion. Ideally this should be 90 degrees. If the pterygomaxillary fissure gnathion line lies anterior to the perpendicular, this suggests horizontal growth, whereas posterior position indicates vertical growth.

The mandible is compared to the cranial base by evaluating the distance from pogonion to nasion-perpendicular. For small individuals, pogonion should be 0-4 mm behind, for medium individuals it should be 0-4mm behind and for large individuals it should be 2mm behind to 5mm anterior.

Finally, McNamara evaluated the dentition by looking at positions of the incisors (not inclinations). A line is drawn through point A parallel to N-perpendicular. The distance from this line to the facial surface of the maxillary incisors is measured. This should be 4 to 6 mm. To evaluate mandibular incisors, a line is drawn from point A to pogonion. The distance to the edge of the incisors should be 1 to 3 mm.

Viken Sassouni described his archial analysis in the article “Diagnosis and treatment planning via roentgenographic cephalometry” in 1958. Rather than comparing an individual to a set of norms or ideals, Sassouni attempted to create an analysis that would find balance for an individual based on their own skeletal make up. Sassouni used the reference planes cranial base, the palatal plane, the occlusal plane and the mandibular plane. He then found a point in space behind the cranium where these points converged most and called this center “O”. Using center O, arcs were drawn with a compass from different points on the skeleton. In this way the positions of the maxilla, mandible, and dentition were evaluated in both a vertical and AP plane. The farther center O was from the profile, the deeper the skeletal bite. The closer center “O” was to the profile, the more open it was. Sassouni's analysis, however, made no attempt at evaluating the soft tissue.

An arc is dropped from nasion with the rotational center being at center O. If ANS lies on the anterior arc, then no compensating arc needs to be drawn. If it does not, a compensating arc is dropped from ANS. If pogonion is within 3mm of this arc, the skeletal relationship is class I. If it is behind, then it is class II. If it lies more than 3mm in front, it is class III. A basal arc is then dropped in a similar fashion from point A. If point B is within 3 mm then the dental bases are class I. If it is behind, dental bases are class II. If it is in front, then the patient is class III dental bases.

In order to evaluate vertical balance, the upper anterior facial height is compared to the lower. The distance from ANS-supraorbitale is compared to ANS-menton. At 12 years of age for both sexes and for adult females, the lower facial height should be 5 mm greater than the upper. Adult males should have a 10 mm greater facial height. The bite is considered skeletal open if the lower height is 3 mm above the normal. It is considered skeletal deep if it is 3 mm shorter than the normal.

The way a patient is diagnosed and treatment planned has evolved since the previously cited articles were published. These authors all realized that skeletal and dental movements had effects on soft tissue. However, the thinking was predominantly "if we as orthodontists treat the hard tissue, the soft tissue will also be optimized." This is not always the case, and newer literature cites a need for planning to treat the soft tissue first, making the hard tissue movements secondary to this.

2.3 RACIAL DIFFERENCES

They're 12 percent of the population. Who the hell cares?
-Rush Limbaugh

Most of the previously cited studies use Caucasian subjects to establish norms, or are based on ideal Caucasian standards. One must question how well these ideal values apply to other races and ethnicities – specifically for soft tissue profile measurements. Will the Soft Tissue Arc proposed in this thesis be valid for every race?

Numerous studies have compared their target population with white subjects. Satravaha and Schlegal (1987) compared 180 Thai subjects to Caucasians using a variety of analysis. In a general soft-tissue profile convexity analysis using soft-tissue nasion, subnasale, and soft tissue pogonion, the Asian population (165 degrees) was found to have a significantly less convex soft-tissue profile than Caucasians (161 degrees). Additionally, they reported that the nasolabial angles of their subjects were approximately 20 degrees larger than the Caucasian ideal of 74 degrees advocated by Burstone (1967). The authors encouraged more studies of different ethnic groups for diagnostic aids in treatment planning.

Alcade et al. (2000) compared 211 Japanese female adults to a white adult sample. Several significant differences were found. Ricketts E-lane showed the Japanese had a more prominent lower lip in a closed position the whites. A Holdaway analysis of the Japanese demonstrated that the Japanese had a less prominent nose, greater upper lip curvature, a less convex skeletal profile, larger upper lip strain, a lower lip in a more anterior position and a thicker soft tissue chin. An Epker's soft tissue analysis showed larger upper lip length, a larger interlabial distance, prominent lips and a retruded chin. The authors emphasized cephalometric norms are specific for ethnic groups and that soft tissue values should be an aid in treatment planning, not treatment goals.

Much has been published on the standards for the Turkish population. Erbay, Caniklioglu and Erbay (2002) analyzed 96 Turkish adults using a variety of soft tissue analyses. They found that Turkish adults had retrusive upper and lower lips compared to norms of Steiner and Ricketts. However, according to Burstone's B line, the Turkish lips were within normal range. The upper lip was protrusive and the lower retrusive compared to the Sushner norms for a black population. Nasal prominence was greater than Holdaway's norms. The authors noted that soft tissue analysis differs according to population because each race has its own characteristics. Basciftci, Uysal and Buyukerkmen (2003) examined 175 dental students at Selcuk University in Turkey in order to determine Holdaway soft tissue standards for Turkish adults. They analyzed ten linear and two angular measurements for each subject. Most soft tissue measurements were similar to the established Holdaway values. However, it was found that mean soft tissue chin thickness was 12.96 mm, which was slightly larger than the Holdaway norm of 10-12 mm. Additionally, basic upper lip thickness was 16.64 mm, compared to the Holdaway norm of 15mm. With these findings in mind, the paper concluded that differences should be considered when diagnosing and treatment planning for patients of different ethnicities. Uysal et al. (2009) analyzed 133 cephalometric radiographs to establish standards of the soft tissue Arnett analysis for surgical planning in Turkish adults. All subjects were selected because they had normal antero-posterior and vertical skeletal relationships. The Arnett analysis was performed on each subject and a variety of differences were identified. Most of the Turkish means were within Arnett's standards. However, the Turkish population had less lower lip thickness, more menton thickness, depressed orbital rims, cheek bones, thin lips and retruded incisors. From this, the authors recommended that differences between ethnic groups should be considered when treatment planning for patients with dentofacial deformity.

Even within one ethnicity or race, differences may be detected in subgroups. Scavone et al. (2008) compared profiles of white Brazilians to white Americans. 30 Brazilian men and 29 women were compared to 20 American men and 26 women. All subjects were required to have normal occlusions and balanced faces. A true vertical line with measurements to soft tissue points was used to assess many of the facial features. Additionally, the nasolabial angle was assessed. The Brazilian women were found to have a smaller nasal projection, less full lips, a more obtuse nasolabial angle, and less projection of the chin and soft tissue B point. The Brazilian men had more in common with their American counterparts, however they did have a smaller nose projection. They concluded that one standard is not applicable to diverse white populations. Al-Gunaid et al. (2007) showed that soft-tissue profiles of white Yemenis and American differ in certain aspects. They looked at 50 Yemeni men with normal occlusion and analyzed them according to the Holdaway and Legan-Burstone analyses. In the Yemini group, the chin neck angle was more obtuse, the mentolabial sulcus depth was deeper, and the interlabial gap was shorter. Additionally, the skeletal profile convexity and upper-lip thickness were larger than the values recommended by Holdaway. They concluded that racial differences must be considered during diagnosis and treatment planning.

When Japanese-Brazilian adults with normal occlusions and well-balanced faces are compared to white norms, again differences are found. Scavone et al. (2006) evaluated 30 Japanese-Brazilian men and women, and compared them to white norms. Distances from a true vertical line, as well as nasolabial angle were evaluated. The Japanese-Brazilian women had more anteriorly positioned glabellae, less nasal projection, and a more obtuse nasolabial angle.

The Japanese-Brazilian men also had a more anteriorly positioned glabellae, less nasal projection, more protrusive lips, less projection of soft tissue B point and more obtuse nasolabial angles. The authors summarized that a single norm for profile esthetics doesn't apply to all ethnic groups.

Kalha, Latif and Govardhan (2008) proposed soft-tissue cephalometric norms for a South Indian population. They analyzed 30 men and 30 women having class I occlusions and reasonable faces. Each subject was analyzed using the soft tissue cephalometric analysis proposed by Arnett et al. (1999). They found that compared to white norms, South Indian's have more deep-set midfacial structures and more protrusive dentitions. They noted that the clinician must use local norms for a reference rather and established norms for white people.

2.4 SOFT TISSUE PARADIGM

> It is Willie's chin and not his sella turcica that interests his mother.
>
> -Cecil C. Steiner

Sarver and Ackerman (2000) detail the emergence of the "esthetic paradigm" with a short history. In the late 19th century, Norman Kingsley was a prominent orthodontist who emphasized the esthetic objectives of orthodontics. Edward Angle changed the emphasis to occlusion. Angle believed that optimal occlusion lead to optimal facial esthetics. Tweed and Begg challenged this nonextraction philosophy partly on esthetic grounds. In the 1980's, with emphasis on esthetic dentistry, the selection of orthodontic treatment was partly made based on its direct influence on esthetics. The authors propose three guidelines. One, the face must be evaluated clinically in dynamic and static states in three dimensions. Two, lip-tooth relationships and anterior tooth display are very important. And three, there must be an analysis on the hard tissues as they relate to the soft tissues of the face.

Park and Burstone questioned treating to hard tissue standards in their 1986 article. They recognized that treating to hard tissue standards did not ensure good facial form. They further questioned the validity in producing desirable esthetics when a dentoskeletal standard has been achieved. Their sample was thirty orthodontic cases treated to a hard-tissue criteria of having the lower incisor positioned 1.5mm anterior to the A-pogonion plane. When the hard tissue goal was achieved, they found a very large variation in lip protrusion. When limiting the population to two standard deviations (95% of the malocclusions), they found that the protrusion of the lips varied more than +/- 5 mm from the mean. Upper lip inclination varied as much at 32 degrees and the lower lip inclination varied 52 degrees. In summary, they advocated consideration of soft-tissue factors in addition to hard-tissue structures.

Nanda and Ghosh published an article in 1995 that criticized the excessive focus on the use of the dental and skeletal structures in treatment planning. They argue for "harmonized facial structures as a primary goal of treatment." They write that repositioning teeth has the greatest influence on lip posture and as orthodontists we should always look at this carefully. A chin or nose change can only come from orthognathic surgery. They also argue that numbers can never replace good clinical judgment.

In 2004, Arnett and Gunson begin their article with the statement "The bite indicates a problem; the face indicates how to treat the bite." They outline their way of treatment planning for orthodontists and oral surgeons. In it, they advocate clinical, facial, and soft tissue cephalometrics in addition to model analysis and conventional cephalometrics. They do, however, concede that their soft tissue cephalometrics planning remains primarily subjective.

2.4.1 SOFT TISSUE PROFILE ANALYSIS

Before undertaking a soft tissue profile analysis, one must first identify the traits or parts of a profile that are important. Arnett and Bergman attempted to do this in 1993. They identified ten traits on a profile that are important and gave recommendations for general harmony. The profile angle is formed by the points glabella, subnasale and soft tissue pogonion. Generally the profile angle should be between 165 and 175 degrees. The nasolabial angle should be 85 to 105 degrees. The maxillary sulcus contour should normally be slightly curved, but will flatten when under slight tension. The mandibular sulcus contour also is a slight curve, however maxillary incisor impingement may crease a deep curve. The orbital rim should be evaluated as it also correlates with maxillary position. It should be 2 to 4 mm behind the front of the eye. Cheekbone contour is also evaluated, as osseous structures are often deficient as groups. It may be deficient in combination with the orbital rim, indicating maxillary retrusion. The authors advocated the nasal base-lip contour as an indicator of maxillary and mandibular skeletal anteroposterior position. Nasal projection is measured horizontally from subnasale to nasal tip and should be 16 to 20 mm. The throat length and contour should be subjectively evaluated. The authors warn that a mandibular setback may produce a sagging throat. Finally, the subnasale-pogonion line gives an important indicator of lip position. The upper lip should be 3.5mm in front of the line, the lower should be in front by 2.2 mm.

Ackerman and Proffit (1995) outlined 10 guidelines for soft tissue limitations during orthodontic treatment planning. First, if someone has a large nose or chin, moving incisors forward is better than retraction. Second, severe midface deficiency or prognathism creates unattractive lip posture and this can rarely be corrected with orthodontics alone. Third, Moderate mandibular deficiency is often acceptable, especially to patients. Fourth, an upper lip inclining back from a true vertical is unesthetic. Fifth, lack of a well-defined labiomental sulcus in unattractive. In this case, retraction of incisors is better esthetically. Sixth, a large amount of gingiva showing is unattractive. Seventh, a curled lower lip is unattractive. Eighth, a concave profile with thin lips is unesthetic, when possible proclining the incisors is best. Ninth, bilabial protrusion is unattractive. And finally, soft tissue surgical procedures will have a more dramatic effect on facial soft tissue contours than orthodontic tooth movement.

Czarnecki et al. (1993) had 545 professionals evaluate soft tissue silhouettes to see what profile attributes were found in the most desirable profiles. The subjects favored straighter profiles in males than females. They also found that extremely recessive chins or convex faces fared worst. Lip protrusion was found to be acceptable when a large nose or chin was present. They suggested orthodontic goals be planned with balance and harmony of the face in mind rather than strict dental and skeletal ideals.

The Holdaway soft-tissue cephalometric analysis (1983) is one of the earliest full featured soft-tissue cephalometric analyses proposed. Holdaway claimed that his analysis “demonstrates the inadequacy of using a hard-tissue analysis alone for treatment planning.” Holdaway describes six lines and eleven measurements in his analysis.

1. The H line or harmony line drawn tangent to the soft-tissue chin and the upper lip.
2. A soft-tissue facial line from soft-tissue nasion to the point on the soft-tissue chin overlying Rickett’s suprapogonion.
3. The usual hard-tissue facial plane.

4. The sella-nasion line.
5. Frankfort horizontal plane.
6. A line running at a right angle to the Frankfort plane down tangent to the vermilion border of the upper lip.

The first measure is soft-tissue facial angle. A line is drawn from soft-tissue nasion to the soft-tissue chin point overlying hard-tissue suprapogonion, measured to the Frankfort horizontal. Ideally, Holdaway says this should be 91 degrees with a range +/- 7 degrees. It may be a better measurement of chin prominence because of a wide range of soft-tissue chin thickness at normal soft-tissue pogonion. Nose prominence is measured by taking a line perpendicular to Frankfort and running it tangent to the vermilion border of the upper lip. Arbitrarily, noses under 14 mm are small and those larger than 24 mm are large. Holdaway cautions that noses should still be judged on an individual basis. Using this same line, one can measure the superior sulcus depth of the upper lip. Ideal is 3mm with an acceptable range of 1 to 4 mm. Next, the measurement of soft-tissue subnasale to H line is assessed. The ideal is 5mm with a range of 3 to 7 mm. Basic upper lip thickness is assessed by measuring from the base of the alveolar process (about 3mm below point A). This is compared to the lip thickness overlying the incisor crowns (measured from crowns to the vermilion border) to determine lip strain or incompetency. Usually the thickness at the vermilion border is 13 to 14 mm.

The H-Angle is the angular measurement of the H line to the soft-tissue Na-Po line. 10 degrees is ideal. However, as the skeletal convexity increases, so must the H-angle. The angle measures the prominence of the upper lip in relation to the overall soft tissue profile.

The lower lip to the H line is also assessed. Ideally, the lower lip should be on or 0.5mm anterior. However, 1mm behind to 2mm in front of the H line is acceptable. Lingual collapse or extractions may make this too negative, and this indicates lost lip support. Concomitantly, the inferior sulcus to the H line should be measured. It should be harmonious with the superior sulcus form. It indicates how well the lower incisor proclination was managed. The last measure Holdaway looks at is the soft-tissue chin thickness. It is the distance between two vertical lines at the level of Ricketts' suprapogonion hard and soft tissue. It is usually 10 to 12 mm. Very thick chins need to be recognized because the upper and lower incisors should be left in more anterior positions to not take away needed lip support.

Holdaway summarizes with 7 traits of an ideal face.

1. A soft-tissue chin nicely positioned in the facial profile.
2. No serious skeletal profile convexity problems.
3. An H angle that is within 1 or 2 degrees of average.
4. A definite curl or form to the upper lip, measuring in the vary narrow range of 4 to 6 mm. in depth of the superior sulcus to the H line and from 2.5 to 4mm. to a perpendicular line drawn from Frankfort.
5. The lower lip either on the H line or within 1mm of it.
6. Lower lip form and sulcus depth harmonious with those of the upper lip, although there was more variation in this area than in the upper lip.
7. No unusually large or small measurements of either total nose prominence or soft-tissue chin thickness.

Arnett et al. (1999) expanded on their article "Facial keys to orthodontic diagnosis and treatment planning" with a new proposed Soft Tissue Cephalometric Analysis (STCA). In this article they build upon the "Facial Keys" by emphasizing the soft tissue measurements in treatment planning. Four main areas are looked at, which are dentoskeletal factors, soft tissue structures, facial lengths and projections to a true vertical line.

First, the authors propose evaluating a number of key dentoskeletal factors. Upper incisor inclination to maxillary occlusal plane, lower incisor to mandibular occlusal plane, overbite, overjet and maxillary occlusal plane are all evaluated.

Next, soft tissue structures that control facial esthetics are measured including tissue thickness at upper lip, lower lip, soft tissue pogonion and soft tissue menton. Upper lip angle and nasolabial angle are appraised.

A number of facial length measurements are also obtained. Purely soft tissue lengths include facial height (soft tissue nasion to soft tissue menton), lower one-third height (subnasale to soft tissue menton), upper lip length (subnasale to upper lip inferior), lower lip length (lower lip superior to soft tissue menton), and inter labial gap (upper lip inferior to lower lip superior). Some soft tissue to hard tissue measurements are also obtained, these are maxillary incisor exposure (upper lip inferior to maxillary incisor tip), maxillary height (subnasale to maxillary incisor tip), and mandibular height (mandibular incisor tip to soft tissue menton). Overbite is also measured.

Finally projections to a true vertical line are measured. A true vertical line runs through subnasale. If there is true maxillary retrusion, this must be adjusted. Distances for profile points are measured from glabella, nasal tip, soft tissue A point, upper lip anterior, lower lip anterior, soft tissue B point and soft tissue pogonion. Midface points, measured with metallic beads, are soft tissue orbital rim, cheekbone height of contour, subpupil and alar base. Hard tissue measures to the true vertical line are upper and lower incisor tip.

The final step in STCA is determining harmony values. Intramandibular harmony, interjaw harmony, orbital rim to jaw harmony and total facial harmony are evaluated. For intramandibular harmony, lower incisor to soft tissue pogonion, lower lip to pogonion, soft tissue B point to soft tissue pogonion and neck throat point to soft tissue pogonion are evaluated. For interjaw harmony, subnasale to soft tissue pogonion, soft tissue A to soft tissue B point, and upper lip anterior to lower lip anterior are evaluated. For the orbital rim to jaw harmony, only soft tissue orbital rim to soft tissue A point and soft tissue pogonion are appraised. Finally, for total facial harmony, facial angle, glabella to soft tissue a point and glabella to soft tissue pogonion are assessed.

Once the STCA is completed, a seven step cephalometric treatment planning (CTP) can begin. First the correct mandibular incisor inclination is obtained. Next the correct maxillary incisor inclination is obtained. These two steps eliminated dental compensation and true skeletal overjet is revealed. Third, the maxillary incisor is positioned so that 4 to 5 mm of incisor is exposed under the relaxed lip. Sagital positioning is determined by a number of clinical factors such as orbital rims, cheekbones, subpupil, alar base contours, nasal projection, upper lip support, upper lip thickness and upper lip angle. Fourth, the mandible is autorotated until there is 3 mm of overbite. If the occlusion is class I, skip step five. If it is class II or III, then a mandibular surgery is needed to move it anteriorly or posteriorly. Sixth, the maxillary occlusal plane is defined. A more superior first molar placement may mean more convex and less pleasing profile. Generally, the occlusal plane angle should be at its normal to the true vertical line. The seventh and final step is to finalize chin position. It can be augmented with an osetotomy or by changing the occlusal plane cant. A steep occlusal plane means decreased chin projection.

The authors stress that their STCA is to be used with a through clinical facial examination and cephalometric treatment planning.

More contemporary articles have fully accepted the need for a soft tissue emphasis in treatment planning. However, no common soft tissue analysis has become as commonly used as the hard tissue analyses listed earlier. This has produced an outflow of ideas and more abundant literature on the subject. Spyropoulous and Halazonetis published their article “Significance of the soft tissue profile on facial esthetics” in the AJODO in 2000. An average soft tissue outline was made from a sample of 20 profiles. Each face was then morphed to the composite outline. Judges rated the images differently, suggesting factors other than just soft tissue profile contribute to beauty. Interestingly, a composite set of images, averaged from all 20 profiles scored highest. This may suggest that treating to an ideal is a valid concept.

2.5 ORTHODONTIC TREATMENT EFFECTS

> The trivial excuses often given by men of high standing in dentistry for extraction of teeth are amazing.
>
> -Edward Angle

Once a case has been properly diagnosed, the clinician must come up with a treatment plan. If they are counting on orthodontic therapy to improve the facial profile, they must have good evidence that shows the effects of the proposed treatment. Orthodontic treatment effects on the profile (with and without extractions) are examined.

Vikkula et al. (2009) examined soft-tissue response to early cervical headgear in a randomized study with a control group. At 8 year follow up, the main findings were a thicker soft-tissue chin and lower lip, and a deeper mentolabial sulcus. When comparing cervical headgear to a mandibular protraction appliance (MPA), it was found that the group with the MPA had significantly greater lower lip protrusion, but no difference in nasio labial angle and upper lip protrusion (Siqueira et al. 2007). Sloss et al. (2008) compared soft-tissue profiles after treatment with headgear or Herbst by creating silhouette profiles and having laypersons and orthodontic residents judge them. The authors found no significant difference between the groups.

Class II subjects are often treated with a functional appliance. Functional appliance therapy was found to decrease ANB by 2 degrees, increase anterior face height by over 3mm, decrease soft tissue profile convexity by over 2 degrees and increase the mentolabial angle by over 17 degrees when compared to a control group (Lang et al., 1995). Though there are statistically measurable differences, one must question whether these are significant. O'Neill et al. (2000) had dental professionals as well as laypeople judge treated and untreated control silhouette profiles of patients who had undergone functional appliance therapy. A variety of functional appliances were employed. They found there was not a significant difference between the groups. In contrast to this, O'Brien et al. (2009) treated a group with twin-block functional appliances and compared their profile silhouettes to an untreated control group. They did find a statistical difference in the ratings and concluded that profile silhouettes of children who received early treatment were perceived to be more attractive than those who did not receive treatment. A systematic review evaluating soft tissue changes with fixed functional appliances reached a conclusion that though some studies show statistically significant changes, these changes may be of no clinical significance (Flores-Mir, Major and Major, 2006).

Often class III subjects are treatment planned with maxillary protraction therapy. Following therapy, the maxillary soft tissues show anterior movement and the mandibular soft tissues rotate backward and downward. This combination helps correct concave soft tissue profiles (Kilic et al., 2010).

In the past, orthodontists have often limited their decision on extraction to the amount of crowding, curve of spee and dental protrusion without evaluating the effects on the patient's face. Two likely extraction scenarios are 4 bicuspid and 2 upper biscuspid for class II patients. For upper premolar extraction in class II camouflage cases it appears that similar profiles will be achieved whether treatment is extraction or non-extraction (Janson et al., 2007). When appropriate, the extraction of two upper bicuspids also leaves the patient with good overall facial harmony and balance (Conley and Jernigan, 2006).

When treatment includes four premolar extractions, it appears that overall the soft-tissue facial profile measurements are similar at the end of treatment (Erdinc AE, Nanda RS and Dandajena TC, 2007, Yount TM and Smith RJ, 1993). Drobocky and Smith (1989) examined 160 orthodontic patients with extractions and had no comparison control group. They found that approximately 10 to 15% of patient profiles were excessively flat and 80 to 90% had a profile that remained satisfactory or improved. Bishara et al. (1995) did use a control group and found that overall the extraction group tended to have straighter faces. They also found that the upper and lower lips were more retrusive in the extraction group. However, they noted that none of the effects were deleterious to the facial profile, based on sound diagnostic criteria. Other studies with control groups have supported the notion that extraction therapy causes lip retraction (Cummins et al., 1995 and Kocadereli, 2002).

3.0 STATEMENT OF THE PROBLEM

Before orthodontists begin treatment planning they must first obtain comprehensive records. This includes a clinical exam, radiographs, models and photographs of the patient. The analysis of these records often includes various cephalometric analyses performed on the cephalometric radiograph. This often assists in identifying skeletal and dental problems.

Though many tools are available to help the clinician with hard tissue problems, the assessment of soft tissues is largely subjective. Soft tissue assessments on cephalograms are often a very minor aspect of an analysis and often only quantify lip protrusion or retrusion. A Soft Tissue Arc from nasion, based at Center “O” on the Sassouni analysis, is proposed and assessed to see if it would be a valid tool in evaluating the soft tissue profile of patients.

4.0 OBJECTIVES

The objective of this study is to compare the profiles changed by the Soft Tissue Arc and those morphed by orthodontic faculty and residents.

4.1 SPECIFIC AIMS

1. Determine if there is a significant mean difference between orthodontic faculty and residents on facial profile image “morphing” values at the maxilla, mandible and chin locations.
2. Determine whether the mean differences, if any, between orthodontic faculty and residents depended on the image being “morphed” at the maxilla, mandible and chin locations.
3. Determine if there is a significant mean difference between the orthodontic faculty and resident “morphed” images, and Soft Tissue Arc difference values at the maxilla, mandible, and chin locations?
4. Determine if there is an overall mean difference between the image “morphed” measurements and the STA values?

5. Determine whether mean differences, if any, between orthodontic faculty and residents are dependent on the paired image morph and STA individual differences?
6. Determine if there is a significant mean difference of the visual analogue scale ratings between images that were morphed by experts and those changed by the soft tissue arc.
7. Determine if there is a significant mean difference of visual analogue scale ratings between the three groups of judges: the residents, dental school faculty and the laypersons.
8. Determine if the Soft Tissue Arc provides a valid assessment of what constitutes a pleasing soft tissue profile.

5.0 RESEARCH QUESTION

Do judges prefer the images morphed to Soft Tissue Arc ideals or those morphed by orthodontic faculty and residents?

6.0 MATERIALS AND METHODS

6.1 SOFT TISSUE ARC MEANS

The Bolton standards are cephalometric tracings that can be obtained from Case-Western Reserve. There is one for each year of age (there is no separate male and female tracings). They were created using Caucasian children only. A Sassouni archial analysis was done on each Bolton cephalogram to find center "O" as defined in the archial analysis. Using center "O", an arc was then drawn from the soft tissue nasion to below the soft tissue pogonion. This arc is the Soft Tissue Arc. An example is shown in Figure 1. Linear measurements from this arc to soft tissue A point, soft tissue B point and the soft tissue pogonion were obtained for ages 10 to 15. The mean of the distances for ages 10 through 15 was calculated for each soft tissue point. On average, soft tissue A point was 4 mm anterior to the soft tissue arc, soft tissue B point was 0.5 mm posterior to the Soft Tissue Arc, and soft tissue pogonion was 5.5 mm anterior to the arc. These average distances from the Soft Tissue Arc will be considered the ideal positions of the soft tissue A point, B point, and chin.

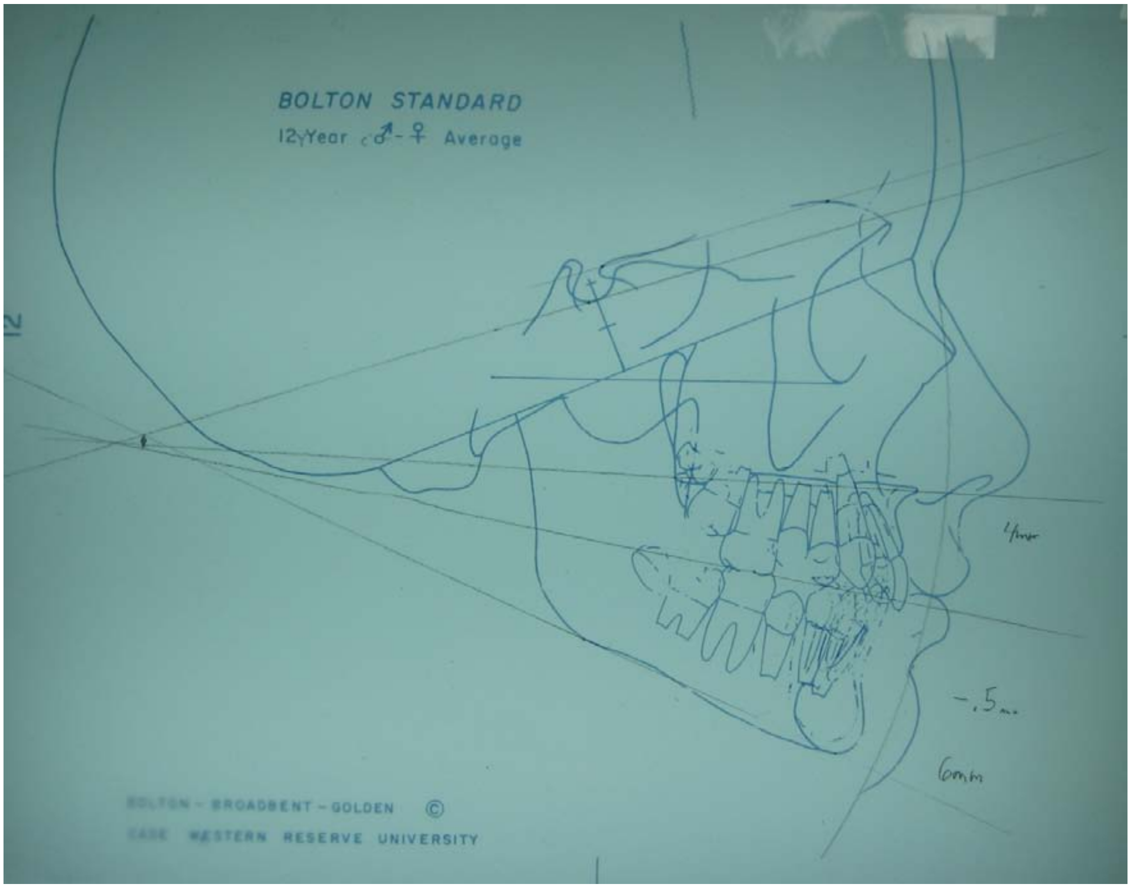

Figure 1. A Soft Tissue Arc with its center as Center "O" is drawn from nasion. Linear measurements from the arc to soft tissue A point, soft tissue B point, and soft tissue pogonion are obtained.

6.2 SUBJECTS FOR MORPHING

Thirty Caucasian subjects between the ages of 10 and 15 were selected randomly from records at the University of Pittsburgh, School of Dental Medicine, Department of Orthodontics and Dentofacial Orthopedics. In order to minimize recognition of the images by research participants, only images from patients starting orthodontic treatment before 2007 were included. The average orthodontic treatment is 24 months, so all of the patients are finished with orthodontic treatment. Subjects were not included if they appeared to be syndromic. Though complete records were not needed, at a minimum there had to be a profile picture, a lateral ceph and a visible ruler on the ceph. As long as soft tissue points could be identified, images were not excluded for poor image quality or head position.

6.3 IMAGE ALTERATION USING THE SOFT TISSUE ARC AVERAGES

The thirty patient profile photographs to be morphed were altered using Dolphin Imaging software. A Sassouni analysis was done digitally on each image to identify center “O”. Acetate paper was then diretly taped onto the computer screen. Each image had a Soft Tissue Arch drawn from soft tissue nasion, as described when determining the normal values. Using the Dolphin treatment simulator, the image first had a simulated LeFort I advancement or setback of the maxilla until the soft tissue point A reached the ideal distance from the arc, as determined by the mean value. Next the patient had a simulated bilateral sagittal split osteotomy and the mandible was advanced or setback until the soft tissue point B reached the ideal distance from the arc. Finally, pogonion was advanced or setback (a simulated genioplasty) until it reached the ideal distance from the arc. Minor touch ups of jagged lips or soft tissue discontinuations were performed by the author. Care was taken not to change the overall jaw position or profile.

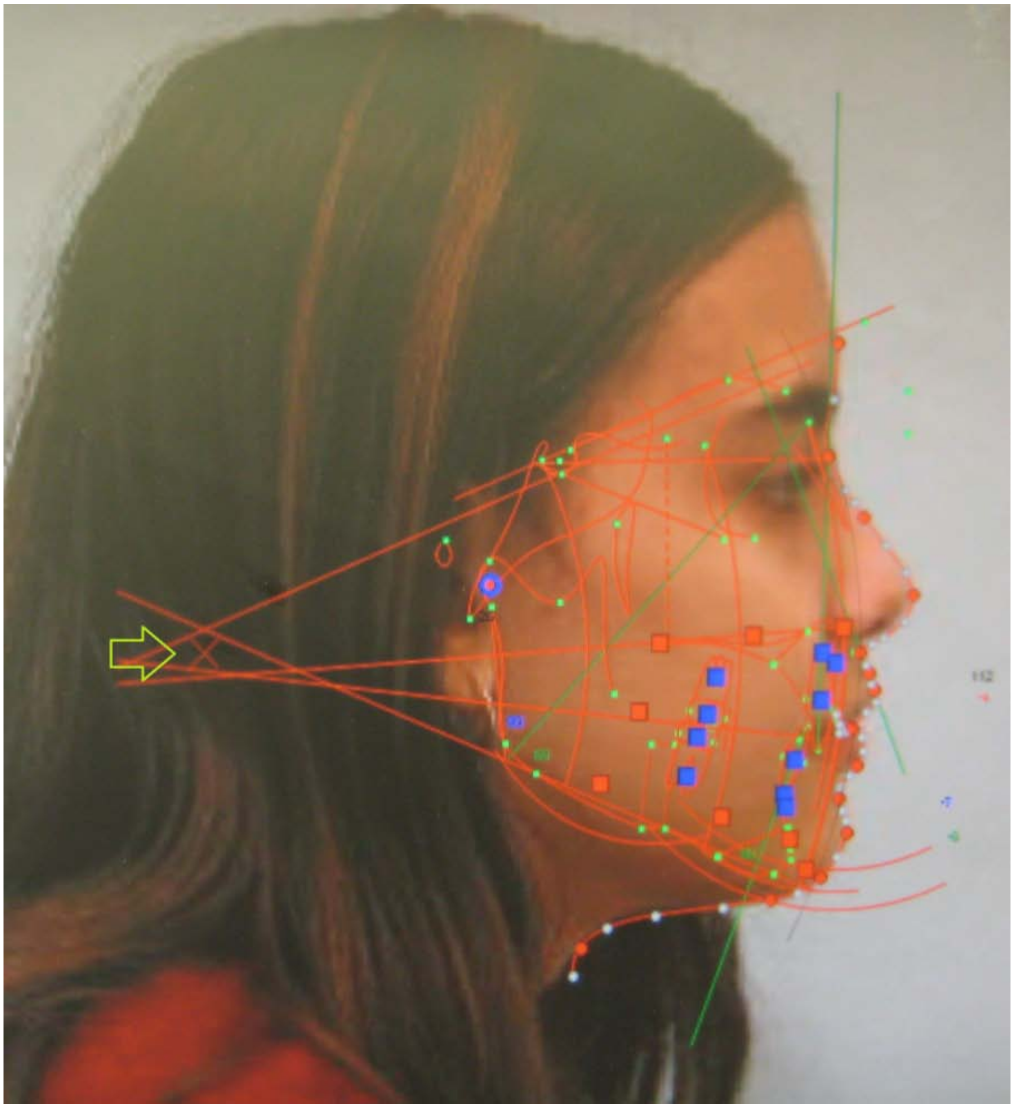

Figure 2. A Sassouni analysis is done to identify Center "O"

Figure 3. A Soft Tissue Arc is drawn

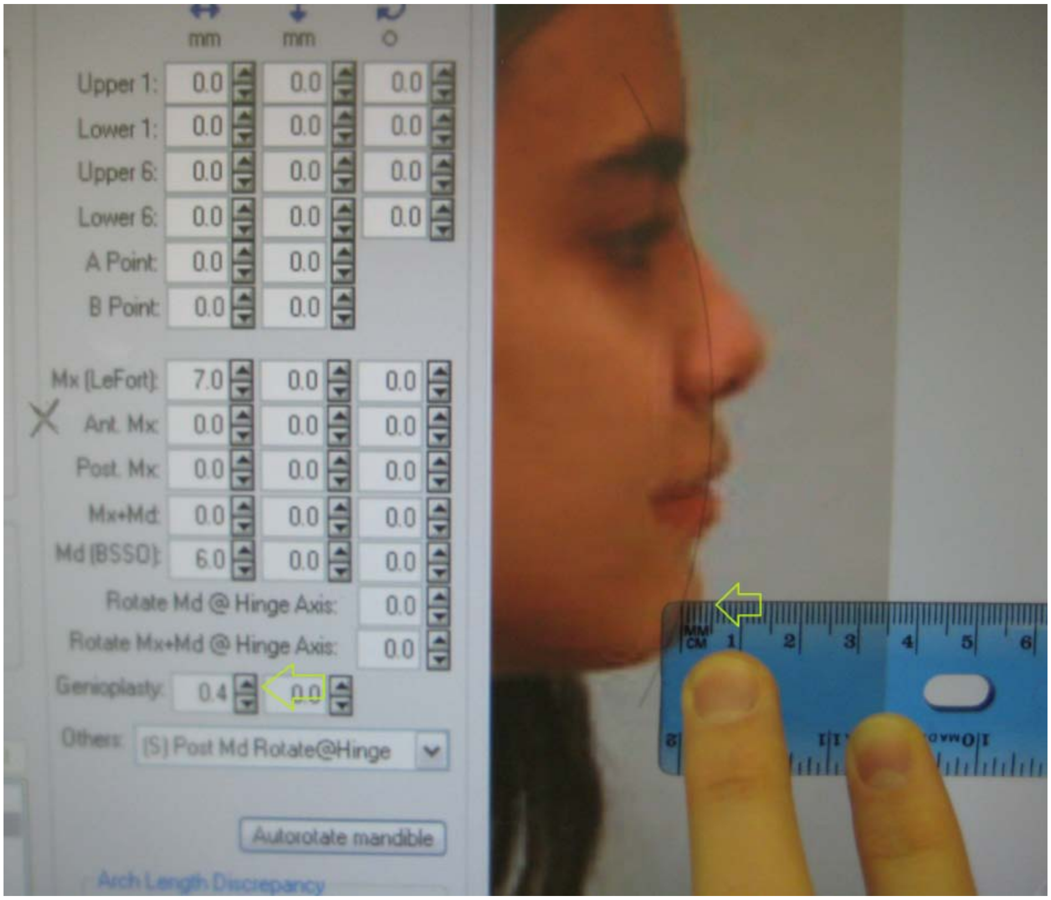

Figure 4. Adjustments are made to position the soft tissue points at ideal distances from the Soft Tissue Arc. In this photograph, the virtual genioplasty is adjusting A-P chin position.

Figure 5. Final morphed image with all 3 soft tissue points adjust to lie at ideal distances from the Soft Tissue Arc.

6.4 IMAGE ALTERATION USING EXPERT OPINION

The same thirty patient profile photographs were again altered using Dolphin Imaging software. Five faculty orthodontists and five orthodontic residents morphed each of the 30 patients to their own vision of ideal for each patient via virtual jaw surgeries. Instructions were simple “Please give this patient an ideal profile that you think would be most pleasing using the LeFort, BSSO and genioplasty. Only A-P movements are allowed. Please ignore the lip commisure if it becomes distorted or if the lips appear jagged." The subject's maxilla and mandible were again advanced or setback using either a LeFort I osteotomy or bilateral sagittal split osteotomy, and pogonion was adjusted with a virtual genioplasty. The changes were based entirely on each resident and orthodontist's own opinion. Each resident and orthodontist was allowed to manipulate the profiles in this way until they thought it yielded the most esthetically pleasing result.

6.5 JUDGING

Three groups of five people rated the images. The first group was comprised of five orthodontic residents (different residents from the group who altered the images). All were residents at the University of Pittsburgh. The second group was comprised of oral surgeons and orthodontists who were full or part time faculty (different from those who altered the images). The final group was comprised of laypeople who were staff in the orthodontics department or parents of patients seeking care at the University Of Pittsburgh Department Of Orthodontics. Each individual was asked to rate the attractiveness of the virtually corrected profiles on a 10 cm visual analogue scale, where 0 was less attractive profile and 10 was more attractive profile. They were allowed to use whatever criteria that they wanted to use in the judging. Each judge then placed a mark on the visual analogue scale indicating their opinion of the attractiveness.

6.6 DATA ANALYSIS

In order to compare the resident morphs to faculty morphs, a multivariate approach using a 2x30 mixed between-within MANOVA was utilized. This was to identify any statistical difference between the virtual jaw surgeries and genioplasties of the orthodontic residents and faculty. To compare the expert opinion morphs to the Soft Tissue Arc changes, a multivariate approach using a 2x2x30 mixed between-within MANOVA was used. To compare to results of the judging on a visual analogue scale, a multivariate approach using a 2x3x30 mixed between-within MANOVA was used.

When significant effects in the MANOVA were found, a univariate ANOVA was carried out between the groups.

7.0 RESULTS

7.1 FACULTY VS RESIDENTS

Comparing the orthodontic resident morphs to the orthodontic faculty morphs, overall Wilk's Lamda showed no significant difference between them, p =0.183. Table 1 displays the means of the 2 groups.

Table 1. Means, standard errors, and confidence intervals for morphing changes.

Measure	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Max	**Faculty**	.680	.257	.088	1.272
	Resident	1.697	.257	1.105	2.288
Mand	**Faculty**	1.920	.328	1.164	2.676
	Resident	2.513	.328	1.757	3.269
Chin	**Faculty**	1.680	.484	.564	2.796
	Resident	2.015	.484	.899	3.130

Comparing the amount of morphing from one image to the next, Wilk's Lamda showed a highly significant difference, p<.001. We would expect this because the images are of different people.

Across the 30 images, the differences between faculty and residents were not consistent. In other words the amount of morphing depended on the image itself. Wilks' Lamda showed this significant difference, p=.017.

The univariate tests showed all three variables (max, mand and chin) were different across the images. Greenhouse-Geisser, $p<.001$. Max will be used for the virtual LeFort advancement or setback, mand will be used for the BSSO advancement or setback, and chin is used for the genioplasty advancement or setback.

Though not valid when there is no between group difference in a MANOVA, a univariate ANOVA between the groups was carried out on max, mand and chin. This is displayed in Figures 6, 7, and 8. It appeared there was a significant difference in the placement of the maxilla between the residents and faculty, $p=.023$.

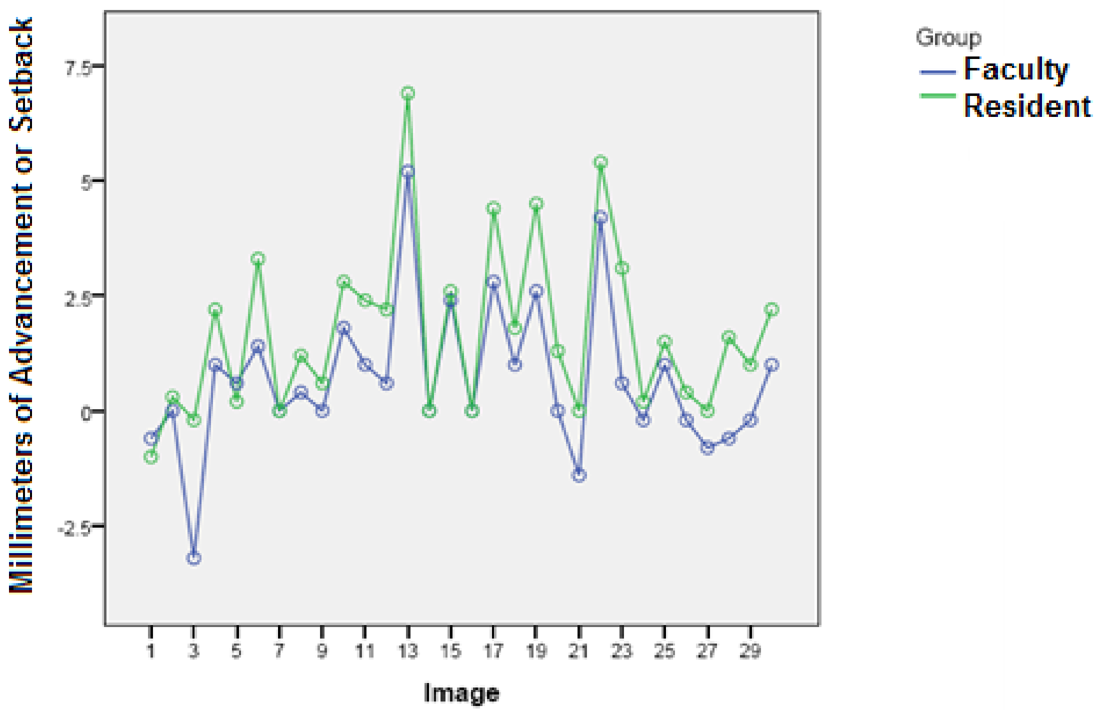

Figure 6. Faculty vs residents change in position of maxilla

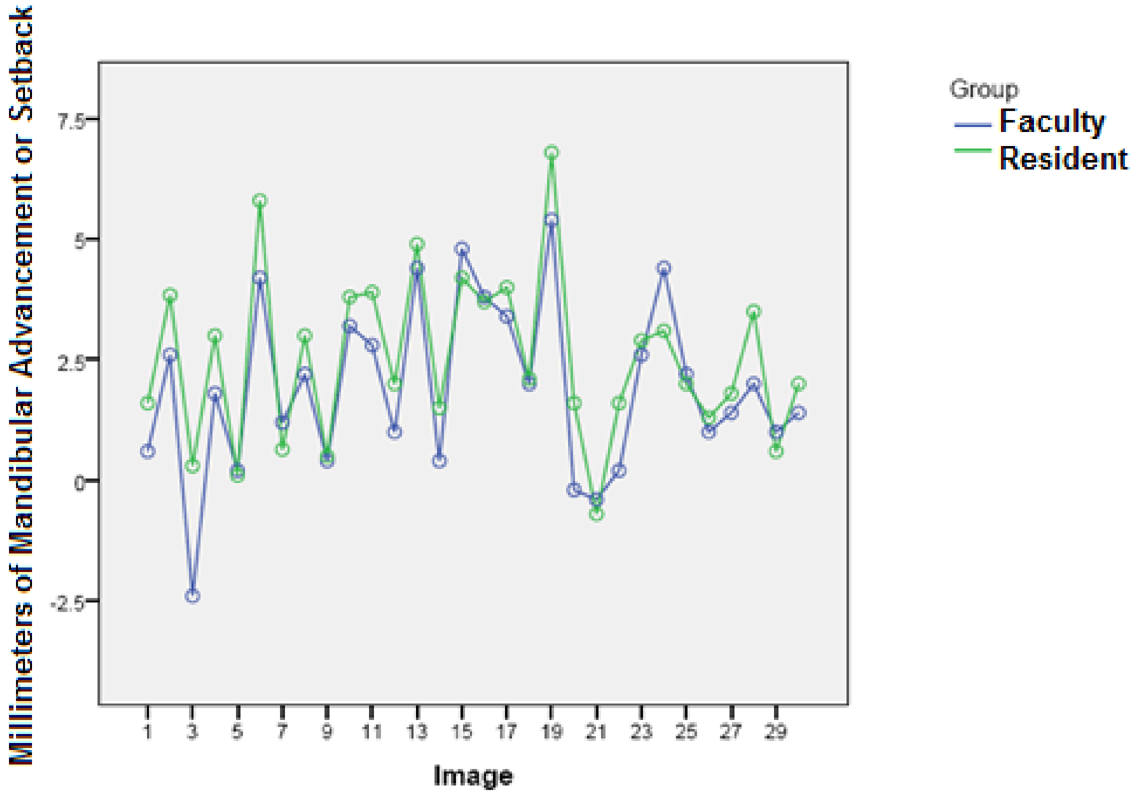

Figure 7. Faculty vs residents change in position of mandible

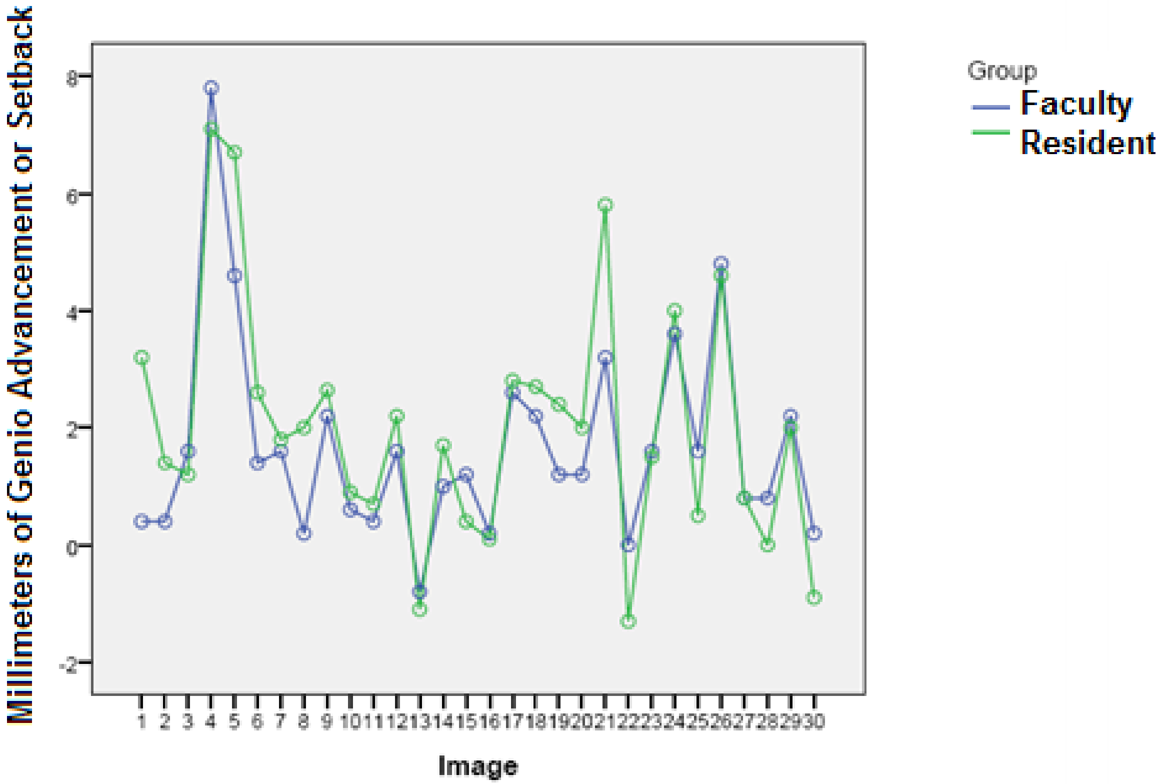

Figure 8. Faculty vs residents change in position of the chin

7.2 FACULTY AND RESIDENT VS SOFT TISSUE ARC

Using a MANOVA and pairing the morphed data with the Soft Tissue Arc, Wilks' Lamda was $p<.001$, showing a highly significant difference. Across the board the morphing and Soft Tissue Arc was very different. Table 2 shows the means and standard errors.

Table 2. Soft Tissue Arc means and standard errors compared to their expert opinion counterparts.

Measure	Group	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Max	Faculty	Expert	.680	.257	.088	1.272
		STA	5.063	.000	5.063	5.063
	Resident	Expert	1.697	.257	1.105	2.288
		STA	5.063	.000	5.063	5.063
Mand	Faculty	Expert	1.920	.328	1.164	2.676
		STA	.747	.000	.747	.747
	Resident	Expert	2.513	.328	1.757	3.269
		STA	.747	.000	.747	.747
Chin	Faculty	Expert	1.680	.484	.564	2.796
		STA	2.380	.000	2.380	2.380
	Resident	Expert	2.015	.484	.899	3.130
		STA	2.380	.000	2.380	2.380

When comparing the difference of resident morphing vs Soft Tissue Arc and faculty morphing vs Soft Tissue Arc, there was not a significant difference, Wilks' Lambda p=.183.

Across the 30 images, the differences between the morphing and Soft Tissue Arc were not consistent. In other words the amount of change depended on the image itself. Wilks' Lamda showed this significant difference, p<.001. These differences were not the same for each group (faculty and residents), and were once again dependent on the image, Wilks' Lamda p=.017.

The univariate tests showed that the max, mand and chin all differed in the morphed images verses the Soft Tissue Arc across the 30 images, Greenhouse-Geisser p<.001. In other words, the amount of max advancement or setback was different from that of either the mandible or chin. Figures 9 through 14 illustrate the differences between the faculty and STA, or residents and the STA.

Overall, the difference between the morphed changes and Soft Tissue Arc changes were significant for the max and mand (p<.001), however, for the chin there was not a significant difference, p=0.158.

Across the 30 images, for the max, mand and chin, the differences between the morphing and Soft Tissue Arc were not consistent. In other words, the amount of change depended on the image itself, Greenhouse-Geisser p<.001.

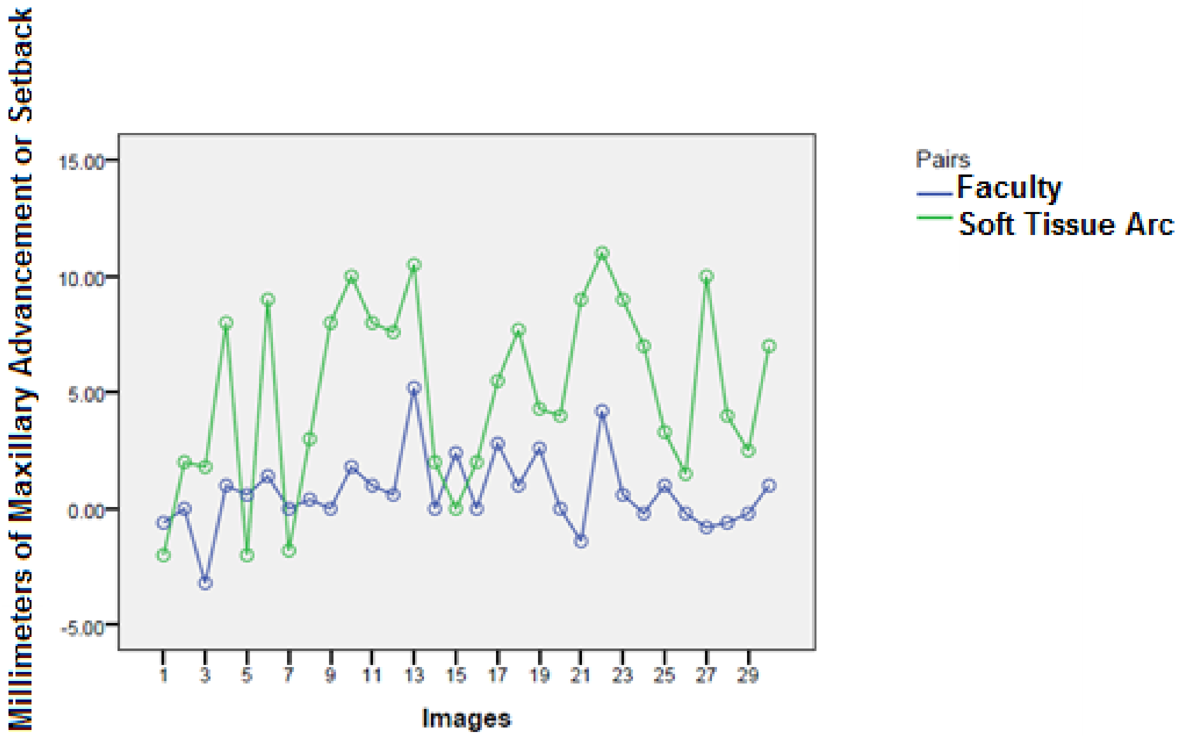

Figure 9. Faculty vs STA changes for the maxilla.

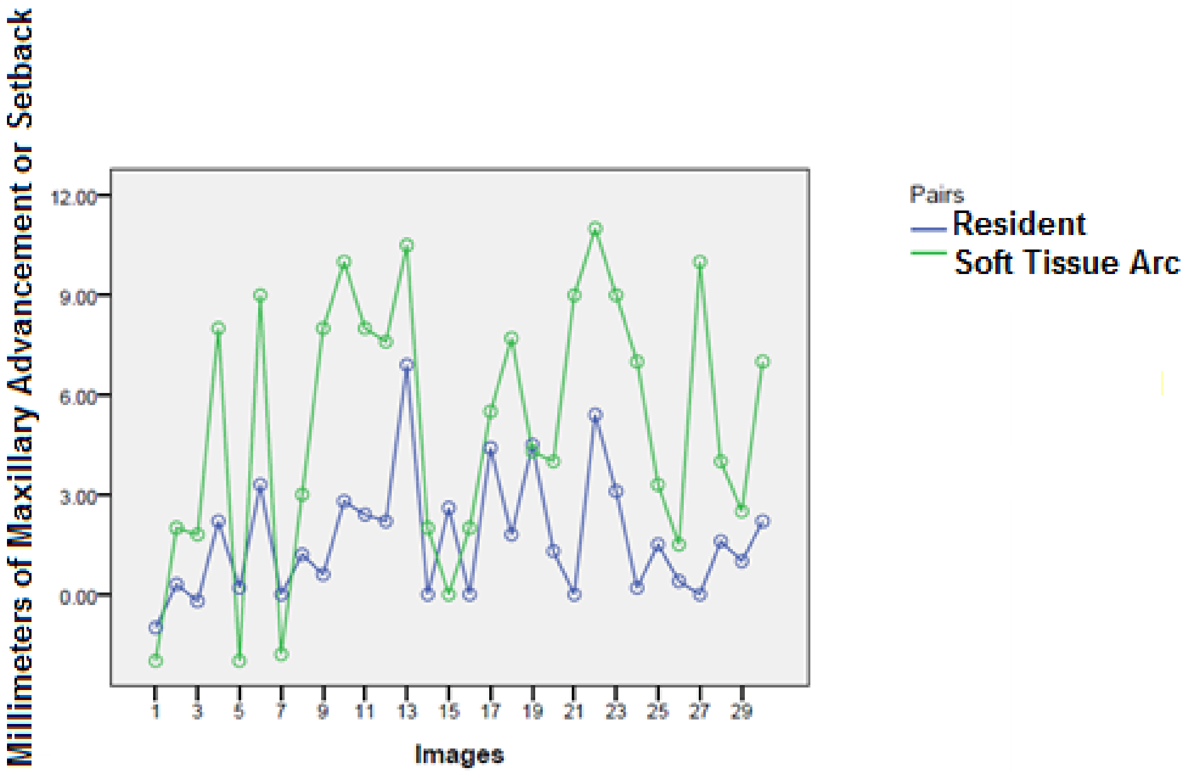

Figure 10. Residents vs STA changes for the maxilla.

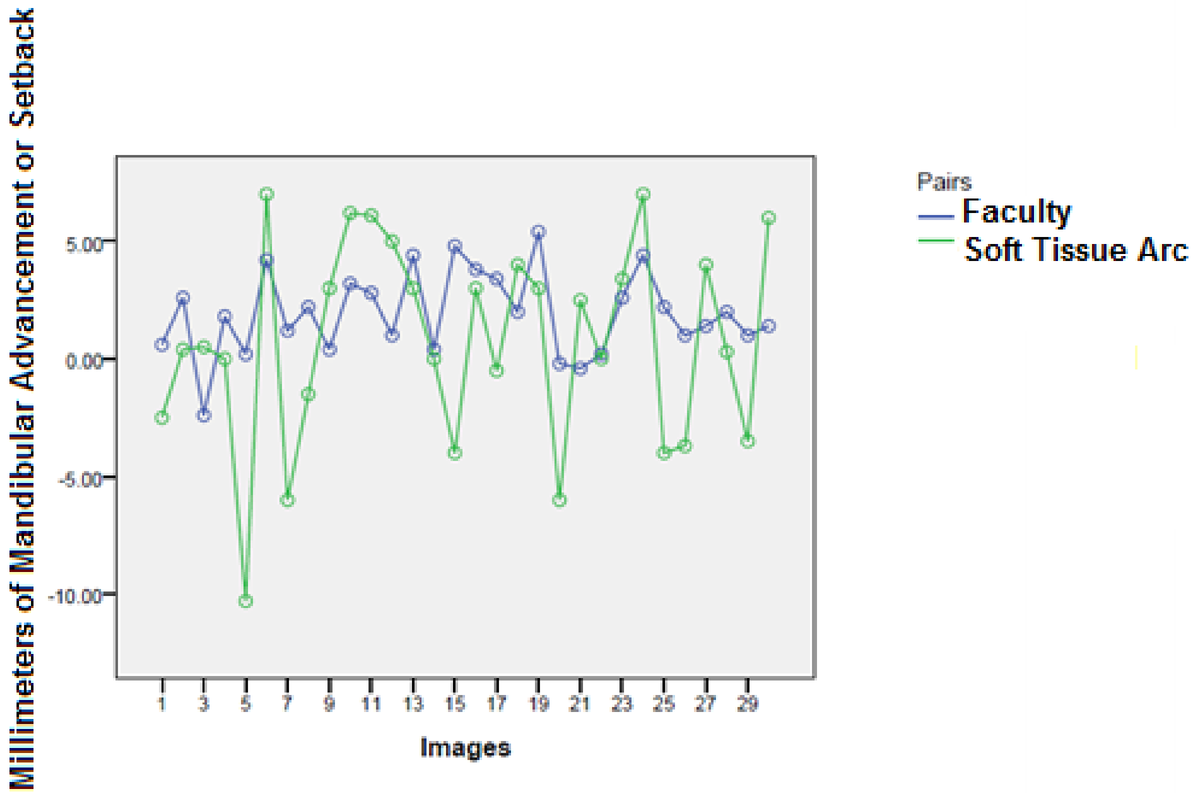

Figure 11. Faculty vs STA changes for the mandible.

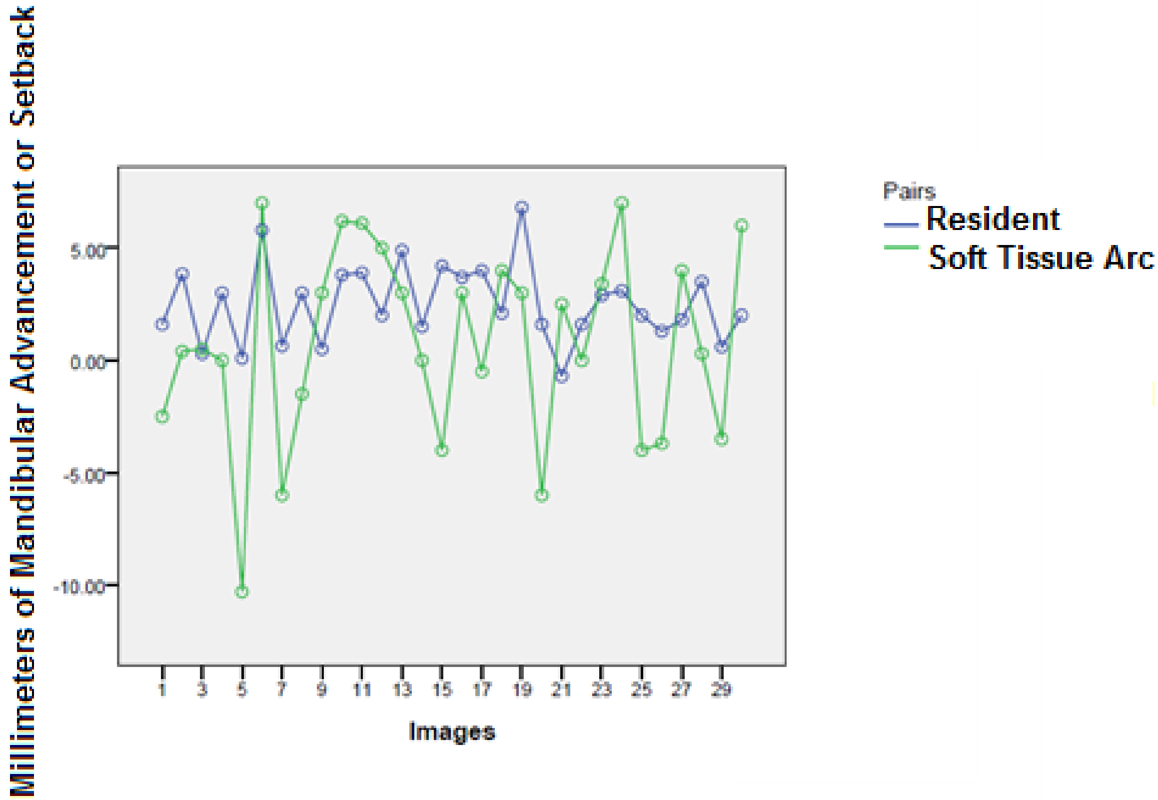

Figure 12. Residents vs STA changes for the mandible.

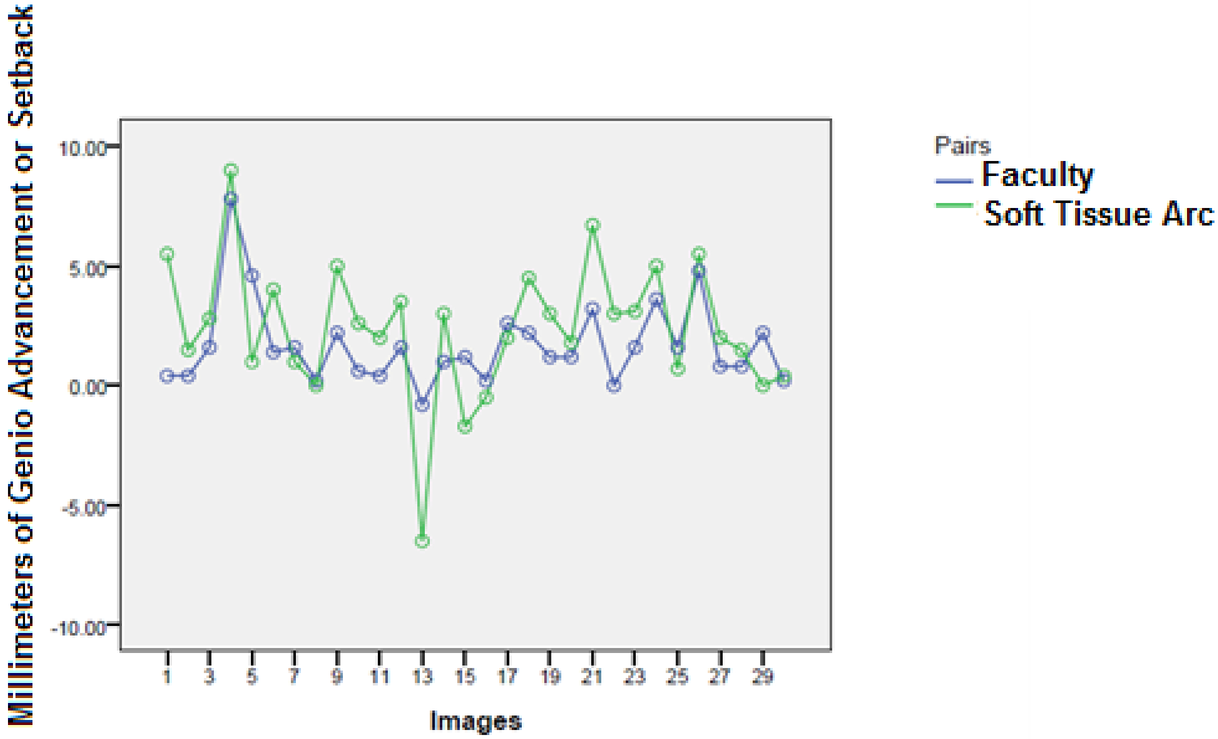

Figure 13. Faculty vs. STA changes for the chin.

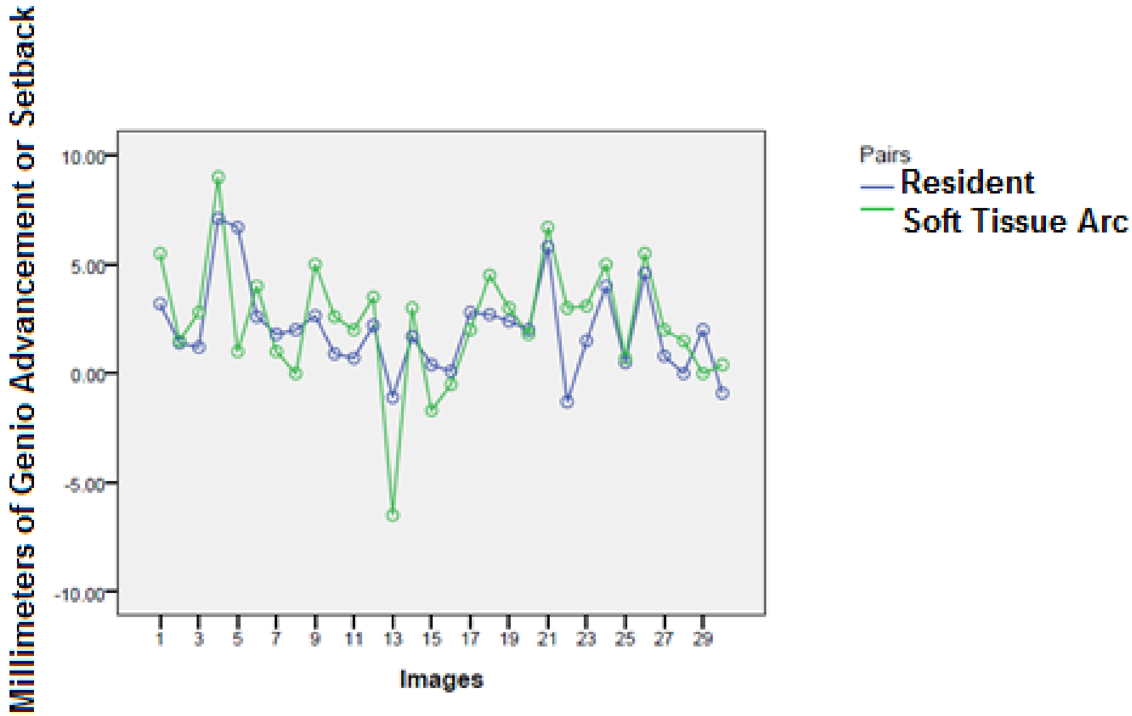

Figure 14. Residents vs. STA changes for the chin.

7.3 JUDGING THE MORPHED IMAGES VS. SOFT TISSUE ARC ADJUSTED IMAGES

Comparing the scores of the STA changed images to the expert opinion morphed images, Greenhouse-Geisser showed that the difference was highly significant, p <.001. Across the board the expert opinion morphed images scored better. The means are listed in Table 3 and this can be seen in Figure 18.

When breaking down the differences across the 3 groups, they differ significantly, Greenhouse-Geisser p=.037. In other words, each group did not give the same scores as another group. This can be seen in Figure 16.

The images themselves received significantly different ratings on the visual analogue scale from one image to the next (Greenhouse-Geisser p<.001).

Comparing the scores of individual images across the 3 groups, there was not a significant difference, Greenhouse-Geisser p=.252. In other words, the three groups gave similar scores from one image to the next (they scored in a similar pattern across the 30 images).

Across the 30 images, comparing the STA vs morphing, there was a difference in the magnitude of difference, Greenhouse-Geisser p<.001. In other words, from one image to the next, morphing did not score better by a consistent amount. This can be seen in Figure 15. When looking at this across the groups of judges, there was no significant different, Greehouse-Geisser p=.235. In other words, the differences mentioned above did not differ by group (faculty, resident or layperson).

Table 3. Mean, standard error and confidence intervals of the ratings by type of alteration (Soft Tissue Arc changes or morphing by expert opinion).

			95% Confidence Interval	
	Mean	Std. Error	Lower Bound	Upper Bound
STA	40.360	2.720	34.433	46.287
Expert	65.182	2.653	59.401	70.963

Table 4. Mean, standard error and confidence intervals of the ratings by judging category.

			95% Confidence Interval	
	Mean	Std. Error	Lower Bound	Upper Bound
Faculty	48.850	4.304	39.473	58.227
Layperson	62.217	4.304	52.839	71.594
Resident	47.247	4.304	37.869	56.624

Table 5. Breakdown of the 3 judging groups and their ratings for STA changes and morphing by expert opinion.

Fac.Res. or Lay	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Faculty	STA	39.767	4.712	29.500	50.033
	Expert	57.933	4.596	47.920	67.946
Layperson	STA	51.073	4.712	40.807	61.340
	Expert	73.360	4.596	63.347	83.373
Resident	STA	30.240	4.712	19.974	40.506
	Expert	64.253	4.596	54.240	74.266

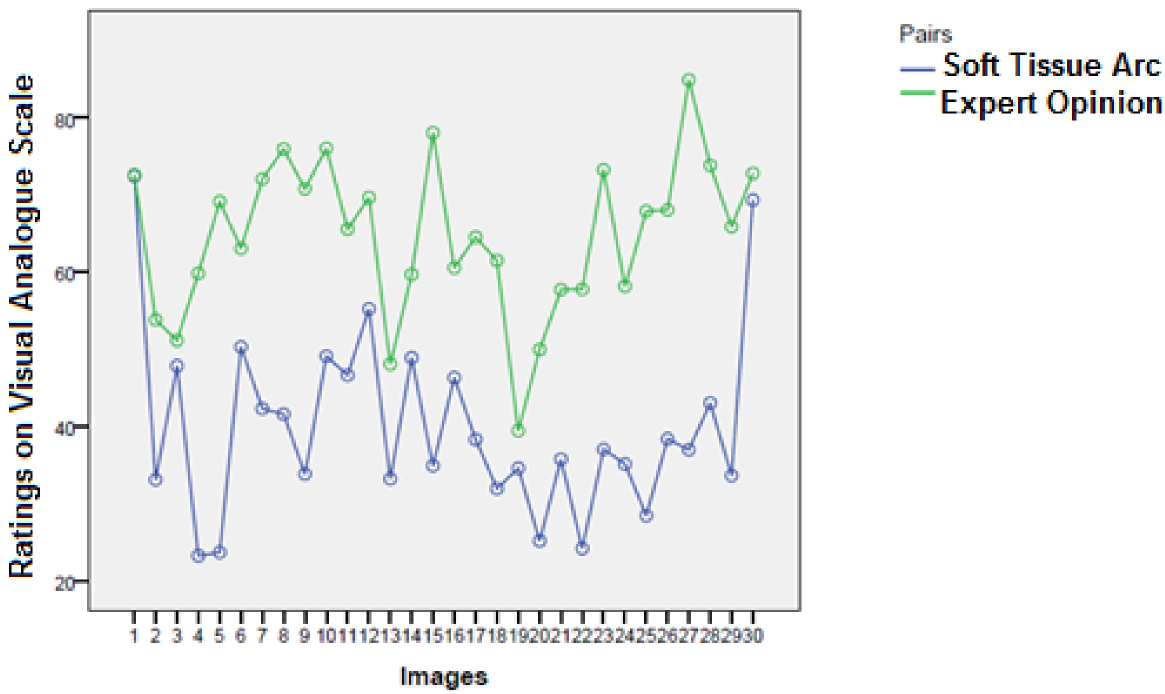

Figure 15. Overall ratings (combination of faculty, resident and layperson judgments) of images changed by STA or expert opinion morphing.

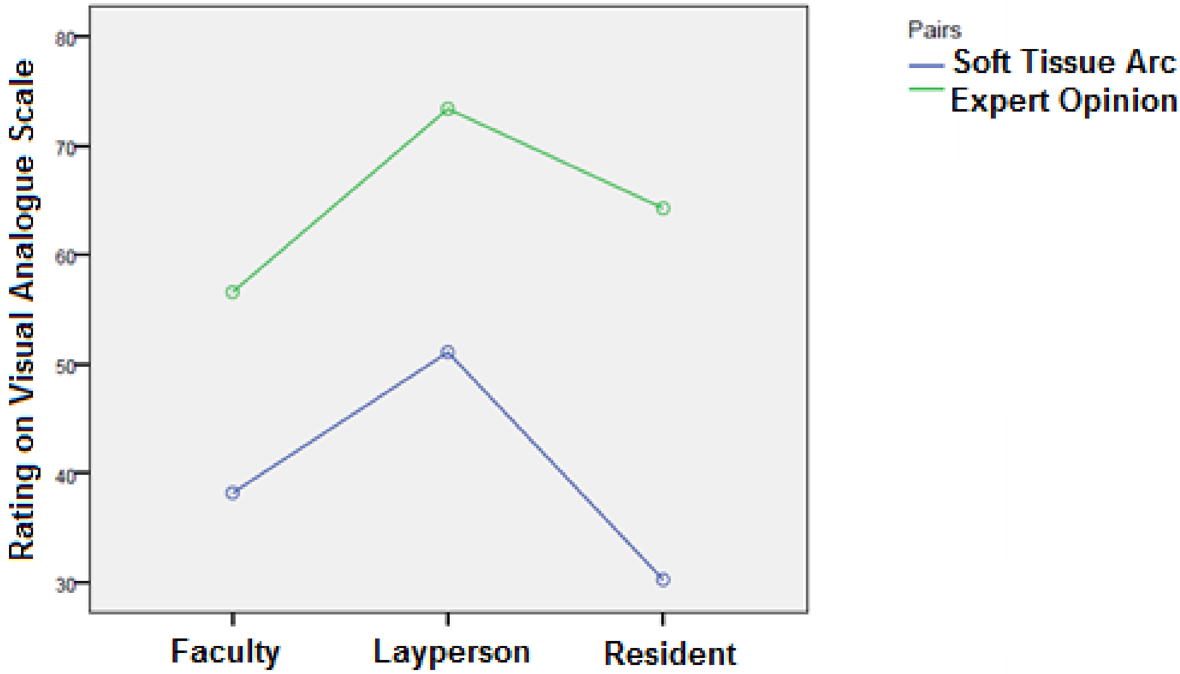

Figure 16. The average ratings of faculty, laypersons, and residents for STA vs morphing..

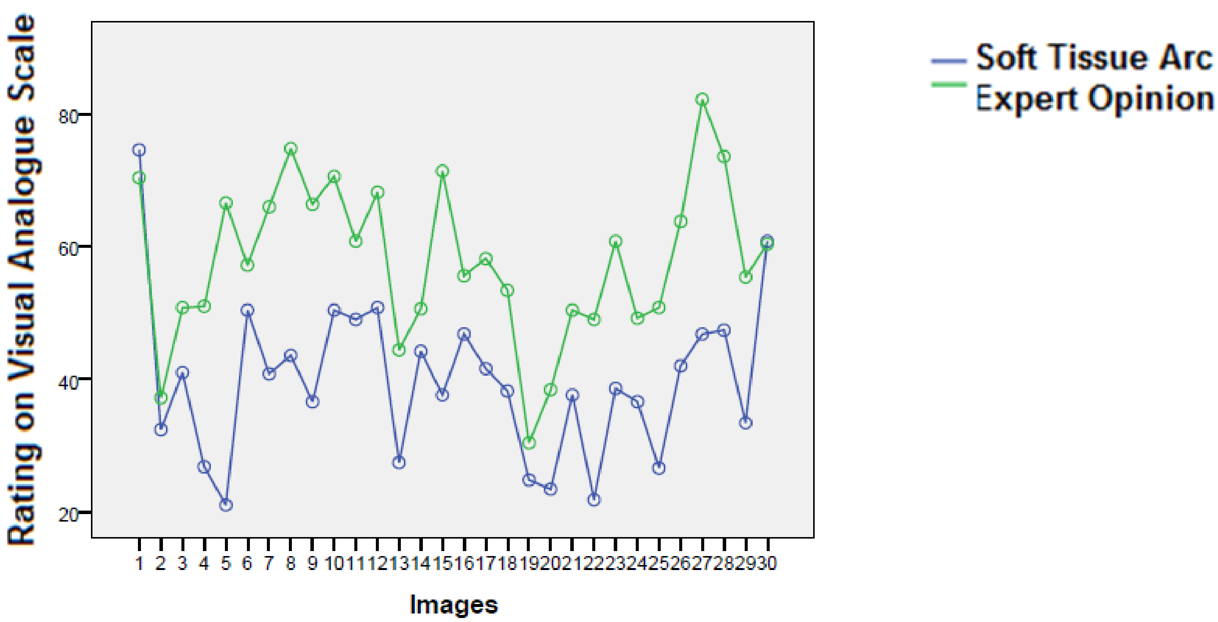

Figure 17. Faculty ratings of images changed by STA or expert opinion morphing.

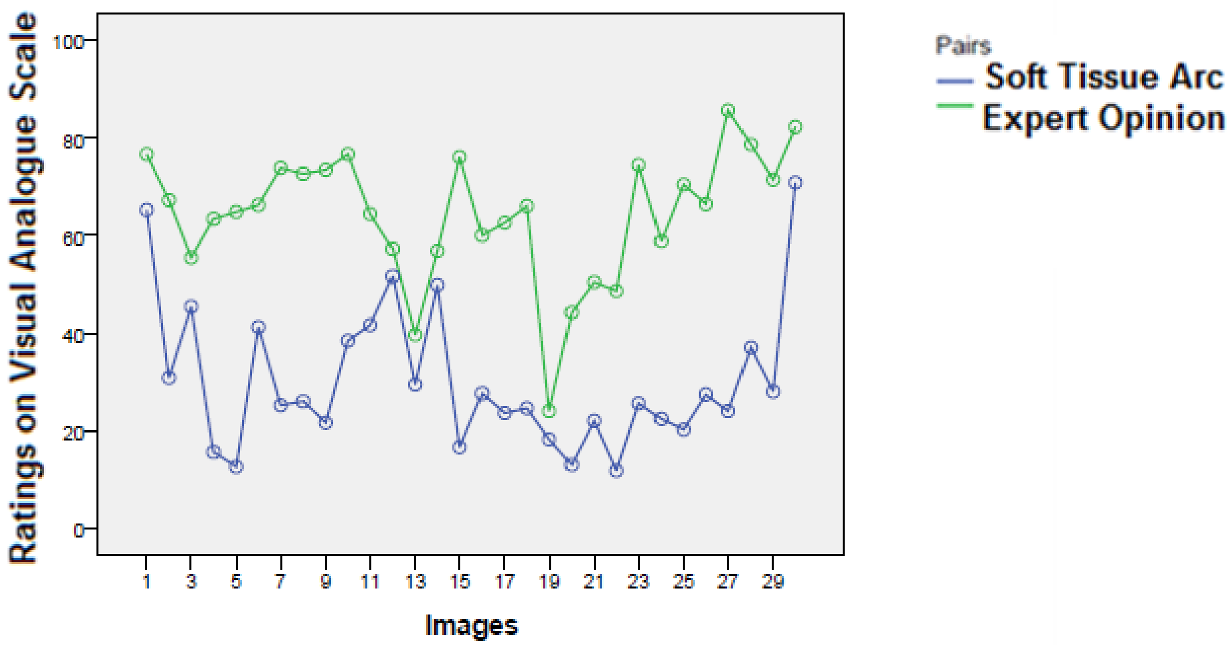

Figure 18. Resident ratings of images changed by STA or expert opinion morphing.

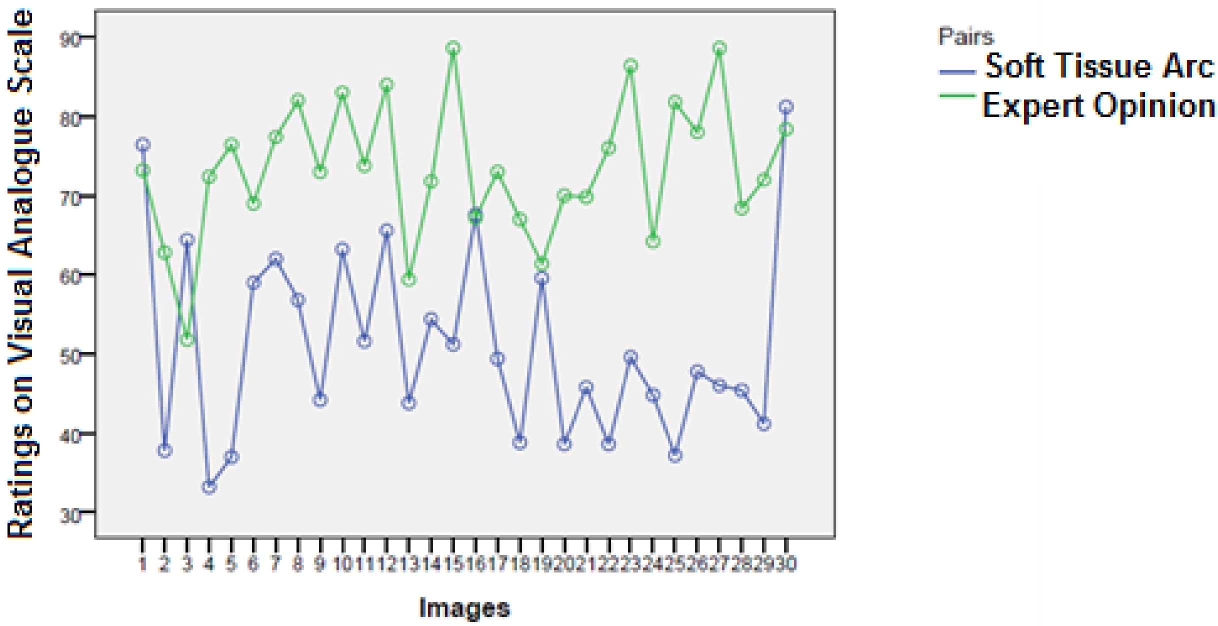

Figure 19. Layperson ratings of images changed by STA or expert opinion morphing.

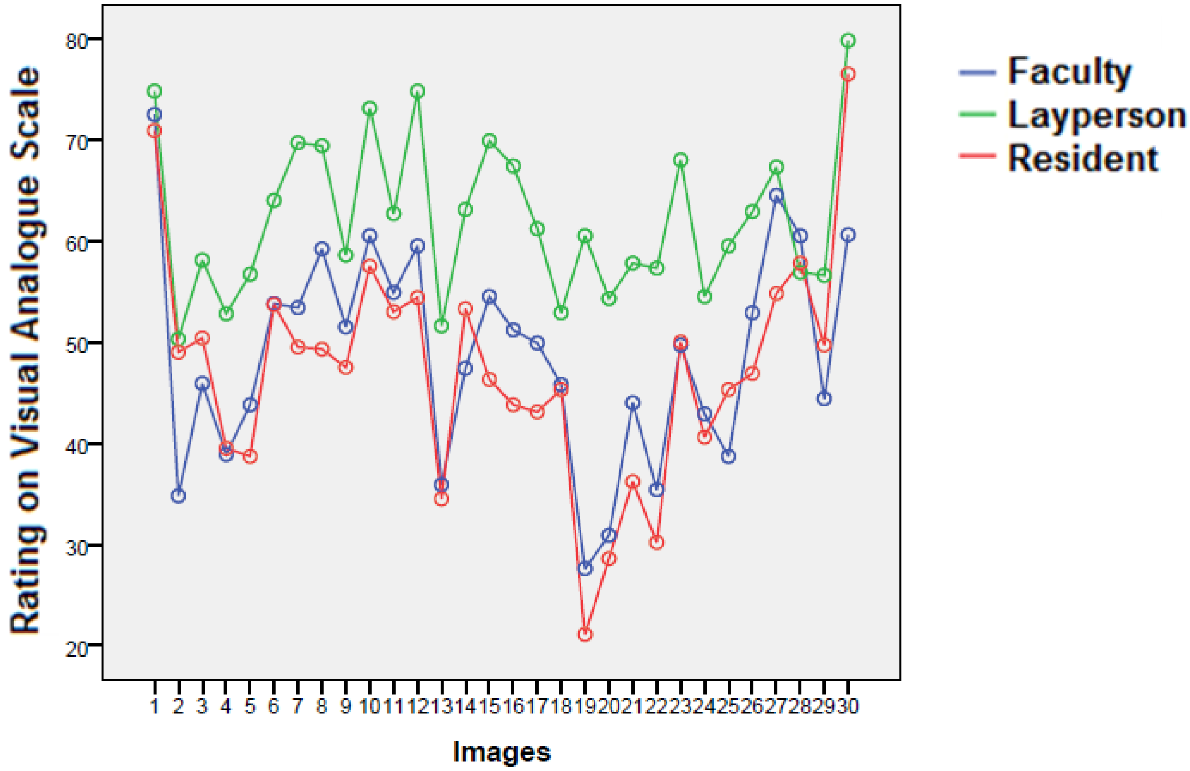

Figure 20. Average ratings (combining STA and morphing scores) between the different groups of judges.

8.0 DISCUSSION

An attempt was made to differentiate the morph values of the orthodontic and oral surgery faculty members and the orthodontic residents. In essence, this would establish different preferences for these groups. A statistical difference was not detected between the groups at the maxilla, mandible or chin positions. However, there was a trend of residents making larger advancements and it appeared this study may have been underpowered to detect this difference. A cursory glance at figures 6 through 8 shows the resident values in green quite consistently above the faculty values in blue. A higher value indicates further advancement. Specifically out of the 30 images, residents advanced the maxilla more in 25 of the images, advanced the mandible more in 22 of the images and advanced the chin more in 18 of the images.

The amount of morphing differed from one image to the next, which would be expected because the images are of different people. For example, we would not expect that the faculty and residents would think that everyone needed a 5mm maxillary advancement, 3 mm mandible advancement, and a genioplasty with 1 mm of advancement. Rather, each image dictated the amount of morphing needed for facial balance. Across the 30 images, the difference between the faculty and residents was not always the same. Once again, this would be expected because of the different images, the amount of morphing change needed is dependent on the image itself. One last expected finding was that the univariate tests showed that all three of the variables were different across the images. For example, an image did not need 5 mm advancement of the maxilla, mandible and chin, but rather a unique position for each of those. Faculty and residents morphed each image uniquely, based upon their expert opinion.

A univariate ANOVA between the faculty and residents was carried out on each individual variable. This is not entirely valid though, because the test should only be done to break down the variables when a difference is found between the groups in the MANOVA. The maxilla did show a significant difference in placement between the maxilla between the residents and the faculty. At the very least, this should lend support to the idea that there is a difference in preferences between the faculty and residents, but as mentioned, the study was underpowered to detect this.

Figures 9 through 14 shows the amount of change for the faculty vs the Soft Tissue Arc and residents versus the Soft Tissue Arc. In the multivariate tests, the differences were highly significant, meaning that across the board the morphed values and the Soft Tissue Arc placement was very different. When comparing the differences of the residents morphing vs the Soft Tissue Arc and the faculty morphing vs the Soft Tissue Arc, no significant difference was found. This makes sense, since no statistical difference was found directly between the faculty and resident morphing. Faculty and residents do not morph the images in the same manner as the values from the Soft Tissue Arc

Once again the differences between the morphing and the Soft Tissue Arc were not consistent. The univariate tests also showed that each variable differed. For example, the maxilla was not always advanced 5mm more in the resident group vs the Soft Tissue Arc group, rather each image had a unique difference. Also, across the images, the differences between the morphing and Soft Tissue Arc were not consistent, which may be expected. The changes are not consistent in either the morphing group or by the Soft Tissue Arc because of unique images.

One very interesting finding was found when performing univariate tests to find differences between the morphed changes and the Soft Tissue Arc changes for the specific variables. Significant differences were found between the morphed changes and Soft Tissue Arc for the maxilla and mandible. However, there was no significant different for chin placement. In other words, the Soft Tissue Arc placed the soft tissue pogonion where the experts from each group placed it. Visually, this can be seen in Figures 13 and 14, in which the Soft Tissue Arc values for the chin approximate morphing values closer than in Figures 9 through 12, which show for the maxilla and mandible. It is interesting to note that though this is furthest from the reference point of the arc (soft tissue nasion), it is most highly correlated. When treatment planning, it may be helpful to start by placing soft tissue pogonion at its ideal distance from the Soft Tissue Arc, and working back from this. Often times, the chin position is considered only after other elements of the face have been planned.

The results of the judging showed that overall, the groups morphed by the experts were rated better on the visual analogue scale. For complete profile adjustment, the Soft Tissue Arc is not nearly as good as the gold standard in facial planning (the expert opinion of orthodontists).

An interesting difference was noted when the ratings were broken down by groups. In Figure 20, the residents and faculty all gave similar ratings. However, the lay group scored consistently higher. Laypersons were considerably more forgiving in their judgement and gave a wide range of facial profiles higher ratings than dental professionals.

It was also observed that images were rated differently from one image to the next. This is expected, as the images are all unique. Across the 30 images, the groups scored in a similar pattern. For example if the laypersons thought an image was less attractive, so did the other groups of judges.

As a final note, the morphing was not consistently better by the same magnitude of difference. For example, it was not always exactly 10 points higher. Rather, the amount of difference from one image to the next changed. Sometimes the morphing by experts produced much more attractive profiles, whereas on a few select images, the STA achieved similar ratings. For example, in Figure 15, the first and last images achieved similar scores regardless of the method in which they were altered.

9.0 SUMMARY

With the invention of cephalometrics, a useful new tool was given to the orthodontist. Cephalometric analysis soon followed. Emphasis was given to jaw disharmonies, which were to be treated to ideal or normal values for optimum outcome. The soft tissue paradigm represents a newer philosophy in orthodontic treatment planning, in which orthodontic treatment effects on the face are given more consideration. Analyses with soft tissue emphasis are appearing, such as Arnett's STCA and CTP, but there is nowhere near as many tools to help the clinician with soft tissue as there is for hard tissue.

Residents and orthodontic faculty were asked to morph 30 images. There was no statistical difference between the groups, though the trend was for residents to advance the points more than the faculty. The study appeared to be underpowered to detect this difference, and a similar study with more subjects may be able to identify preferences between orthodontic residents and faculty.

A Soft Tissue Arc drawn on the Bolton Standards allows normal values from the arc to soft tissue A point, soft tissue B point and soft tissue pogonion to be obtained. The same 30 images were then adjusted to match these normal values. This was compared to morphing of the same images done by orthodontic residents and orthodontic and oral surgery faculty.

The groups of judges all rated the images altered by orthodontic experts as being more attractive. Using a STA to create a treatment plan will not yield as pleasing as result. One interesting finding was that laypersons scored the images consistently higher than any of the dental judges. The layperson's eye is not as critical on profiles as a dental professional.

Though not comparable to the expert eye, the placement of soft tissue pogonion by means of a Soft Tissue Arc showed no difference of that from the experts. The Soft Tissue Arc could be a tool to help orthodontists and oral surgeons in treatment planning for ideal placement chin.

10.0 CONCLUSIONS

1. Residents and faculty have similar soft tissue treatment goals in mind when given the opportunity to manipulate the lower face via a virtual LeFort, BSSO and genioplasty.
2. Though not significant, a trend appeared for residents to advance the points more, thus preferring a fuller face. Further study is needed to explore their preferences.
3. When an orthodontic professional morphed a soft tissue profile via virtual jaw surgeries and a genioplasty, there was no significant difference of soft tissue pogonion position when compared to the images changed to match ideal distance from the Soft Tissue Arc.
4. Judges prefer faces treatment planned by orthodontic professionals over that of a Soft Tissue Arc.
5. Laypersons consistently were less critical of altered profile pictures and rated them more attractive than did orthodontic residents or dental faculty.

APPENDIX A

RAW DATA AND ANALYSIS

Andrew Thompson Thesis: 2 x 30r MANOVA for Pt. Image Morphing Diffs (Fac vs Residents) 12-FEB-2011

[DataSet1] C:\Documents and Settings\HP_Administrator.HP-D4100Y\My Documents\JMC\Data & Analyses\Andrew Thompson Thesis\Andrew T. MorphingStudy.SAV.sav

Between-Subjects Factors

		N
Group	F	5
	R	5

Descriptive Statistics

	Group	Mean	Std. Deviation	N
max1	F	-.60	1.342	5
	R	-1.00	1.000	5
	Total	-.80	1.135	10
max2	F	.00	.707	5
	R	.30	1.095	5
	Total	.15	.883	10
max3	F	-3.20	2.168	5
	R	-.20	1.924	5
	Total	-1.70	2.497	10
max4	F	1.00	1.000	5
	R	2.20	1.483	5
	Total	1.60	1.350	10
max5	F	.60	1.517	5
	R	.20	2.168	5
	Total	.40	1.776	10
max6	F	1.40	2.191	5
	R	3.30	1.565	5
	Total	2.35	2.055	10
max7	F	.00	.707	5
	R	.00	.707	5
	Total	.00	.667	10
max8	F	.40	.548	5
	R	1.20	.837	5
	Total	.80	.789	10
max9	F	.00	.707	5
	R	.60	.548	5

Descriptive Statistics

	Group	Mean	Std. Deviation	N
max9	Total	.30	.675	10
max10	F	1.80	1.789	5
	R	2.80	1.304	5
	Total	2.30	1.567	10
max11	F	1.00	1.732	5
	R	2.40	.894	5
	Total	1.70	1.494	10
max12	F	.60	.894	5
	R	2.20	1.643	5
	Total	1.40	1.506	10
max13	F	5.20	1.095	5
	R	6.90	1.884	5
	Total	6.05	1.707	10
max14	F	.00	1.414	5
	R	.00	.707	5
	Total	.00	1.054	10
max15	F	2.40	2.074	5
	R	2.60	.894	5
	Total	2.50	1.509	10
max16	F	.00	.707	5
	R	.00	.707	5
	Total	.00	.667	10
max17	F	2.80	1.483	5
	R	4.40	1.342	5
	Total	3.60	1.578	10
max18	F	1.00	1.414	5
	R	1.80	.837	5
	Total	1.40	1.174	10
max19	F	2.60	.548	5
	R	4.50	1.323	5
	Total	3.55	1.383	10
max20	F	.00	.707	5
	R	1.30	.837	5
	Total	.65	1.001	10
max21	F	-1.40	1.140	5
	R	.00	1.871	5
	Total	-.70	1.636	10
max22	F	4.20	2.387	5
	R	5.40	.652	5
	Total	4.80	1.767	10

Descriptive Statistics

	Group	Mean	Std. Deviation	N
max23	F	.60	.894	5
	R	3.10	1.140	5
	Total	1.85	1.634	10
max24	F	-.20	.447	5
	R	.20	.837	5
	Total	.00	.667	10
max25	F	1.00	1.000	5
	R	1.50	.500	5
	Total	1.25	.791	10
max26	F	-.20	.447	5
	R	.40	1.140	5
	Total	.10	.876	10
max27	F	-.80	1.643	5
	R	.00	1.225	5
	Total	-.40	1.430	10
max28	F	-.60	1.342	5
	R	1.60	1.817	5
	Total	.50	1.900	10
max29	F	-.20	1.483	5
	R	1.00	1.000	5
	Total	.40	1.350	10
max30	F	1.00	1.000	5
	R	2.20	1.643	5
	Total	1.60	1.430	10
mand1	F	.60	.894	5
	R	1.60	.894	5
	Total	1.10	.994	10
mand2	F	2.60	1.673	5
	R	3.84	.910	5
	Total	3.22	1.428	10
mand3	F	-2.40	1.817	5
	R	.30	2.335	5
	Total	-1.05	2.432	10
mand4	F	1.80	1.304	5
	R	3.00	2.000	5
	Total	2.40	1.713	10
mand5	F	.20	2.864	5
	R	.10	2.408	5

Descriptive Statistics

	Group	Mean	Std. Deviation	N
mand5	Total	.15	2.495	10
mand6	F	4.20	1.924	5
	R	5.80	.837	5
	Total	5.00	1.633	10
mand7	F	1.20	1.304	5
	R	.64	1.884	5
	Total	.92	1.555	10
mand8	F	2.20	1.483	5
	R	3.00	.707	5
	Total	2.60	1.174	10
mand9	F	.40	.894	5
	R	.50	1.323	5
	Total	.45	1.066	10
mand10	F	3.20	2.168	5
	R	3.80	1.304	5
	Total	3.50	1.716	10
mand11	F	2.80	1.483	5
	R	3.90	1.432	5
	Total	3.35	1.492	10
mand12	F	1.00	1.732	5
	R	2.00	1.225	5
	Total	1.50	1.509	10
mand13	F	4.40	1.342	5
	R	4.90	1.245	5
	Total	4.65	1.248	10
mand14	F	.40	.894	5
	R	1.50	1.118	5
	Total	.95	1.117	10
mand15	F	4.80	1.095	5
	R	4.20	1.304	5
	Total	4.50	1.179	10
mand16	F	3.80	.837	5
	R	3.70	.975	5
	Total	3.75	.858	10
mand17	F	3.40	1.140	5
	R	4.00	1.225	5
	Total	3.70	1.160	10
mand18	F	2.00	1.225	5
	R	2.10	.894	5
	Total	2.05	1.012	10

Descriptive Statistics

	Group	Mean	Std. Deviation	N
mand19	F	5.40	1.817	5
	R	6.80	1.924	5
	Total	6.10	1.912	10
mand20	F	-.20	1.095	5
	R	1.60	1.517	5
	Total	.70	1.567	10
mand21	F	-.40	2.966	5
	R	-.70	2.588	5
	Total	-.55	2.629	10
mand22	F	.20	1.924	5
	R	1.60	.894	5
	Total	.90	1.595	10
mand23	F	2.60	2.302	5
	R	2.90	.894	5
	Total	2.75	1.654	10
mand24	F	4.40	1.140	5
	R	3.10	.894	5
	Total	3.75	1.184	10
mand25	F	2.20	1.304	5
	R	2.00	1.225	5
	Total	2.10	1.197	10
mand26	F	1.00	1.414	5
	R	1.30	1.304	5
	Total	1.15	1.292	10
mand27	F	1.40	.894	5
	R	1.80	1.304	5
	Total	1.60	1.075	10
mand28	F	2.00	1.225	5
	R	3.50	1.500	5
	Total	2.75	1.514	10
mand29	F	1.00	1.581	5
	R	.60	1.140	5
	Total	.80	1.317	10
mand30	F	1.40	.894	5
	R	2.00	1.414	5
	Total	1.70	1.160	10
chin1	F	.40	.894	5
	R	3.20	1.304	5

Descriptive Statistics

	Group	Mean	Std. Deviation	N
chin1	Total	1.80	1.814	10
chin2	F	.40	1.140	5
	R	1.40	.548	5
	Total	.90	.994	10
chin3	F	1.60	2.702	5
	R	1.20	1.304	5
	Total	1.40	2.011	10
chin4	F	7.80	4.712	5
	R	7.10	2.302	5
	Total	7.45	3.515	10
chin5	F	4.60	2.966	5
	R	6.70	3.154	5
	Total	5.65	3.092	10
chin6	F	1.40	1.517	5
	R	2.60	1.140	5
	Total	2.00	1.414	10
chin7	F	1.60	1.817	5
	R	1.80	2.490	5
	Total	1.70	2.058	10
chin8	F	.20	.447	5
	R	2.00	1.225	5
	Total	1.10	1.287	10
chin9	F	2.20	1.643	5
	R	2.64	2.224	5
	Total	2.42	1.858	10
chin10	F	.60	.894	5
	R	.90	2.356	5
	Total	.75	1.687	10
chin11	F	.40	.548	5
	R	.70	.975	5
	Total	.55	.762	10
chin12	F	1.60	1.140	5
	R	2.20	2.049	5
	Total	1.90	1.595	10
chin13	F	-.80	1.095	5
	R	-1.10	2.247	5
	Total	-.95	1.674	10
chin14	F	1.00	1.414	5
	R	1.70	1.987	5
	Total	1.35	1.667	10

Descriptive Statistics

	Group	Mean	Std. Deviation	N
chin15	F	1.20	1.095	5
	R	.40	1.517	5
	Total	.80	1.317	10
chin16	F	.20	.837	5
	R	.10	1.817	5
	Total	.15	1.334	10
chin17	F	2.60	2.408	5
	R	2.80	1.956	5
	Total	2.70	2.071	10
chin18	F	2.20	.447	5
	R	2.70	.447	5
	Total	2.45	.497	10
chin19	F	1.20	1.095	5
	R	2.40	1.517	5
	Total	1.80	1.398	10
chin20	F	1.20	1.304	5
	R	2.00	1.414	5
	Total	1.60	1.350	10
chin21	F	3.20	2.387	5
	R	5.80	2.387	5
	Total	4.50	2.635	10
chin22	F	.00	.707	5
	R	-1.30	2.387	5
	Total	-.65	1.796	10
chin23	F	1.60	1.673	5
	R	1.50	1.323	5
	Total	1.55	1.423	10
chin24	F	3.60	1.949	5
	R	4.00	2.121	5
	Total	3.80	1.932	10
chin25	F	1.60	1.517	5
	R	.50	1.225	5
	Total	1.05	1.423	10
chin26	F	4.80	1.095	5
	R	4.60	1.342	5
	Total	4.70	1.160	10
chin27	F	.80	.837	5
	R	.80	.837	5

Descriptive Statistics

	Group	Mean	Std. Deviation	N
chin27	Total	.80	.789	10
chin28	F	.80	.837	5
	R	.00	2.000	5
	Total	.40	1.506	10
chin29	F	2.20	1.924	5
	R	2.00	1.000	5
	Total	2.10	1.449	10
chin30	F	.20	.447	5
	R	-.90	1.517	5
	Total	-.35	1.203	10

Multivariate Tests[d]

Effect			Value	F	Hypothesis df
Between Subjects	Intercept	Pillai's Trace	.925	24.775[a]	3.000
		Wilks' Lambda	.075	24.775[a]	3.000
		Hotelling's Trace	12.387	24.775[a]	3.000
		Roy's Largest Root	12.387	24.775[a]	3.000
	Group	Pillai's Trace	.529	2.250[a]	3.000
		Wilks' Lambda	.471	2.250[a]	3.000
		Hotelling's Trace	1.125	2.250[a]	3.000
		Roy's Largest Root	1.125	2.250[a]	3.000
Within Subjects	Image	Pillai's Trace	.[c]	.	.
		Wilks' Lambda	.[c]	.	.
		Hotelling's Trace	.[c]	.	.
		Roy's Largest Root	.[c]	.	.
	Image * Group	Pillai's Trace	.[c]	.	.
		Wilks' Lambda	.[c]	.	.
		Hotelling's Trace	.[c]	.	.
		Roy's Largest Root	.[c]	.	.

a. Exact statistic

c. Cannot produce multivariate test statistics because of insufficient residual degrees of freedom.

d. Design: Intercept + Group
Within Subjects Design: Image

Multivariate Tests[d]

Effect			Error df	Sig.	Partial Eta Squared
Between Subjects	Intercept	Pillai's Trace	6.000	.001	.925
		Wilks' Lambda	6.000	.001	.925
		Hotelling's Trace	6.000	.001	.925
		Roy's Largest Root	6.000	.001	.925
	Group	Pillai's Trace	6.000	.183	.529
		Wilks' Lambda	6.000	.183	.529
		Hotelling's Trace	6.000	.183	.529
		Roy's Largest Root	6.000	.183	.529
Within Subjects	Image	Pillai's Trace	.	.	.
		Wilks' Lambda	.	.	.
		Hotelling's Trace	.	.	.
		Roy's Largest Root	.	.	.
	Image * Group	Pillai's Trace	.	.	.
		Wilks' Lambda	.	.	.
		Hotelling's Trace	.	.	.
		Roy's Largest Root	.	.	.

d. Design: Intercept + Group
Within Subjects Design: Image

Multivariate Tests[d]

Effect			Noncent. Parameter	Observed Power[b]
Between Subjects	Intercept	Pillai's Trace	74.325	1.000
		Wilks' Lambda	74.325	1.000
		Hotelling's Trace	74.325	1.000
		Roy's Largest Root	74.325	1.000
	Group	Pillai's Trace	6.751	.330
		Wilks' Lambda	6.751	.330
		Hotelling's Trace	6.751	.330
		Roy's Largest Root	6.751	.330
Within Subjects	Image	Pillai's Trace	.	.
		Wilks' Lambda	.	.
		Hotelling's Trace	.	.
		Roy's Largest Root	.	.
	Image * Group	Pillai's Trace	.	.
		Wilks' Lambda	.	.
		Hotelling's Trace	.	.
		Roy's Largest Root	.	.

b. Computed using alpha = .05

d. Design: Intercept + Group
Within Subjects Design: Image

Tests of Within-Subjects Effects

Multivariate[c,d]

Within Subjects Effect		Value	F	Hypothesis df	Error df	Sig.
Image	Pillai's Trace	2.087	18.278	87.000	696.000	.000
	Wilks' Lambda	.027	18.632	87.000	689.068	.000
	Hotelling's Trace	7.214	18.961	87.000	686.000	.000
	Roy's Largest Root	3.361	26.885[b]	29.000	232.000	.000
Image * Group	Pillai's Trace	.439	1.371	87.000	696.000	.019
	Wilks' Lambda	.618	1.380	87.000	689.068	.017
	Hotelling's Trace	.528	1.388	87.000	686.000	.015
	Roy's Largest Root	.282	2.258[b]	29.000	232.000	.000

b. The statistic is an upper bound on F that yields a lower bound on the significance level.

c. Design: Intercept + Group
Within Subjects Design: Image

d. Tests are based on averaged variables.

Multivariate[c,d]

Within Subjects Effect		Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Image	Pillai's Trace	.696	1590.171	1.000
	Wilks' Lambda	.701	1613.598	1.000
	Hotelling's Trace	.706	1649.609	1.000
	Roy's Largest Root	.771	779.669	1.000
Image * Group	Pillai's Trace	.146	119.279	1.000
	Wilks' Lambda	.148	119.690	1.000
	Hotelling's Trace	.150	120.795	1.000
	Roy's Largest Root	.220	65.474	.999

a. Computed using alpha = .05

c. Design: Intercept + Group
Within Subjects Design: Image

d. Tests are based on averaged variables.

Univariate Tests

Source	Measure		Type III Sum of Squares	df	Mean Square	F
Image	Max	Sphericity Assumed	827.534	29	28.536	20.238
		Greenhouse-Geisser	827.534	5.362	154.339	20.238
		Huynh-Feldt	827.534	19.566	42.295	20.238
		Lower-bound	827.534	1.000	827.534	20.238
	Mand	Sphericity Assumed	841.833	29	29.029	16.036
		Greenhouse-Geisser	841.833	4.509	186.684	16.036
		Huynh-Feldt	841.833	12.346	68.189	16.036
		Lower-bound	841.833	1.000	841.833	16.036
	Chin	Sphericity Assumed	980.072	29	33.796	17.475
		Greenhouse-Geisser	980.072	5.003	195.886	17.475
		Huynh-Feldt	980.072	16.029	61.145	17.475
		Lower-bound	980.072	1.000	980.072	17.475
Image * Group	Max	Sphericity Assumed	50.454	29	1.740	1.234
		Greenhouse-Geisser	50.454	5.362	9.410	1.234
		Huynh-Feldt	50.454	19.566	2.579	1.234
		Lower-bound	50.454	1.000	50.454	1.234
	Mand	Sphericity Assumed	52.809	29	1.821	1.006
		Greenhouse-Geisser	52.809	4.509	11.711	1.006
		Huynh-Feldt	52.809	12.346	4.278	1.006

Univariate Tests

Source	Measure		Sig.	Partial Eta Squared	Noncent. Parameter
Image	Max	Sphericity Assumed	.000	.717	586.904
		Greenhouse-Geisser	.000	.717	108.513
		Huynh-Feldt	.000	.717	395.971
		Lower-bound	.002	.717	20.238
	Mand	Sphericity Assumed	.000	.667	465.048
		Greenhouse-Geisser	.000	.667	72.313
		Huynh-Feldt	.000	.667	197.977
		Lower-bound	.004	.667	16.036
	Chin	Sphericity Assumed	.000	.686	506.776
		Greenhouse-Geisser	.000	.686	87.433
		Huynh-Feldt	.000	.686	280.099
		Lower-bound	.003	.686	17.475
Image * Group	Max	Sphericity Assumed	.199	.134	35.783
		Greenhouse-Geisser	.309	.134	6.616
		Huynh-Feldt	.235	.134	24.142
		Lower-bound	.299	.134	1.234
	Mand	Sphericity Assumed	.463	.112	29.173
		Greenhouse-Geisser	.423	.112	4.536
		Huynh-Feldt	.450	.112	12.419

Univariate Tests

Source	Measure		Observed Power[a]
Image	Max	Sphericity Assumed	1.000
		Greenhouse-Geisser	1.000
		Huynh-Feldt	1.000
		Lower-bound	.975
	Mand	Sphericity Assumed	1.000
		Greenhouse-Geisser	1.000
		Huynh-Feldt	1.000
		Lower-bound	.937
	Chin	Sphericity Assumed	1.000
		Greenhouse-Geisser	1.000
		Huynh-Feldt	1.000
		Lower-bound	.954
Image * Group	Max	Sphericity Assumed	.931
		Greenhouse-Geisser	.408
		Huynh-Feldt	.828
		Lower-bound	.166
	Mand	Sphericity Assumed	.850
		Greenhouse-Geisser	.301
		Huynh-Feldt	.557

a. Computed using alpha = .05

Univariate Tests

Source	Measure		Type III Sum of Squares	df	Mean Square	F
Image * Group	Mand	Lower-bound	52.809	1.000	52.809	1.006
	Chin	Sphericity Assumed	78.384	29	2.703	1.398
		Greenhouse-Geisser	78.384	5.003	15.666	1.398
		Huynh-Feldt	78.384	16.029	4.890	1.398
		Lower-bound	78.384	1.000	78.384	1.398
Error(Image)	Max	Sphericity Assumed	327.120	232	1.410	
		Greenhouse-Geisser	327.120	42.894	7.626	
		Huynh-Feldt	327.120	156.525	2.090	
		Lower-bound	327.120	8.000	40.890	
	Mand	Sphericity Assumed	419.968	232	1.810	
		Greenhouse-Geisser	419.968	36.075	11.641	
		Huynh-Feldt	419.968	98.765	4.252	
		Lower-bound	419.968	8.000	52.496	
	Chin	Sphericity Assumed	448.673	232	1.934	
		Greenhouse-Geisser	448.673	40.026	11.209	
		Huynh-Feldt	448.673	128.228	3.499	
		Lower-bound	448.673	8.000	56.084	

Univariate Tests

Source	Measure		Sig.	Partial Eta Squared	Noncent. Parameter
Image * Group	Mand	Lower-bound	.345	.112	1.006
	Chin	Sphericity Assumed	.093	.149	40.531
		Greenhouse-Geisser	.246	.149	6.993
		Huynh-Feldt	.153	.149	22.402
		Lower-bound	.271	.149	1.398

Univariate Tests

Source	Measure		Observed Power[a]
Image * Group	Mand	Lower-bound	.144
	Chin	Sphericity Assumed	.963
		Greenhouse-Geisser	.441
		Huynh-Feldt	.826
		Lower-bound	.181

a. Computed using alpha = .05

Tests of Between-Subjects Effects

Transformed Variable:Average

Source	Measure	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	Max	423.641	1	423.641	42.911	.000	.843
	Mand	1473.640	1	1473.640	91.434	.000	.920
	Chin	1023.792	1	1023.792	29.166	.001	.785
Group	Max	77.521	1	77.521	7.852	.023	.495
	Mand	26.344	1	26.344	1.635	.237	.170
	Chin	8.400	1	8.400	.239	.638	.029
Error	Max	78.980	8	9.872			
	Mand	128.936	8	16.117			
	Chin	280.819	8	35.102			

Tests of Between-Subjects Effects

Transformed Variable:Average

Source	Measure	Noncent. Parameter	Observed Power[a]
Intercept	Max	42.911	1.000
	Mand	91.434	1.000
	Chin	29.166	.997
Group	Max	7.852	.690
	Mand	1.635	.204
	Chin	.239	.072

a. Computed using alpha = .05

Estimated Marginal Means

1. Group

Measure	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Max	F	.680	.257	.088	1.272
	R	1.697	.257	1.105	2.288
Mand	F	1.920	.328	1.164	2.676
	R	2.513	.328	1.757	3.269
Chin	F	1.680	.484	.564	2.796
	R	2.015	.484	.899	3.130

2. Image

Measure	Image	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Max	1	-.800	.374	-1.663	.063
	2	.150	.292	-.522	.822

2. Image

Measure	Image	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Max	3	-1.700	.648	-3.194	-.206
	4	1.600	.400	.678	2.522
	5	.400	.592	-.964	1.764
	6	2.350	.602	.962	3.738
	7	.000	.224	-.516	.516
	8	.800	.224	.284	1.316
	9	.300	.200	-.161	.761
	10	2.300	.495	1.159	3.441
	11	1.700	.436	.695	2.705
	12	1.400	.418	.435	2.365
	13	6.050	.487	4.926	7.174
	14	.000	.354	-.815	.815
	15	2.500	.505	1.336	3.664
	16	.000	.224	-.516	.516
	17	3.600	.447	2.569	4.631
	18	1.400	.367	.553	2.247
	19	3.550	.320	2.812	4.288
	20	.650	.245	.085	1.215
	21	-.700	.490	-1.830	.430
	22	4.800	.553	3.524	6.076
	23	1.850	.324	1.103	2.597
	24	.000	.212	-.489	.489
	25	1.250	.250	.673	1.827
	26	.100	.274	-.532	.732
	27	-.400	.458	-1.457	.657
	28	.500	.505	-.664	1.664
	29	.400	.400	-.522	1.322
	30	1.600	.430	.608	2.592

2. Image

Measure	Image	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Mand	1	1.100	.283	.448	1.752
	2	3.220	.426	2.238	4.202
	3	-1.050	.661	-2.575	.475
	4	2.400	.534	1.169	3.631
	5	.150	.837	-1.779	2.079
	6	5.000	.469	3.918	6.082
	7	.920	.512	-.261	2.101
	8	2.600	.367	1.753	3.447
	9	.450	.357	-.373	1.273
	10	3.500	.566	2.196	4.804
	11	3.350	.461	2.287	4.413
	12	1.500	.474	.406	2.594
	13	4.650	.409	3.706	5.594
	14	.950	.320	.212	1.688
	15	4.500	.381	3.622	5.378
	16	3.750	.287	3.088	4.412
	17	3.700	.374	2.837	4.563
	18	2.050	.339	1.268	2.832
	19	6.100	.592	4.736	7.464
	20	.700	.418	-.265	1.665
	21	-.550	.880	-2.580	1.480
	22	.900	.474	-.194	1.994
	23	2.750	.552	1.476	4.024
	24	3.750	.324	3.003	4.497
	25	2.100	.400	1.178	3.022
	26	1.150	.430	.158	2.142
	27	1.600	.354	.785	2.415
	28	2.750	.433	1.751	3.749
	29	.800	.436	-.205	1.805
	30	1.700	.374	.837	2.563

2. Image

Measure	Image	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Chin	1	1.800	.354	.985	2.615
	2	.900	.283	.248	1.552
	3	1.400	.671	-.147	2.947
	4	7.450	1.173	4.746	10.154
	5	5.650	.968	3.417	7.883
	6	2.000	.424	1.022	2.978
	7	1.700	.689	.111	3.289
	8	1.100	.292	.428	1.772
	9	2.420	.618	.994	3.846
	10	.750	.563	-.549	2.049
	11	.550	.250	-.027	1.127
	12	1.900	.524	.691	3.109
	13	-.950	.559	-2.239	.339
	14	1.350	.545	.092	2.608
	15	.800	.418	-.165	1.765
	16	.150	.447	-.881	1.181
	17	2.700	.694	1.100	4.300
	18	2.450	.141	2.124	2.776
	19	1.800	.418	.835	2.765
	20	1.600	.430	.608	2.592
	21	4.500	.755	2.759	6.241
	22	-.650	.557	-1.934	.634
	23	1.550	.477	.450	2.650
	24	3.800	.644	2.314	5.286
	25	1.050	.436	.045	2.055
	26	4.700	.387	3.807	5.593
	27	.800	.265	.190	1.410
	28	.400	.485	-.718	1.518
	29	2.100	.485	.982	3.218
	30	-.350	.354	-1.165	.465

3. Group * Image

Measure	Group	Image	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Max	F	1	-.600	.529	-1.820	.620
		2	.000	.412	-.951	.951
		3	-3.200	.917	-5.313	-1.087
		4	1.000	.566	-.304	2.304
		5	.600	.837	-1.329	2.529
		6	1.400	.851	-.563	3.363

3. Group * Image

Measure	Group	Image	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Max	F	7	.000	.316	-.729	.729
		8	.400	.316	-.329	1.129
		9	.000	.283	-.652	.652
		10	1.800	.700	.186	3.414
		11	1.000	.616	-.422	2.422
		12	.600	.592	-.764	1.964
		13	5.200	.689	3.611	6.789
		14	.000	.500	-1.153	1.153
		15	2.400	.714	.753	4.047
		16	.000	.316	-.729	.729
		17	2.800	.632	1.342	4.258
		18	1.000	.520	-.198	2.198
		19	2.600	.453	1.556	3.644
		20	.000	.346	-.799	.799
		21	-1.400	.693	-2.998	.198
		22	4.200	.783	2.395	6.005
		23	.600	.458	-.457	1.657
		24	-.200	.300	-.892	.492
		25	1.000	.354	.185	1.815
		26	-.200	.387	-1.093	.693
		27	-.800	.648	-2.294	.694
		28	-.600	.714	-2.247	1.047
		29	-.200	.566	-1.504	1.104
		30	1.000	.608	-.403	2.403

3. Group * Image

Measure	Group	Image	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Max	R	1	-1.000	.529	-2.220	.220
		2	.300	.412	-.651	1.251
		3	-.200	.917	-2.313	1.913
		4	2.200	.566	.896	3.504
		5	.200	.837	-1.729	2.129
		6	3.300	.851	1.337	5.263
		7	.000	.316	-.729	.729
		8	1.200	.316	.471	1.929
		9	.600	.283	-.052	1.252
		10	2.800	.700	1.186	4.414
		11	2.400	.616	.978	3.822
		12	2.200	.592	.836	3.564
		13	6.900	.689	5.311	8.489
		14	.000	.500	-1.153	1.153
		15	2.600	.714	.953	4.247
		16	.000	.316	-.729	.729
		17	4.400	.632	2.942	5.858
		18	1.800	.520	.602	2.998
		19	4.500	.453	3.456	5.544
		20	1.300	.346	.501	2.099
		21	8.327E-17	.693	-1.598	1.598
		22	5.400	.783	3.595	7.205
		23	3.100	.458	2.043	4.157
		24	.200	.300	-.492	.892
		25	1.500	.354	.685	2.315
		26	.400	.387	-.493	1.293
		27	.000	.648	-1.494	1.494
		28	1.600	.714	-.047	3.247
		29	1.000	.566	-.304	2.304
		30	2.200	.608	.797	3.603

3. Group * Image

Measure	Group	Image	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Mand	F	1	.600	.400	-.322	1.522
		2	2.600	.602	1.211	3.989
		3	-2.400	.935	-4.557	-.243
		4	1.800	.755	.059	3.541
		5	.200	1.183	-2.529	2.929
		6	4.200	.663	2.670	5.730
		7	1.200	.724	-.471	2.871
		8	2.200	.520	1.002	3.398
		9	.400	.505	-.764	1.564
		10	3.200	.800	1.355	5.045
		11	2.800	.652	1.297	4.303
		12	1.000	.671	-.547	2.547
		13	4.400	.579	3.065	5.735
		14	.400	.453	-.644	1.444
		15	4.800	.539	3.558	6.042
		16	3.800	.406	2.863	4.737
		17	3.400	.529	2.180	4.620
		18	2.000	.480	.894	3.106
		19	5.400	.837	3.471	7.329
		20	-.200	.592	-1.564	1.164
		21	-.400	1.245	-3.271	2.471
		22	.200	.671	-1.347	1.747
		23	2.600	.781	.799	4.401
		24	4.400	.458	3.343	5.457
		25	2.200	.566	.896	3.504
		26	1.000	.608	-.403	2.403
		27	1.400	.500	.247	2.553
		28	2.000	.612	.588	3.412
		29	1.000	.616	-.422	2.422
		30	1.400	.529	.180	2.620

3. Group * Image

Measure	Group	Image	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Mand	R	1	1.600	.400	.678	2.522
		2	3.840	.602	2.451	5.229
		3	.300	.935	-1.857	2.457
		4	3.000	.755	1.259	4.741
		5	.100	1.183	-2.629	2.829
		6	5.800	.663	4.270	7.330
		7	.640	.724	-1.031	2.311
		8	3.000	.520	1.802	4.198
		9	.500	.505	-.664	1.664
		10	3.800	.800	1.955	5.645
		11	3.900	.652	2.397	5.403
		12	2.000	.671	.453	3.547
		13	4.900	.579	3.565	6.235
		14	1.500	.453	.456	2.544
		15	4.200	.539	2.958	5.442
		16	3.700	.406	2.763	4.637
		17	4.000	.529	2.780	5.220
		18	2.100	.480	.994	3.206
		19	6.800	.837	4.871	8.729
		20	1.600	.592	.236	2.964
		21	-.700	1.245	-3.571	2.171
		22	1.600	.671	.053	3.147
		23	2.900	.781	1.099	4.701
		24	3.100	.458	2.043	4.157
		25	2.000	.566	.696	3.304
		26	1.300	.608	-.103	2.703
		27	1.800	.500	.647	2.953
		28	3.500	.612	2.088	4.912
		29	.600	.616	-.822	2.022
		30	2.000	.529	.780	3.220

3. Group * Image

Measure	Group	Image	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Chin	F	1	.400	.500	-.753	1.553
		2	.400	.400	-.522	1.322
		3	1.600	.949	-.588	3.788
		4	7.800	1.658	3.976	11.624
		5	4.600	1.369	1.442	7.758
		6	1.400	.600	.016	2.784
		7	1.600	.975	-.648	3.848
		8	.200	.412	-.751	1.151
		9	2.200	.875	.183	4.217
		10	.600	.797	-1.238	2.438
		11	.400	.354	-.415	1.215
		12	1.600	.742	-.110	3.310
		13	-.800	.791	-2.623	1.023
		14	1.000	.771	-.779	2.779
		15	1.200	.592	-.164	2.564
		16	.200	.632	-1.258	1.658
		17	2.600	.981	.338	4.862
		18	2.200	.200	1.739	2.661
		19	1.200	.592	-.164	2.564
		20	1.200	.608	-.203	2.603
		21	3.200	1.068	.738	5.662
		22	.000	.787	-1.816	1.816
		23	1.600	.675	.045	3.155
		24	3.600	.911	1.499	5.701
		25	1.600	.616	.178	3.022
		26	4.800	.548	3.537	6.063
		27	.800	.374	-.063	1.663
		28	.800	.686	-.781	2.381
		29	2.200	.686	.619	3.781
		30	.200	.500	-.953	1.353

3. Group * Image

Measure	Group	Image	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Chin	R	1	3.200	.500	2.047	4.353
		2	1.400	.400	.478	2.322
		3	1.200	.949	-.988	3.388
		4	7.100	1.658	3.276	10.924
		5	6.700	1.369	3.542	9.858
		6	2.600	.600	1.216	3.984
		7	1.800	.975	-.448	4.048
		8	2.000	.412	1.049	2.951
		9	2.640	.875	.623	4.657
		10	.900	.797	-.938	2.738
		11	.700	.354	-.115	1.515
		12	2.200	.742	.490	3.910
		13	-1.100	.791	-2.923	.723
		14	1.700	.771	-.079	3.479
		15	.400	.592	-.964	1.764
		16	.100	.632	-1.358	1.558
		17	2.800	.981	.538	5.062
		18	2.700	.200	2.239	3.161
		19	2.400	.592	1.036	3.764
		20	2.000	.608	.597	3.403
		21	5.800	1.068	3.338	8.262
		22	-1.300	.787	-3.116	.516
		23	1.500	.675	-.055	3.055
		24	4.000	.911	1.899	6.101
		25	.500	.616	-.922	1.922
		26	4.600	.548	3.337	5.863
		27	.800	.374	-.063	1.663
		28	.000	.686	-1.581	1.581
		29	2.000	.686	.419	3.581
		30	-.900	.500	-2.053	.253

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Descriptive Statistics

	Group	Mean	Std. Deviation	N
max1	F	-.6000	1.34164	5
	R	-1.0000	1.00000	5
	Total	-.8000	1.13529	10
amax1	F	-2.0000	.00000	5
	R	-2.0000	.00000	5
	Total	-2.0000	.00000	10
max2	F	.0000	.70711	5
	R	.3000	1.09545	5
	Total	.1500	.88349	10
amax2	F	2.0000	.00000	5
	R	2.0000	.00000	5
	Total	2.0000	.00000	10
max3	F	-3.2000	2.16795	5
	R	-.2000	1.92354	5
	Total	-1.7000	2.49666	10
amax3	F	1.8000	.00000	5
	R	1.8000	.00000	5
	Total	1.8000	.00000	10
max4	F	1.0000	1.00000	5
	R	2.2000	1.48324	5
	Total	1.6000	1.34990	10
amax4	F	8.0000	.00000	5
	R	8.0000	.00000	5
	Total	8.0000	.00000	10
max5	F	.6000	1.51658	5
	R	.2000	2.16795	5
	Total	.4000	1.77639	10
amax5	F	-2.0000	.00000	5
	R	-2.0000	.00000	5
	Total	-2.0000	.00000	10
max6	F	1.4000	2.19089	5
	R	3.3000	1.56525	5
	Total	2.3500	2.05548	10

Descriptive Statistics

	Group	Mean	Std. Deviation	N
amax6	F	9.0000	.00000	5
	R	9.0000	.00000	5
	Total	9.0000	.00000	10
max7	F	.0000	.70711	5
	R	.0000	.70711	5
	Total	.0000	.66667	10
amax7	F	-1.8000	.00000	5
	R	-1.8000	.00000	5
	Total	-1.8000	.00000	10
max8	F	.4000	.54772	5
	R	1.2000	.83666	5
	Total	.8000	.78881	10
amax8	F	3.0000	.00000	5
	R	3.0000	.00000	5
	Total	3.0000	.00000	10
max9	F	.0000	.70711	5
	R	.6000	.54772	5
	Total	.3000	.67495	10
amax9	F	8.0000	.00000	5
	R	8.0000	.00000	5
	Total	8.0000	.00000	10
max10	F	1.8000	1.78885	5
	R	2.8000	1.30384	5
	Total	2.3000	1.56702	10
amax10	F	10.0000	.00000	5
	R	10.0000	.00000	5
	Total	10.0000	.00000	10
max11	F	1.0000	1.73205	5
	R	2.4000	.89443	5
	Total	1.7000	1.49443	10
amax11	F	8.0000	.00000	5
	R	8.0000	.00000	5
	Total	8.0000	.00000	10
max12	F	.6000	.89443	5
	R	2.2000	1.64317	5
	Total	1.4000	1.50555	10
amax12	F	7.6000	.00000	5
	R	7.6000	.00000	5

Descriptive Statistics

	Group	Mean	Std. Deviation	N
amax12	Total	7.6000	.00000	10
max13	F	5.2000	1.09545	5
	R	6.9000	1.88414	5
	Total	6.0500	1.70701	10
amax13	F	10.5000	.00000	5
	R	10.5000	.00000	5
	Total	10.5000	.00000	10
max14	F	.0000	1.41421	5
	R	.0000	.70711	5
	Total	.0000	1.05409	10
amax14	F	2.0000	.00000	5
	R	2.0000	.00000	5
	Total	2.0000	.00000	10
max15	F	2.4000	2.07364	5
	R	2.6000	.89443	5
	Total	2.5000	1.50923	10
amax15	F	.0000	.00000	5
	R	.0000	.00000	5
	Total	.0000	.00000	10
max16	F	.0000	.70711	5
	R	.0000	.70711	5
	Total	.0000	.66667	10
amax16	F	2.0000	.00000	5
	R	2.0000	.00000	5
	Total	2.0000	.00000	10
max17	F	2.8000	1.48324	5
	R	4.4000	1.34164	5
	Total	3.6000	1.57762	10
amax17	F	5.5000	.00000	5
	R	5.5000	.00000	5
	Total	5.5000	.00000	10
max18	F	1.0000	1.41421	5
	R	1.8000	.83666	5
	Total	1.4000	1.17379	10
amax18	F	7.7000	.00000	5
	R	7.7000	.00000	5
	Total	7.7000	.00000	10
max19	F	2.6000	.54772	5
	R	4.5000	1.32288	5
	Total	3.5500	1.38343	10

Descriptive Statistics

	Group	Mean	Std. Deviation	N
amax19	F	4.3000	.00000	5
	R	4.3000	.00000	5
	Total	4.3000	.00000	10
max20	F	.0000	.70711	5
	R	1.3000	.83666	5
	Total	.6500	1.00139	10
amax20	F	4.0000	.00000	5
	R	4.0000	.00000	5
	Total	4.0000	.00000	10
max21	F	-1.4000	1.14018	5
	R	.0000	1.87083	5
	Total	-.7000	1.63639	10
amax21	F	9.0000	.00000	5
	R	9.0000	.00000	5
	Total	9.0000	.00000	10
max22	F	4.2000	2.38747	5
	R	5.4000	.65192	5
	Total	4.8000	1.76698	10
amax22	F	11.0000	.00000	5
	R	11.0000	.00000	5
	Total	11.0000	.00000	10
max23	F	.6000	.89443	5
	R	3.1000	1.14018	5
	Total	1.8500	1.63384	10
amax23	F	9.0000	.00000	5
	R	9.0000	.00000	5
	Total	9.0000	.00000	10
max24	F	-.2000	.44721	5
	R	.2000	.83666	5
	Total	.0000	.66667	10
amax24	F	7.0000	.00000	5
	R	7.0000	.00000	5
	Total	7.0000	.00000	10
max25	F	1.0000	1.00000	5
	R	1.5000	.50000	5
	Total	1.2500	.79057	10
amax25	F	3.3000	.00000	5
	R	3.3000	.00000	5

Descriptive Statistics

	Group	Mean	Std. Deviation	N
amax25	Total	3.3000	.00000	10
max26	F	-.2000	.44721	5
	R	.4000	1.14018	5
	Total	.1000	.87560	10
amax26	F	1.5000	.00000	5
	R	1.5000	.00000	5
	Total	1.5000	.00000	10
max27	F	-.8000	1.64317	5
	R	.0000	1.22474	5
	Total	-.4000	1.42984	10
amax27	F	10.0000	.00000	5
	R	10.0000	.00000	5
	Total	10.0000	.00000	10
max28	F	-.6000	1.34164	5
	R	1.6000	1.81659	5
	Total	.5000	1.90029	10
amax28	F	4.0000	.00000	5
	R	4.0000	.00000	5
	Total	4.0000	.00000	10
max29	F	-.2000	1.48324	5
	R	1.0000	1.00000	5
	Total	.4000	1.34990	10
amax29	F	2.5000	.00000	5
	R	2.5000	.00000	5
	Total	2.5000	.00000	10
max30	F	1.0000	1.00000	5
	R	2.2000	1.64317	5
	Total	1.6000	1.42984	10
amax30	F	7.0000	.00000	5
	R	7.0000	.00000	5
	Total	7.0000	.00000	10
mand1	F	.6000	.89443	5
	R	1.6000	.89443	5
	Total	1.1000	.99443	10
amand1	F	-2.5000	.00000	5
	R	-2.5000	.00000	5
	Total	-2.5000	.00000	10
mand2	F	2.6000	1.67332	5
	R	3.8400	.90995	5
	Total	3.2200	1.42813	10

Descriptive Statistics

	Group	Mean	Std. Deviation	N
amand2	F	.4000	.00000	5
	R	.4000	.00000	5
	Total	.4000	.00000	10
mand3	F	-2.4000	1.81659	5
	R	.3000	2.33452	5
	Total	-1.0500	2.43185	10
amand3	F	.5000	.00000	5
	R	.5000	.00000	5
	Total	.5000	.00000	10
mand4	F	1.8000	1.30384	5
	R	3.0000	2.00000	5
	Total	2.4000	1.71270	10
amand4	F	.0000	.00000	5
	R	.0000	.00000	5
	Total	.0000	.00000	10
mand5	F	.2000	2.86356	5
	R	.1000	2.40832	5
	Total	.1500	2.49499	10
amand5	F	-10.3000	.00000	5
	R	-10.3000	.00000	5
	Total	-10.3000	.00000	10
mand6	F	4.2000	1.92354	5
	R	5.8000	.83666	5
	Total	5.0000	1.63299	10
amand6	F	7.0000	.00000	5
	R	7.0000	.00000	5
	Total	7.0000	.00000	10
mand7	F	1.2000	1.30384	5
	R	.6400	1.88361	5
	Total	.9200	1.55549	10
amand7	F	-6.0000	.00000	5
	R	-6.0000	.00000	5
	Total	-6.0000	.00000	10
mand8	F	2.2000	1.48324	5
	R	3.0000	.70711	5
	Total	2.6000	1.17379	10
amand8	F	-1.5000	.00000	5
	R	-1.5000	.00000	5

Descriptive Statistics

	Group	Mean	Std. Deviation	N
amand8	Total	-1.5000	.00000	10
mand9	F	.4000	.89443	5
	R	.5000	1.32288	5
	Total	.4500	1.06589	10
amand9	F	3.0000	.00000	5
	R	3.0000	.00000	5
	Total	3.0000	.00000	10
mand10	F	3.2000	2.16795	5
	R	3.8000	1.30384	5
	Total	3.5000	1.71594	10
amand10	F	6.2000	.00000	5
	R	6.2000	.00000	5
	Total	6.2000	.00000	10
mand11	F	2.8000	1.48324	5
	R	3.9000	1.43178	5
	Total	3.3500	1.49164	10
amand11	F	6.1000	.00000	5
	R	6.1000	.00000	5
	Total	6.1000	.00000	10
mand12	F	1.0000	1.73205	5
	R	2.0000	1.22474	5
	Total	1.5000	1.50923	10
amand12	F	5.0000	.00000	5
	R	5.0000	.00000	5
	Total	5.0000	.00000	10
mand13	F	4.4000	1.34164	5
	R	4.9000	1.24499	5
	Total	4.6500	1.24833	10
amand13	F	3.0000	.00000	5
	R	3.0000	.00000	5
	Total	3.0000	.00000	10
mand14	F	.4000	.89443	5
	R	1.5000	1.11803	5
	Total	.9500	1.11679	10
amand14	F	.0000	.00000	5
	R	.0000	.00000	5
	Total	.0000	.00000	10
mand15	F	4.8000	1.09545	5
	R	4.2000	1.30384	5
	Total	4.5000	1.17851	10

Descriptive Statistics

	Group	Mean	Std. Deviation	N
amand15	F	-4.0000	.00000	5
	R	-4.0000	.00000	5
	Total	-4.0000	.00000	10
mand16	F	3.8000	.83666	5
	R	3.7000	.97468	5
	Total	3.7500	.85797	10
amand16	F	3.0000	.00000	5
	R	3.0000	.00000	5
	Total	3.0000	.00000	10
mand17	F	3.4000	1.14018	5
	R	4.0000	1.22474	5
	Total	3.7000	1.15950	10
amand17	F	-.5000	.00000	5
	R	-.5000	.00000	5
	Total	-.5000	.00000	10
mand18	F	2.0000	1.22474	5
	R	2.1000	.89443	5
	Total	2.0500	1.01242	10
amand18	F	4.0000	.00000	5
	R	4.0000	.00000	5
	Total	4.0000	.00000	10
mand19	F	5.4000	1.81659	5
	R	6.8000	1.92354	5
	Total	6.1000	1.91195	10
amand19	F	3.0000	.00000	5
	R	3.0000	.00000	5
	Total	3.0000	.00000	10
mand20	F	-.2000	1.09545	5
	R	1.6000	1.51658	5
	Total	.7000	1.56702	10
amand20	F	-6.0000	.00000	5
	R	-6.0000	.00000	5
	Total	-6.0000	.00000	10
mand21	F	-.4000	2.96648	5
	R	-.7000	2.58844	5
	Total	-.5500	2.62943	10
amand21	F	2.5000	.00000	5
	R	2.5000	.00000	5

Descriptive Statistics

	Group	Mean	Std. Deviation	N
amand21	Total	2.5000	.00000	10
mand22	F	.2000	1.92354	5
	R	1.6000	.89443	5
	Total	.9000	1.59513	10
amand22	F	.0000	.00000	5
	R	.0000	.00000	5
	Total	.0000	.00000	10
mand23	F	2.6000	2.30217	5
	R	2.9000	.89443	5
	Total	2.7500	1.65412	10
amand23	F	3.4000	.00000	5
	R	3.4000	.00000	5
	Total	3.4000	.00000	10
mand24	F	4.4000	1.14018	5
	R	3.1000	.89443	5
	Total	3.7500	1.18439	10
amand24	F	7.0000	.00000	5
	R	7.0000	.00000	5
	Total	7.0000	.00000	10
mand25	F	2.2000	1.30384	5
	R	2.0000	1.22474	5
	Total	2.1000	1.19722	10
amand25	F	-4.0000	.00000	5
	R	-4.0000	.00000	5
	Total	-4.0000	.00000	10
mand26	F	1.0000	1.41421	5
	R	1.3000	1.30384	5
	Total	1.1500	1.29207	10
amand26	F	-3.7000	.00000	5
	R	-3.7000	.00000	5
	Total	-3.7000	.00000	10
mand27	F	1.4000	.89443	5
	R	1.8000	1.30384	5
	Total	1.6000	1.07497	10
amand27	F	4.0000	.00000	5
	R	4.0000	.00000	5
	Total	4.0000	.00000	10
mand28	F	2.0000	1.22474	5
	R	3.5000	1.50000	5
	Total	2.7500	1.51383	10

Descriptive Statistics

	Group	Mean	Std. Deviation	N
amand28	F	.3000	.00000	5
	R	.3000	.00000	5
	Total	.3000	.00000	10
mand29	F	1.0000	1.58114	5
	R	.6000	1.14018	5
	Total	.8000	1.31656	10
amand29	F	-3.5000	.00000	5
	R	-3.5000	.00000	5
	Total	-3.5000	.00000	10
mand30	F	1.4000	.89443	5
	R	2.0000	1.41421	5
	Total	1.7000	1.15950	10
amand30	F	6.0000	.00000	5
	R	6.0000	.00000	5
	Total	6.0000	.00000	10
chin1	F	.4000	.89443	5
	R	3.2000	1.30384	5
	Total	1.8000	1.81353	10
achin1	F	5.5000	.00000	5
	R	5.5000	.00000	5
	Total	5.5000	.00000	10
chin2	F	.4000	1.14018	5
	R	1.4000	.54772	5
	Total	.9000	.99443	10
achin2	F	1.5000	.00000	5
	R	1.5000	.00000	5
	Total	1.5000	.00000	10
chin3	F	1.6000	2.70185	5
	R	1.2000	1.30384	5
	Total	1.4000	2.01108	10
achin3	F	2.8000	.00000	5
	R	2.8000	.00000	5
	Total	2.8000	.00000	10
chin4	F	7.8000	4.71169	5
	R	7.1000	2.30217	5
	Total	7.4500	3.51544	10
achin4	F	9.0000	.00000	5
	R	9.0000	.00000	5

Descriptive Statistics

	Group	Mean	Std. Deviation	N
achin4	Total	9.0000	.00000	10
chin5	F	4.6000	2.96648	5
	R	6.7000	3.15436	5
	Total	5.6500	3.09166	10
achin5	F	1.0000	.00000	5
	R	1.0000	.00000	5
	Total	1.0000	.00000	10
chin6	F	1.4000	1.51658	5
	R	2.6000	1.14018	5
	Total	2.0000	1.41421	10
achin6	F	4.0000	.00000	5
	R	4.0000	.00000	5
	Total	4.0000	.00000	10
chin7	F	1.6000	1.81659	5
	R	1.8000	2.48998	5
	Total	1.7000	2.05751	10
achin7	F	1.0000	.00000	5
	R	1.0000	.00000	5
	Total	1.0000	.00000	10
chin8	F	.2000	.44721	5
	R	2.0000	1.22474	5
	Total	1.1000	1.28668	10
achin8	F	.0000	.00000	5
	R	.0000	.00000	5
	Total	.0000	.00000	10
chin9	F	2.2000	1.64317	5
	R	2.6400	2.22441	5
	Total	2.4200	1.85820	10
achin9	F	5.0000	.00000	5
	R	5.0000	.00000	5
	Total	5.0000	.00000	10
chin10	F	.6000	.89443	5
	R	.9000	2.35584	5
	Total	.7500	1.68737	10
achin10	F	2.6000	.00000	5
	R	2.6000	.00000	5
	Total	2.6000	.00000	10
chin11	F	.4000	.54772	5
	R	.7000	.97468	5
	Total	.5500	.76194	10

Descriptive Statistics

	Group	Mean	Std. Deviation	N
achin11	F	2.0000	.00000	5
	R	2.0000	.00000	5
	Total	2.0000	.00000	10
chin12	F	1.6000	1.14018	5
	R	2.2000	2.04939	5
	Total	1.9000	1.59513	10
achin12	F	3.5000	.00000	5
	R	3.5000	.00000	5
	Total	3.5000	.00000	10
chin13	F	-.8000	1.09545	5
	R	-1.1000	2.24722	5
	Total	-.9500	1.67415	10
achin13	F	-6.5000	.00000	5
	R	-6.5000	.00000	5
	Total	-6.5000	.00000	10
chin14	F	1.0000	1.41421	5
	R	1.7000	1.98746	5
	Total	1.3500	1.66750	10
achin14	F	3.0000	.00000	5
	R	3.0000	.00000	5
	Total	3.0000	.00000	10
chin15	F	1.2000	1.09545	5
	R	.4000	1.51658	5
	Total	.8000	1.31656	10
achin15	F	-1.7000	.00000	5
	R	-1.7000	.00000	5
	Total	-1.7000	.00000	10
chin16	F	.2000	.83666	5
	R	.1000	1.81659	5
	Total	.1500	1.33437	10
achin16	F	-.5000	.00000	5
	R	-.5000	.00000	5
	Total	-.5000	.00000	10
chin17	F	2.6000	2.40832	5
	R	2.8000	1.95576	5
	Total	2.7000	2.07096	10
achin17	F	2.0000	.00000	5
	R	2.0000	.00000	5

Descriptive Statistics

	Group	Mean	Std. Deviation	N
achin17	Total	2.0000	.00000	10
chin18	F	2.2000	.44721	5
	R	2.7000	.44721	5
	Total	2.4500	.49721	10
achin18	F	4.5000	.00000	5
	R	4.5000	.00000	5
	Total	4.5000	.00000	10
chin19	F	1.2000	1.09545	5
	R	2.4000	1.51658	5
	Total	1.8000	1.39841	10
achin19	F	3.0000	.00000	5
	R	3.0000	.00000	5
	Total	3.0000	.00000	10
chin20	F	1.2000	1.30384	5
	R	2.0000	1.41421	5
	Total	1.6000	1.34990	10
achin20	F	1.8000	.00000	5
	R	1.8000	.00000	5
	Total	1.8000	.00000	10
chin21	F	3.2000	2.38747	5
	R	5.8000	2.38747	5
	Total	4.5000	2.63523	10
achin21	F	6.7000	.00000	5
	R	6.7000	.00000	5
	Total	6.7000	.00000	10
chin22	F	.0000	.70711	5
	R	-1.3000	2.38747	5
	Total	-.6500	1.79583	10
achin22	F	3.0000	.00000	5
	R	3.0000	.00000	5
	Total	3.0000	.00000	10
chin23	F	1.6000	1.67332	5
	R	1.5000	1.32288	5
	Total	1.5500	1.42302	10
achin23	F	3.1000	.00000	5
	R	3.1000	.00000	5
	Total	3.1000	.00000	10
chin24	F	3.6000	1.94936	5
	R	4.0000	2.12132	5
	Total	3.8000	1.93218	10

Descriptive Statistics

	Group	Mean	Std. Deviation	N
achin24	F	5.0000	.00000	5
	R	5.0000	.00000	5
	Total	5.0000	.00000	10
chin25	F	1.6000	1.51658	5
	R	.5000	1.22474	5
	Total	1.0500	1.42302	10
achin25	F	.7000	.00000	5
	R	.7000	.00000	5
	Total	.7000	.00000	10
chin26	F	4.8000	1.09545	5
	R	4.6000	1.34164	5
	Total	4.7000	1.15950	10
achin26	F	5.5000	.00000	5
	R	5.5000	.00000	5
	Total	5.5000	.00000	10
chin27	F	.8000	.83666	5
	R	.8000	.83666	5
	Total	.8000	.78881	10
achin27	F	2.0000	.00000	5
	R	2.0000	.00000	5
	Total	2.0000	.00000	10
chin28	F	.8000	.83666	5
	R	.0000	2.00000	5
	Total	.4000	1.50555	10
achin28	F	1.5000	.00000	5
	R	1.5000	.00000	5
	Total	1.5000	.00000	10
chin29	F	2.2000	1.92354	5
	R	2.0000	1.00000	5
	Total	2.1000	1.44914	10
achin29	F	.0000	.00000	5
	R	.0000	.00000	5
	Total	.0000	.00000	10
chin30	F	.2000	.44721	5
	R	-.9000	1.51658	5
	Total	-.3500	1.20301	10
achin30	F	.4000	.00000	5
	R	.4000	.00000	5
	Total	.4000	.00000	10

Multivariate Tests[d]

Effect			Value	F	Hypothesis df
Between Subjects	Intercept	Pillai's Trace	.993	302.583[a]	3.000
		Wilks' Lambda	.007	302.583[a]	3.000
		Hotelling's Trace	151.291	302.583[a]	3.000
		Roy's Largest Root	151.291	302.583[a]	3.000
	Group	Pillai's Trace	.529	2.250[a]	3.000
		Wilks' Lambda	.471	2.250[a]	3.000
		Hotelling's Trace	1.125	2.250[a]	3.000
		Roy's Largest Root	1.125	2.250[a]	3.000
Within Subjects	Images	Pillai's Trace	.[c]	.	.
		Wilks' Lambda	.[c]	.	.
		Hotelling's Trace	.[c]	.	.
		Roy's Largest Root	.[c]	.	.
	Images * Group	Pillai's Trace	.[c]	.	.
		Wilks' Lambda	.[c]	.	.
		Hotelling's Trace	.[c]	.	.
		Roy's Largest Root	.[c]	.	.
	Pairs	Pillai's Trace	.990	201.756[a]	3.000
		Wilks' Lambda	.010	201.756[a]	3.000
		Hotelling's Trace	100.878	201.756[a]	3.000
		Roy's Largest Root	100.878	201.756[a]	3.000
	Pairs * Group	Pillai's Trace	.529	2.250[a]	3.000
		Wilks' Lambda	.471	2.250[a]	3.000
		Hotelling's Trace	1.125	2.250[a]	3.000
		Roy's Largest Root	1.125	2.250[a]	3.000
	Images * Pairs	Pillai's Trace	.[c]	.	.
		Wilks' Lambda	.[c]	.	.
		Hotelling's Trace	.[c]	.	.
		Roy's Largest Root	.[c]	.	.
	Images * Pairs * Group	Pillai's Trace	.[c]	.	.
		Wilks' Lambda	.[c]	.	.
		Hotelling's Trace	.[c]	.	.
		Roy's Largest Root	.[c]	.	.

a. Exact statistic

c. Cannot produce multivariate test statistics because of insufficient residual degrees of freedom.

d. Design: Intercept + Group
Within Subjects Design: Images + Pairs + Images * Pairs

Multivariate Tests[d]

Effect			Error df	Sig.	Partial Eta Squared
Between Subjects	Intercept	Pillai's Trace	6.000	.000	.993
		Wilks' Lambda	6.000	.000	.993
		Hotelling's Trace	6.000	.000	.993
		Roy's Largest Root	6.000	.000	.993
	Group	Pillai's Trace	6.000	.183	.529
		Wilks' Lambda	6.000	.183	.529
		Hotelling's Trace	6.000	.183	.529
		Roy's Largest Root	6.000	.183	.529
Within Subjects	Images	Pillai's Trace	.	.	.
		Wilks' Lambda	.	.	.
		Hotelling's Trace	.	.	.
		Roy's Largest Root	.	.	.
	Images * Group	Pillai's Trace	.	.	.
		Wilks' Lambda	.	.	.
		Hotelling's Trace	.	.	.
		Roy's Largest Root	.	.	.
	Pairs	Pillai's Trace	6.000	.000	.990
		Wilks' Lambda	6.000	.000	.990
		Hotelling's Trace	6.000	.000	.990
		Roy's Largest Root	6.000	.000	.990
	Pairs * Group	Pillai's Trace	6.000	.183	.529
		Wilks' Lambda	6.000	.183	.529
		Hotelling's Trace	6.000	.183	.529
		Roy's Largest Root	6.000	.183	.529
	Images * Pairs	Pillai's Trace	.	.	.
		Wilks' Lambda	.	.	.
		Hotelling's Trace	.	.	.
		Roy's Largest Root	.	.	.
	Images * Pairs * Group	Pillai's Trace	.	.	.
		Wilks' Lambda	.	.	.
		Hotelling's Trace	.	.	.
		Roy's Largest Root	.	.	.

d. Design: Intercept + Group
Within Subjects Design: Images + Pairs + Images * Pairs

Multivariate Tests[d]

Effect			Noncent. Parameter	Observed Power[b]
Between Subjects	Intercept	Pillai's Trace	907.748	1.000
		Wilks' Lambda	907.748	1.000
		Hotelling's Trace	907.748	1.000
		Roy's Largest Root	907.748	1.000
	Group	Pillai's Trace	6.751	.330
		Wilks' Lambda	6.751	.330
		Hotelling's Trace	6.751	.330
		Roy's Largest Root	6.751	.330
Within Subjects	Images	Pillai's Trace	.	.
		Wilks' Lambda	.	.
		Hotelling's Trace	.	.
		Roy's Largest Root	.	.
	Images * Group	Pillai's Trace	.	.
		Wilks' Lambda	.	.
		Hotelling's Trace	.	.
		Roy's Largest Root	.	.
	Pairs	Pillai's Trace	605.268	1.000
		Wilks' Lambda	605.268	1.000
		Hotelling's Trace	605.268	1.000
		Roy's Largest Root	605.268	1.000
	Pairs * Group	Pillai's Trace	6.751	.330
		Wilks' Lambda	6.751	.330
		Hotelling's Trace	6.751	.330
		Roy's Largest Root	6.751	.330
	Images * Pairs	Pillai's Trace	.	.
		Wilks' Lambda	.	.
		Hotelling's Trace	.	.
		Roy's Largest Root	.	.
	Images * Pairs * Group	Pillai's Trace	.	.
		Wilks' Lambda	.	.
		Hotelling's Trace	.	.
		Roy's Largest Root	.	.

b. Computed using alpha = .05

d. Design: Intercept + Group
Within Subjects Design: Images + Pairs + Images * Pairs

Tests of Within-Subjects Effects

Multivariate[d,e]

Within Subjects Effect		Value	F	Hypothesis df	Error df
Images	Pillai's Trace	2.832	135.254	87.000	696.000
	Wilks' Lambda	.000	141.227	87.000	689.068
	Hotelling's Trace	55.222	145.143	87.000	686.000
	Roy's Largest Root	23.091	184.732[b]	29.000	232.000
Images * Group	Pillai's Trace	.439	1.371	87.000	696.000
	Wilks' Lambda	.618	1.380	87.000	689.068
	Hotelling's Trace	.528	1.388	87.000	686.000
	Roy's Largest Root	.282	2.258[b]	29.000	232.000
Pairs	Pillai's Trace	.990	201.756[c]	3.000	6.000
	Wilks' Lambda	.010	201.756[c]	3.000	6.000
	Hotelling's Trace	100.878	201.756[c]	3.000	6.000
	Roy's Largest Root	100.878	201.756[c]	3.000	6.000
Pairs * Group	Pillai's Trace	.529	2.250[c]	3.000	6.000
	Wilks' Lambda	.471	2.250[c]	3.000	6.000
	Hotelling's Trace	1.125	2.250[c]	3.000	6.000
	Roy's Largest Root	1.125	2.250[c]	3.000	6.000
Images * Pairs	Pillai's Trace	2.384	30.972	87.000	696.000
	Wilks' Lambda	.004	43.315	87.000	689.068
	Hotelling's Trace	22.410	58.901	87.000	686.000
	Roy's Largest Root	15.372	122.977[b]	29.000	232.000
Images * Pairs * Group	Pillai's Trace	.439	1.371	87.000	696.000
	Wilks' Lambda	.618	1.380	87.000	689.068
	Hotelling's Trace	.528	1.388	87.000	686.000
	Roy's Largest Root	.282	2.258[b]	29.000	232.000

b. The statistic is an upper bound on F that yields a lower bound on the significance level.

c. Exact statistic

d. Design: Intercept + Group
Within Subjects Design: Images + Pairs + Images * Pairs

e. Tests are based on averaged variables.

Multivariate[d,e]

Within Subjects Effect		Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Images	Pillai's Trace	.000	.944	11767.088	1.000
	Wilks' Lambda	.000	.946	12186.842	1.000
	Hotelling's Trace	.000	.948	12627.455	1.000
	Roy's Largest Root	.000	.958	5357.217	1.000
Images * Group	Pillai's Trace	.019	.146	119.279	1.000
	Wilks' Lambda	.017	.148	119.690	1.000
	Hotelling's Trace	.015	.150	120.795	1.000
	Roy's Largest Root	.000	.220	65.474	.999
Pairs	Pillai's Trace	.000	.990	605.268	1.000
	Wilks' Lambda	.000	.990	605.268	1.000
	Hotelling's Trace	.000	.990	605.268	1.000
	Roy's Largest Root	.000	.990	605.268	1.000
Pairs * Group	Pillai's Trace	.183	.529	6.751	.330
	Wilks' Lambda	.183	.529	6.751	.330
	Hotelling's Trace	.183	.529	6.751	.330
	Roy's Largest Root	.183	.529	6.751	.330
Images * Pairs	Pillai's Trace	.000	.795	2694.533	1.000
	Wilks' Lambda	.000	.845	3746.526	1.000
	Hotelling's Trace	.000	.882	5124.406	1.000
	Roy's Largest Root	.000	.939	3566.337	1.000
Images * Pairs * Group	Pillai's Trace	.019	.146	119.279	1.000
	Wilks' Lambda	.017	.148	119.690	1.000
	Hotelling's Trace	.015	.150	120.795	1.000
	Roy's Largest Root	.000	.220	65.474	.999

a. Computed using alpha = .05

d. Design: Intercept + Group
Within Subjects Design: Images + Pairs + Images * Pairs

e. Tests are based on averaged variables.

Univariate Tests

Source	Measure		Type III Sum of Squares	df	Mean Square
Images	Max	Sphericity Assumed	3583.887	29	123.582
		Greenhouse-Geisser	3583.887	5.362	668.411
		Huynh-Feldt	3583.887	19.566	183.172
		Lower-bound	3583.887	1.000	3583.887

Univariate Tests

Source	Measure		F	Sig.	Partial Eta Squared
Images	Max	Sphericity Assumed	175.294	.000	.956
		Greenhouse-Geisser	175.294	.000	.956
		Huynh-Feldt	175.294	.000	.956
		Lower-bound	175.294	.000	.956

Univariate Tests

Source	Measure		Noncent. Parameter	Observed Power[a]
Images	Max	Sphericity Assumed	5083.528	1.000
		Greenhouse-Geisser	939.893	1.000
		Huynh-Feldt	3429.746	1.000
		Lower-bound	175.294	1.000

a. Computed using alpha = .05

Univariate Tests

Source	Measure		Type III Sum of Squares	df	Mean Square
Images	Mand	Sphericity Assumed	4038.311	29	139.252
		Greenhouse-Geisser	4038.311	4.509	895.534
		Huynh-Feldt	4038.311	12.346	327.103
		Lower-bound	4038.311	1.000	4038.311
	Chin	Sphericity Assumed	2675.930	29	92.273
		Greenhouse-Geisser	2675.930	5.003	534.834
		Huynh-Feldt	2675.930	16.029	166.948
		Lower-bound	2675.930	1.000	2675.930
Images * Group	Max	Sphericity Assumed	25.227	29	.870
		Greenhouse-Geisser	25.227	5.362	4.705
		Huynh-Feldt	25.227	19.566	1.289
		Lower-bound	25.227	1.000	25.227
	Mand	Sphericity Assumed	26.404	29	.910
		Greenhouse-Geisser	26.404	4.509	5.855
		Huynh-Feldt	26.404	12.346	2.139
		Lower-bound	26.404	1.000	26.404
	Chin	Sphericity Assumed	39.192	29	1.351
		Greenhouse-Geisser	39.192	5.003	7.833
		Huynh-Feldt	39.192	16.029	2.445
		Lower-bound	39.192	1.000	39.192
Error(Images)	Max	Sphericity Assumed	163.560	232	.705
		Greenhouse-Geisser	163.560	42.894	3.813
		Huynh-Feldt	163.560	156.525	1.045
		Lower-bound	163.560	8.000	20.445
	Mand	Sphericity Assumed	209.984	232	.905
		Greenhouse-Geisser	209.984	36.075	5.821
		Huynh-Feldt	209.984	98.765	2.126
		Lower-bound	209.984	8.000	26.248
	Chin	Sphericity Assumed	224.336	232	.967
		Greenhouse-Geisser	224.336	40.026	5.605
		Huynh-Feldt	224.336	128.228	1.750
		Lower-bound	224.336	8.000	28.042
Pairs	Max	Sphericity Assumed	2252.344	1	2252.344
		Greenhouse-Geisser	2252.344	1.000	2252.344
		Huynh-Feldt	2252.344	1.000	2252.344

Univariate Tests

Source	Measure		F	Sig.	Partial Eta Squared
Images	Mand	Sphericity Assumed	153.852	.000	.951
		Greenhouse-Geisser	153.852	.000	.951
		Huynh-Feldt	153.852	.000	.951
		Lower-bound	153.852	.000	.951
	Chin	Sphericity Assumed	95.426	.000	.923
		Greenhouse-Geisser	95.426	.000	.923
		Huynh-Feldt	95.426	.000	.923
		Lower-bound	95.426	.000	.923
Images * Group	Max	Sphericity Assumed	1.234	.199	.134
		Greenhouse-Geisser	1.234	.309	.134
		Huynh-Feldt	1.234	.235	.134
		Lower-bound	1.234	.299	.134
	Mand	Sphericity Assumed	1.006	.463	.112
		Greenhouse-Geisser	1.006	.423	.112
		Huynh-Feldt	1.006	.450	.112
		Lower-bound	1.006	.345	.112
	Chin	Sphericity Assumed	1.398	.093	.149
		Greenhouse-Geisser	1.398	.246	.149
		Huynh-Feldt	1.398	.153	.149
		Lower-bound	1.398	.271	.149
Pairs	Max	Sphericity Assumed	456.286	.000	.983
		Greenhouse-Geisser	456.286	.000	.983
		Huynh-Feldt	456.286	.000	.983

Univariate Tests

Source	Measure		Noncent. Parameter	Observed Power[a]
Images	Mand	Sphericity Assumed	4461.715	1.000
		Greenhouse-Geisser	693.780	1.000
		Huynh-Feldt	1899.409	1.000
		Lower-bound	153.852	1.000
	Chin	Sphericity Assumed	2767.342	1.000
		Greenhouse-Geisser	477.442	1.000
		Huynh-Feldt	1529.532	1.000
		Lower-bound	95.426	1.000
Images * Group	Max	Sphericity Assumed	35.783	.931
		Greenhouse-Geisser	6.616	.408
		Huynh-Feldt	24.142	.828
		Lower-bound	1.234	.166
	Mand	Sphericity Assumed	29.173	.850
		Greenhouse-Geisser	4.536	.301
		Huynh-Feldt	12.419	.557
		Lower-bound	1.006	.144
	Chin	Sphericity Assumed	40.531	.963
		Greenhouse-Geisser	6.993	.441
		Huynh-Feldt	22.402	.826
		Lower-bound	1.398	.181
Pairs	Max	Sphericity Assumed	456.286	1.000
		Greenhouse-Geisser	456.286	1.000
		Huynh-Feldt	456.286	1.000

a. Computed using alpha = .05

Univariate Tests

Source	Measure		Type III Sum of Squares	df	Mean Square
Pairs	Max	Lower-bound	2252.344	1.000	2252.344
	Mand	Sphericity Assumed	323.988	1	323.988
		Greenhouse-Geisser	323.988	1.000	323.988
		Huynh-Feldt	323.988	1.000	323.988
		Lower-bound	323.988	1.000	323.988
	Chin	Sphericity Assumed	42.560	1	42.560
		Greenhouse-Geisser	42.560	1.000	42.560
		Huynh-Feldt	42.560	1.000	42.560
		Lower-bound	42.560	1.000	42.560
Pairs * Group	Max	Sphericity Assumed	38.760	1	38.760
		Greenhouse-Geisser	38.760	1.000	38.760
		Huynh-Feldt	38.760	1.000	38.760
		Lower-bound	38.760	1.000	38.760
	Mand	Sphericity Assumed	13.172	1	13.172
		Greenhouse-Geisser	13.172	1.000	13.172
		Huynh-Feldt	13.172	1.000	13.172
		Lower-bound	13.172	1.000	13.172
	Chin	Sphericity Assumed	4.200	1	4.200
		Greenhouse-Geisser	4.200	1.000	4.200
		Huynh-Feldt	4.200	1.000	4.200
		Lower-bound	4.200	1.000	4.200
Error(Pairs)	Max	Sphericity Assumed	39.490	8	4.936
		Greenhouse-Geisser	39.490	8.000	4.936
		Huynh-Feldt	39.490	8.000	4.936
		Lower-bound	39.490	8.000	4.936
	Mand	Sphericity Assumed	64.468	8	8.059
		Greenhouse-Geisser	64.468	8.000	8.059
		Huynh-Feldt	64.468	8.000	8.059
		Lower-bound	64.468	8.000	8.059
	Chin	Sphericity Assumed	140.410	8	17.551
		Greenhouse-Geisser	140.410	8.000	17.551
		Huynh-Feldt	140.410	8.000	17.551
		Lower-bound	140.410	8.000	17.551
Images * Pairs	Max	Sphericity Assumed	1721.544	29	59.364
		Greenhouse-Geisser	1721.544	5.362	321.075
		Huynh-Feldt	1721.544	19.566	87.988
		Lower-bound	1721.544	1.000	1721.544

Univariate Tests

Source	Measure		F	Sig.	Partial Eta Squared
Pairs	Max	Lower-bound	456.286	.000	.983
	Mand	Sphericity Assumed	40.204	.000	.834
		Greenhouse-Geisser	40.204	.000	.834
		Huynh-Feldt	40.204	.000	.834
		Lower-bound	40.204	.000	.834
	Chin	Sphericity Assumed	2.425	.158	.233
		Greenhouse-Geisser	2.425	.158	.233
		Huynh-Feldt	2.425	.158	.233
		Lower-bound	2.425	.158	.233
Pairs * Group	Max	Sphericity Assumed	7.852	.023	.495
		Greenhouse-Geisser	7.852	.023	.495
		Huynh-Feldt	7.852	.023	.495
		Lower-bound	7.852	.023	.495
	Mand	Sphericity Assumed	1.635	.237	.170
		Greenhouse-Geisser	1.635	.237	.170
		Huynh-Feldt	1.635	.237	.170
		Lower-bound	1.635	.237	.170
	Chin	Sphericity Assumed	.239	.638	.029
		Greenhouse-Geisser	.239	.638	.029
		Huynh-Feldt	.239	.638	.029
		Lower-bound	.239	.638	.029
Images * Pairs	Max	Sphericity Assumed	84.204	.000	.913
		Greenhouse-Geisser	84.204	.000	.913
		Huynh-Feldt	84.204	.000	.913
		Lower-bound	84.204	.000	.913

Univariate Tests

Source	Measure		Noncent. Parameter	Observed Power[a]
Pairs	Max	Lower-bound	456.286	1.000
	Mand	Sphericity Assumed	40.204	1.000
		Greenhouse-Geisser	40.204	1.000
		Huynh-Feldt	40.204	1.000
		Lower-bound	40.204	1.000
	Chin	Sphericity Assumed	2.425	.279
		Greenhouse-Geisser	2.425	.279
		Huynh-Feldt	2.425	.279
		Lower-bound	2.425	.279
Pairs * Group	Max	Sphericity Assumed	7.852	.690
		Greenhouse-Geisser	7.852	.690
		Huynh-Feldt	7.852	.690
		Lower-bound	7.852	.690
	Mand	Sphericity Assumed	1.635	.204
		Greenhouse-Geisser	1.635	.204
		Huynh-Feldt	1.635	.204
		Lower-bound	1.635	.204
	Chin	Sphericity Assumed	.239	.072
		Greenhouse-Geisser	.239	.072
		Huynh-Feldt	.239	.072
		Lower-bound	.239	.072
Images * Pairs	Max	Sphericity Assumed	2441.906	1.000
		Greenhouse-Geisser	451.484	1.000
		Huynh-Feldt	1647.501	1.000
		Lower-bound	84.204	1.000

a. Computed using alpha = .05

Univariate Tests

Source	Measure		Type III Sum of Squares	df	Mean Square
Images * Pairs	Mand	Sphericity Assumed	2293.668	29	79.092
		Greenhouse-Geisser	2293.668	4.509	508.643
		Huynh-Feldt	2293.668	12.346	185.787
		Lower-bound	2293.668	1.000	2293.668
	Chin	Sphericity Assumed	643.622	29	22.194
		Greenhouse-Geisser	643.622	5.003	128.640
		Huynh-Feldt	643.622	16.029	40.155
		Lower-bound	643.622	1.000	643.622
Images * Pairs * Group	Max	Sphericity Assumed	25.227	29	.870
		Greenhouse-Geisser	25.227	5.362	4.705
		Huynh-Feldt	25.227	19.566	1.289
		Lower-bound	25.227	1.000	25.227
	Mand	Sphericity Assumed	26.404	29	.910
		Greenhouse-Geisser	26.404	4.509	5.855
		Huynh-Feldt	26.404	12.346	2.139
		Lower-bound	26.404	1.000	26.404
	Chin	Sphericity Assumed	39.192	29	1.351
		Greenhouse-Geisser	39.192	5.003	7.833
		Huynh-Feldt	39.192	16.029	2.445
		Lower-bound	39.192	1.000	39.192
Error(Images*Pairs)	Max	Sphericity Assumed	163.560	232	.705
		Greenhouse-Geisser	163.560	42.894	3.813
		Huynh-Feldt	163.560	156.525	1.045
		Lower-bound	163.560	8.000	20.445
	Mand	Sphericity Assumed	209.984	232	.905
		Greenhouse-Geisser	209.984	36.075	5.821
		Huynh-Feldt	209.984	98.765	2.126
		Lower-bound	209.984	8.000	26.248
	Chin	Sphericity Assumed	224.336	232	.967
		Greenhouse-Geisser	224.336	40.026	5.605
		Huynh-Feldt	224.336	128.228	1.750
		Lower-bound	224.336	8.000	28.042

Univariate Tests

Source	Measure		F	Sig.	Partial Eta Squared
Images * Pairs	Mand	Sphericity Assumed	87.385	.000	.916
		Greenhouse-Geisser	87.385	.000	.916
		Huynh-Feldt	87.385	.000	.916
		Lower-bound	87.385	.000	.916
	Chin	Sphericity Assumed	22.952	.000	.742
		Greenhouse-Geisser	22.952	.000	.742
		Huynh-Feldt	22.952	.000	.742
		Lower-bound	22.952	.001	.742
Images * Pairs * Group	Max	Sphericity Assumed	1.234	.199	.134
		Greenhouse-Geisser	1.234	.309	.134
		Huynh-Feldt	1.234	.235	.134
		Lower-bound	1.234	.299	.134
	Mand	Sphericity Assumed	1.006	.463	.112
		Greenhouse-Geisser	1.006	.423	.112
		Huynh-Feldt	1.006	.450	.112
		Lower-bound	1.006	.345	.112
	Chin	Sphericity Assumed	1.398	.093	.149
		Greenhouse-Geisser	1.398	.246	.149
		Huynh-Feldt	1.398	.153	.149
		Lower-bound	1.398	.271	.149

Univariate Tests

Source	Measure		Noncent. Parameter	Observed Power[a]
Images * Pairs	Mand	Sphericity Assumed	2534.152	1.000
		Greenhouse-Geisser	394.051	1.000
		Huynh-Feldt	1078.821	1.000
		Lower-bound	87.385	1.000
	Chin	Sphericity Assumed	665.609	1.000
		Greenhouse-Geisser	114.836	1.000
		Huynh-Feldt	367.887	1.000
		Lower-bound	22.952	.986
Images * Pairs * Group	Max	Sphericity Assumed	35.783	.931
		Greenhouse-Geisser	6.616	.408
		Huynh-Feldt	24.142	.828
		Lower-bound	1.234	.166
	Mand	Sphericity Assumed	29.173	.850
		Greenhouse-Geisser	4.536	.301
		Huynh-Feldt	12.419	.557
		Lower-bound	1.006	.144
	Chin	Sphericity Assumed	40.531	.963
		Greenhouse-Geisser	6.993	.441
		Huynh-Feldt	22.402	.826
		Lower-bound	1.398	.181

a. Computed using alpha = .05

Tests of Between-Subjects Effects

Transformed Variable:Average

Source	Measure	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	Max	5862.500	1	5862.500	1187.643	.000
	Mand	1316.905	1	1316.905	163.418	.000
	Chin	2680.552	1	2680.552	152.728	.000
Group	Max	38.760	1	38.760	7.852	.023
	Mand	13.172	1	13.172	1.635	.237
	Chin	4.200	1	4.200	.239	.638
Error	Max	39.490	8	4.936		
	Mand	64.468	8	8.059		
	Chin	140.410	8	17.551		

Tests of Between-Subjects Effects

Transformed Variable:Average

Source	Measure	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	Max	.993	1187.643	1.000
	Mand	.953	163.418	1.000
	Chin	.950	152.728	1.000
Group	Max	.495	7.852	.690
	Mand	.170	1.635	.204
	Chin	.029	.239	.072

a. Computed using alpha = .05

Estimated Marginal Means

1. Group

Measure	Group	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Max	F	2.872	.128	2.576	3.167
	R	3.380	.128	3.084	3.676
Mand	F	1.333	.164	.955	1.711
	R	1.630	.164	1.252	2.008
Chin	F	2.030	.242	1.472	2.588
	R	2.197	.242	1.640	2.755

2. Images

Measure	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Max	1	-1.400	.187	-1.831	-.969
	2	1.075	.146	.739	1.411
	3	.050	.324	-.697	.797
	4	4.800	.200	4.339	5.261
	5	-.800	.296	-1.482	-.118
	6	5.675	.301	4.981	6.369
	7	-.900	.112	-1.158	-.642
	8	1.900	.112	1.642	2.158
	9	4.150	.100	3.919	4.381
	10	6.150	.247	5.579	6.721
	11	4.850	.218	4.347	5.353
	12	4.500	.209	4.018	4.982
	13	8.275	.244	7.713	8.837
	14	1.000	.177	.592	1.408
	15	1.250	.252	.668	1.832
	16	1.000	.112	.742	1.258

2. Images

Measure	Images	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Max	17	4.550	.224	4.034	5.066
	18	4.550	.184	4.126	4.974
	19	3.925	.160	3.556	4.294
	20	2.325	.122	2.043	2.607
	21	4.150	.245	3.585	4.715
	22	7.900	.277	7.262	8.538
	23	5.425	.162	5.051	5.799
	24	3.500	.106	3.255	3.745
	25	2.275	.125	1.987	2.563
	26	.800	.137	.484	1.116
	27	4.800	.229	4.272	5.328
	28	2.250	.252	1.668	2.832
	29	1.450	.200	.989	1.911
	30	4.300	.215	3.804	4.796

2. Images

Measure	Images	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Mand	1	-.700	.141	-1.026	-.374
	2	1.810	.213	1.319	2.301
	3	-.275	.331	-1.038	.488
	4	1.200	.267	.584	1.816
	5	-5.075	.418	-6.040	-4.110
	6	6.000	.235	5.459	6.541
	7	-2.540	.256	-3.131	-1.949
	8	.550	.184	.126	.974
	9	1.725	.179	1.313	2.137
	10	4.850	.283	4.198	5.502
	11	4.725	.230	4.193	5.257
	12	3.250	.237	2.703	3.797
	13	3.825	.205	3.353	4.297
	14	.475	.160	.106	.844
	15	.250	.190	-.189	.689
	16	3.375	.144	3.044	3.706
	17	1.600	.187	1.169	2.031
	18	3.025	.170	2.634	3.416
	19	4.550	.296	3.868	5.232
	20	-2.650	.209	-3.132	-2.168
	21	.975	.440	-.040	1.990
	22	.450	.237	-.097	.997
	23	3.075	.276	2.438	3.712
	24	5.375	.162	5.001	5.749
	25	-.950	.200	-1.411	-.489
	26	-1.275	.215	-1.771	-.779
	27	2.800	.177	2.392	3.208
	28	1.525	.217	1.026	2.024
	29	-1.350	.218	-1.853	-.847
	30	3.850	.187	3.419	4.281

2. Images

Measure	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Chin	1	3.650	.177	3.242	4.058
	2	1.200	.141	.874	1.526
	3	2.100	.335	1.327	2.873
	4	8.225	.586	6.873	9.577
	5	3.325	.484	2.209	4.441
	6	3.000	.212	2.511	3.489
	7	1.350	.345	.555	2.145
	8	.550	.146	.214	.886
	9	3.710	.309	2.997	4.423
	10	1.675	.282	1.025	2.325
	11	1.275	.125	.987	1.563
	12	2.700	.262	2.095	3.305
	13	-3.725	.280	-4.370	-3.080
	14	2.175	.273	1.546	2.804
	15	-.450	.209	-.932	.032
	16	-.175	.224	-.691	.341
	17	2.350	.347	1.550	3.150
	18	3.475	.071	3.312	3.638
	19	2.400	.209	1.918	2.882
	20	1.700	.215	1.204	2.196
	21	5.600	.377	4.730	6.470
	22	1.175	.278	.533	1.817
	23	2.325	.238	1.775	2.875
	24	4.400	.322	3.657	5.143
	25	.875	.218	.372	1.378
	26	5.100	.194	4.653	5.547
	27	1.400	.132	1.095	1.705
	28	.950	.242	.391	1.509
	29	1.050	.242	.491	1.609
	30	.025	.177	-.383	.433

3. Pairs

Measure	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Max	1	1.188	.181	.770	1.607
	2	5.063	.000	5.063	5.063
Mand	1	2.216	.232	1.682	2.751
	2	.747	.000	.747	.747
Chin	1	1.847	.342	1.059	2.636
	2	2.380	.000	2.380	2.380

4. Group * Images

Measure	Group	Images	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Max	F	1	-1.300	.265	-1.910	-.690
		2	1.000	.206	.525	1.475
		3	-.700	.458	-1.757	.357
		4	4.500	.283	3.848	5.152
		5	-.700	.418	-1.665	.265
		6	5.200	.426	4.218	6.182
		7	-.900	.158	-1.265	-.535
		8	1.700	.158	1.335	2.065
		9	4.000	.141	3.674	4.326
		10	5.900	.350	5.093	6.707
		11	4.500	.308	3.789	5.211
		12	4.100	.296	3.418	4.782
		13	7.850	.345	7.055	8.645
		14	1.000	.250	.423	1.577
		15	1.200	.357	.377	2.023
		16	1.000	.158	.635	1.365
		17	4.150	.316	3.421	4.879
		18	4.350	.260	3.751	4.949
		19	3.450	.226	2.928	3.972
		20	2.000	.173	1.601	2.399
		21	3.800	.346	3.001	4.599
		22	7.600	.391	6.698	8.502
		23	4.800	.229	4.272	5.328
		24	3.400	.150	3.054	3.746
		25	2.150	.177	1.742	2.558
		26	.650	.194	.203	1.097
		27	4.600	.324	3.853	5.347
		28	1.700	.357	.877	2.523
		29	1.150	.283	.498	1.802
		30	4.000	.304	3.299	4.701

4. Group * Images

Measure	Group	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Max	R	1	-1.500	.265	-2.110	-.890
		2	1.150	.206	.675	1.625
		3	.800	.458	-.257	1.857
		4	5.100	.283	4.448	5.752
		5	-.900	.418	-1.865	.065
		6	6.150	.426	5.168	7.132
		7	-.900	.158	-1.265	-.535
		8	2.100	.158	1.735	2.465
		9	4.300	.141	3.974	4.626
		10	6.400	.350	5.593	7.207
		11	5.200	.308	4.489	5.911
		12	4.900	.296	4.218	5.582
		13	8.700	.345	7.905	9.495
		14	1.000	.250	.423	1.577
		15	1.300	.357	.477	2.123
		16	1.000	.158	.635	1.365
		17	4.950	.316	4.221	5.679
		18	4.750	.260	4.151	5.349
		19	4.400	.226	3.878	4.922
		20	2.650	.173	2.251	3.049
		21	4.500	.346	3.701	5.299
		22	8.200	.391	7.298	9.102
		23	6.050	.229	5.522	6.578
		24	3.600	.150	3.254	3.946
		25	2.400	.177	1.992	2.808
		26	.950	.194	.503	1.397
		27	5.000	.324	4.253	5.747
		28	2.800	.357	1.977	3.623
		29	1.750	.283	1.098	2.402
		30	4.600	.304	3.899	5.301

4. Group * Images

Measure	Group	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Mand	F	1	-.950	.200	-1.411	-.489
		2	1.500	.301	.806	2.194
		3	-.950	.468	-2.029	.129
		4	.900	.377	.030	1.770
		5	-5.050	.592	-6.414	-3.686
		6	5.600	.332	4.835	6.365
		7	-2.400	.362	-3.235	-1.565
		8	.350	.260	-.249	.949
		9	1.700	.252	1.118	2.282
		10	4.700	.400	3.778	5.622
		11	4.450	.326	3.698	5.202
		12	3.000	.335	2.227	3.773
		13	3.700	.289	3.033	4.367
		14	.200	.226	-.322	.722
		15	.400	.269	-.221	1.021
		16	3.400	.203	2.932	3.868
		17	1.450	.265	.840	2.060
		18	3.000	.240	2.447	3.553
		19	4.200	.418	3.235	5.165
		20	-3.100	.296	-3.782	-2.418
		21	1.050	.622	-.385	2.485
		22	.100	.335	-.673	.873
		23	3.000	.391	2.099	3.901
		24	5.700	.229	5.172	6.228
		25	-.900	.283	-1.552	-.248
		26	-1.350	.304	-2.051	-.649
		27	2.700	.250	2.123	3.277
		28	1.150	.306	.444	1.856
		29	-1.250	.308	-1.961	-.539
		30	3.700	.265	3.090	4.310

4. Group * Images

Measure	Group	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Mand	R	1	-.450	.200	-.911	.011
		2	2.120	.301	1.426	2.814
		3	.400	.468	-.679	1.479
		4	1.500	.377	.630	2.370
		5	-5.100	.592	-6.464	-3.736
		6	6.400	.332	5.635	7.165
		7	-2.680	.362	-3.515	-1.845
		8	.750	.260	.151	1.349
		9	1.750	.252	1.168	2.332
		10	5.000	.400	4.078	5.922
		11	5.000	.326	4.248	5.752
		12	3.500	.335	2.727	4.273
		13	3.950	.289	3.283	4.617
		14	.750	.226	.228	1.272
		15	.100	.269	-.521	.721
		16	3.350	.203	2.882	3.818
		17	1.750	.265	1.140	2.360
		18	3.050	.240	2.497	3.603
		19	4.900	.418	3.935	5.865
		20	-2.200	.296	-2.882	-1.518
		21	.900	.622	-.535	2.335
		22	.800	.335	.027	1.573
		23	3.150	.391	2.249	4.051
		24	5.050	.229	4.522	5.578
		25	-1.000	.283	-1.652	-.348
		26	-1.200	.304	-1.901	-.499
		27	2.900	.250	2.323	3.477
		28	1.900	.306	1.194	2.606
		29	-1.450	.308	-2.161	-.739
		30	4.000	.265	3.390	4.610

4. Group * Images

Measure	Group	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Chin	F	1	2.950	.250	2.373	3.527
		2	.950	.200	.489	1.411
		3	2.200	.474	1.106	3.294
		4	8.400	.829	6.488	10.312
		5	2.800	.685	1.221	4.379
		6	2.700	.300	2.008	3.392
		7	1.300	.487	.176	2.424
		8	.100	.206	-.375	.575
		9	3.600	.437	2.592	4.608
		10	1.600	.398	.681	2.519
		11	1.200	.177	.792	1.608
		12	2.550	.371	1.695	3.405
		13	-3.650	.395	-4.562	-2.738
		14	2.000	.386	1.111	2.889
		15	-.250	.296	-.932	.432
		16	-.150	.316	-.879	.579
		17	2.300	.491	1.169	3.431
		18	3.350	.100	3.119	3.581
		19	2.100	.296	1.418	2.782
		20	1.500	.304	.799	2.201
		21	4.950	.534	3.719	6.181
		22	1.500	.394	.592	2.408
		23	2.350	.337	1.572	3.128
		24	4.300	.456	3.250	5.350
		25	1.150	.308	.439	1.861
		26	5.150	.274	4.518	5.782
		27	1.400	.187	.969	1.831
		28	1.150	.343	.360	1.940
		29	1.100	.343	.310	1.890
		30	.300	.250	-.277	.877

4. Group * Images

Measure	Group	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Chin	R	1	4.350	.250	3.773	4.927
		2	1.450	.200	.989	1.911
		3	2.000	.474	.906	3.094
		4	8.050	.829	6.138	9.962
		5	3.850	.685	2.271	5.429
		6	3.300	.300	2.608	3.992
		7	1.400	.487	.276	2.524
		8	1.000	.206	.525	1.475
		9	3.820	.437	2.812	4.828
		10	1.750	.398	.831	2.669
		11	1.350	.177	.942	1.758
		12	2.850	.371	1.995	3.705
		13	-3.800	.395	-4.712	-2.888
		14	2.350	.386	1.461	3.239
		15	-.650	.296	-1.332	.032
		16	-.200	.316	-.929	.529
		17	2.400	.491	1.269	3.531
		18	3.600	.100	3.369	3.831
		19	2.700	.296	2.018	3.382
		20	1.900	.304	1.199	2.601
		21	6.250	.534	5.019	7.481
		22	.850	.394	-.058	1.758
		23	2.300	.337	1.522	3.078
		24	4.500	.456	3.450	5.550
		25	.600	.308	-.111	1.311
		26	5.050	.274	4.418	5.682
		27	1.400	.187	.969	1.831
		28	.750	.343	-.040	1.540
		29	1.000	.343	.210	1.790
		30	-.250	.250	-.827	.327

5. Group * Pairs

Measure	Group	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Max	F	1	.680	.257	.088	1.272
		2	5.063	.000	5.063	5.063

5. Group * Pairs

Measure	Group	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Max	R	1	1.697	.257	1.105	2.288
		2	5.063	.000	5.063	5.063
Mand	F	1	1.920	.328	1.164	2.676
		2	.747	.000	.747	.747
	R	1	2.513	.328	1.757	3.269
		2	.747	.000	.747	.747
Chin	F	1	1.680	.484	.564	2.796
		2	2.380	.000	2.380	2.380
	R	1	2.015	.484	.899	3.130
		2	2.380	.000	2.380	2.380

6. Images * Pairs

Measure	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Max	1	1	-.800	.374	-1.663	.063
		2	-2.000	.000	-2.000	-2.000
	2	1	.150	.292	-.522	.822
		2	2.000	.000	2.000	2.000
	3	1	-1.700	.648	-3.194	-.206
		2	1.800	.000	1.800	1.800
	4	1	1.600	.400	.678	2.522
		2	8.000	.000	8.000	8.000
	5	1	.400	.592	-.964	1.764
		2	-2.000	.000	-2.000	-2.000
	6	1	2.350	.602	.962	3.738
		2	9.000	.000	9.000	9.000
	7	1	.000	.224	-.516	.516
		2	-1.800	.000	-1.800	-1.800
	8	1	.800	.224	.284	1.316
		2	3.000	.000	3.000	3.000
	9	1	.300	.200	-.161	.761
		2	8.000	.000	8.000	8.000
	10	1	2.300	.495	1.159	3.441
		2	10.000	.000	10.000	10.000
	11	1	1.700	.436	.695	2.705
		2	8.000	.000	8.000	8.000
	12	1	1.400	.418	.435	2.365
		2	7.600	.000	7.600	7.600
	13	1	6.050	.487	4.926	7.174
		2	10.500	.000	10.500	10.500

6. Images * Pairs

Measure	Images	Pairs	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Max	14	1	.000	.354	-.815	.815
		2	2.000	.000	2.000	2.000
	15	1	2.500	.505	1.336	3.664
		2	.000	.000	.000	.000
	16	1	.000	.224	-.516	.516
		2	2.000	.000	2.000	2.000
	17	1	3.600	.447	2.569	4.631
		2	5.500	.000	5.500	5.500
	18	1	1.400	.367	.553	2.247
		2	7.700	.000	7.700	7.700
	19	1	3.550	.320	2.812	4.288
		2	4.300	.000	4.300	4.300
	20	1	.650	.245	.085	1.215
		2	4.000	.000	4.000	4.000
	21	1	-.700	.490	-1.830	.430
		2	9.000	.000	9.000	9.000
	22	1	4.800	.553	3.524	6.076
		2	11.000	.000	11.000	11.000
	23	1	1.850	.324	1.103	2.597
		2	9.000	.000	9.000	9.000
	24	1	.000	.212	-.489	.489
		2	7.000	.000	7.000	7.000
	25	1	1.250	.250	.673	1.827
		2	3.300	.000	3.300	3.300
	26	1	.100	.274	-.532	.732
		2	1.500	.000	1.500	1.500
	27	1	-.400	.458	-1.457	.657
		2	10.000	.000	10.000	10.000
	28	1	.500	.505	-.664	1.664
		2	4.000	.000	4.000	4.000
	29	1	.400	.400	-.522	1.322
		2	2.500	.000	2.500	2.500
	30	1	1.600	.430	.608	2.592
		2	7.000	.000	7.000	7.000

6. Images * Pairs

Measure	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Mand	1	1	1.100	.283	.448	1.752
		2	-2.500	.000	-2.500	-2.500
	2	1	3.220	.426	2.238	4.202
		2	.400	.000	.400	.400
	3	1	-1.050	.661	-2.575	.475
		2	.500	.000	.500	.500
	4	1	2.400	.534	1.169	3.631
		2	.000	.000	.000	.000
	5	1	.150	.837	-1.779	2.079
		2	-10.300	.000	-10.300	-10.300
	6	1	5.000	.469	3.918	6.082
		2	7.000	.000	7.000	7.000
	7	1	.920	.512	-.261	2.101
		2	-6.000	.000	-6.000	-6.000
	8	1	2.600	.367	1.753	3.447
		2	-1.500	.000	-1.500	-1.500
	9	1	.450	.357	-.373	1.273
		2	3.000	.000	3.000	3.000
	10	1	3.500	.566	2.196	4.804
		2	6.200	.000	6.200	6.200
	11	1	3.350	.461	2.287	4.413
		2	6.100	.000	6.100	6.100
	12	1	1.500	.474	.406	2.594
		2	5.000	.000	5.000	5.000
	13	1	4.650	.409	3.706	5.594
		2	3.000	.000	3.000	3.000
	14	1	.950	.320	.212	1.688
		2	.000	.000	.000	.000
	15	1	4.500	.381	3.622	5.378
		2	-4.000	.000	-4.000	-4.000
	16	1	3.750	.287	3.088	4.412
		2	3.000	.000	3.000	3.000
	17	1	3.700	.374	2.837	4.563
		2	-.500	.000	-.500	-.500
	18	1	2.050	.339	1.268	2.832
		2	4.000	.000	4.000	4.000
	19	1	6.100	.592	4.736	7.464
		2	3.000	.000	3.000	3.000
	20	1	.700	.418	-.265	1.665
		2	-6.000	.000	-6.000	-6.000

6. Images * Pairs

Measure	Images	Pairs	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Mand	21	1	-.550	.880	-2.580	1.480
		2	2.500	.000	2.500	2.500
	22	1	.900	.474	-.194	1.994
		2	.000	.000	.000	.000
	23	1	2.750	.552	1.476	4.024
		2	3.400	.000	3.400	3.400
	24	1	3.750	.324	3.003	4.497
		2	7.000	.000	7.000	7.000
	25	1	2.100	.400	1.178	3.022
		2	-4.000	.000	-4.000	-4.000
	26	1	1.150	.430	.158	2.142
		2	-3.700	.000	-3.700	-3.700
	27	1	1.600	.354	.785	2.415
		2	4.000	.000	4.000	4.000
	28	1	2.750	.433	1.751	3.749
		2	.300	.000	.300	.300
	29	1	.800	.436	-.205	1.805
		2	-3.500	.000	-3.500	-3.500
	30	1	1.700	.374	.837	2.563
		2	6.000	.000	6.000	6.000

6. Images * Pairs

Measure	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Chin	1	1	1.800	.354	.985	2.615
		2	5.500	.000	5.500	5.500
	2	1	.900	.283	.248	1.552
		2	1.500	.000	1.500	1.500
	3	1	1.400	.671	-.147	2.947
		2	2.800	.000	2.800	2.800
	4	1	7.450	1.173	4.746	10.154
		2	9.000	.000	9.000	9.000
	5	1	5.650	.968	3.417	7.883
		2	1.000	.000	1.000	1.000
	6	1	2.000	.424	1.022	2.978
		2	4.000	.000	4.000	4.000
	7	1	1.700	.689	.111	3.289
		2	1.000	.000	1.000	1.000
	8	1	1.100	.292	.428	1.772
		2	.000	.000	.000	.000
	9	1	2.420	.618	.994	3.846
		2	5.000	.000	5.000	5.000
	10	1	.750	.563	-.549	2.049
		2	2.600	.000	2.600	2.600
	11	1	.550	.250	-.027	1.127
		2	2.000	.000	2.000	2.000
	12	1	1.900	.524	.691	3.109
		2	3.500	.000	3.500	3.500
	13	1	-.950	.559	-2.239	.339
		2	-6.500	.000	-6.500	-6.500
	14	1	1.350	.545	.092	2.608
		2	3.000	.000	3.000	3.000
	15	1	.800	.418	-.165	1.765
		2	-1.700	.000	-1.700	-1.700
	16	1	.150	.447	-.881	1.181
		2	-.500	.000	-.500	-.500
	17	1	2.700	.694	1.100	4.300
		2	2.000	.000	2.000	2.000
	18	1	2.450	.141	2.124	2.776
		2	4.500	.000	4.500	4.500
	19	1	1.800	.418	.835	2.765
		2	3.000	.000	3.000	3.000
	20	1	1.600	.430	.608	2.592
		2	1.800	.000	1.800	1.800

6. Images * Pairs

Measure	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Chin	21	1	4.500	.755	2.759	6.241
		2	6.700	.000	6.700	6.700
	22	1	-.650	.557	-1.934	.634
		2	3.000	.000	3.000	3.000
	23	1	1.550	.477	.450	2.650
		2	3.100	.000	3.100	3.100
	24	1	3.800	.644	2.314	5.286
		2	5.000	.000	5.000	5.000
	25	1	1.050	.436	.045	2.055
		2	.700	.000	.700	.700
	26	1	4.700	.387	3.807	5.593
		2	5.500	.000	5.500	5.500
	27	1	.800	.265	.190	1.410
		2	2.000	.000	2.000	2.000
	28	1	.400	.485	-.718	1.518
		2	1.500	.000	1.500	1.500
	29	1	2.100	.485	.982	3.218
		2	.000	.000	.000	.000
	30	1	-.350	.354	-1.165	.465
		2	.400	.000	.400	.400

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Max	F	1	1	-.600	.529	-1.820	.620
			2	-2.000	.000	-2.000	-2.000
		2	1	.000	.412	-.951	.951
			2	2.000	.000	2.000	2.000
		3	1	-3.200	.917	-5.313	-1.087
			2	1.800	.000	1.800	1.800
		4	1	1.000	.566	-.304	2.304
			2	8.000	.000	8.000	8.000
		5	1	.600	.837	-1.329	2.529
			2	-2.000	.000	-2.000	-2.000
		6	1	1.400	.851	-.563	3.363
			2	9.000	.000	9.000	9.000
		7	1	.000	.316	-.729	.729
			2	-1.800	.000	-1.800	-1.800
		8	1	.400	.316	-.329	1.129
			2	3.000	.000	3.000	3.000

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Max	F	9	1	.000	.283	-.652	.652
			2	8.000	.000	8.000	8.000
		10	1	1.800	.700	.186	3.414
			2	10.000	.000	10.000	10.000
		11	1	1.000	.616	-.422	2.422
			2	8.000	.000	8.000	8.000
		12	1	.600	.592	-.764	1.964
			2	7.600	.000	7.600	7.600
		13	1	5.200	.689	3.611	6.789
			2	10.500	.000	10.500	10.500
		14	1	.000	.500	-1.153	1.153
			2	2.000	.000	2.000	2.000
		15	1	2.400	.714	.753	4.047
			2	.000	.000	.000	.000
		16	1	.000	.316	-.729	.729
			2	2.000	.000	2.000	2.000
		17	1	2.800	.632	1.342	4.258
			2	5.500	.000	5.500	5.500
		18	1	1.000	.520	-.198	2.198
			2	7.700	.000	7.700	7.700
		19	1	2.600	.453	1.556	3.644
			2	4.300	.000	4.300	4.300
		20	1	.000	.346	-.799	.799
			2	4.000	.000	4.000	4.000
		21	1	-1.400	.693	-2.998	.198
			2	9.000	.000	9.000	9.000
		22	1	4.200	.783	2.395	6.005
			2	11.000	.000	11.000	11.000
		23	1	.600	.458	-.457	1.657
			2	9.000	.000	9.000	9.000
		24	1	-.200	.300	-.892	.492
			2	7.000	.000	7.000	7.000
		25	1	1.000	.354	.185	1.815
			2	3.300	.000	3.300	3.300
		26	1	-.200	.387	-1.093	.693
			2	1.500	.000	1.500	1.500
		27	1	-.800	.648	-2.294	.694
			2	10.000	.000	10.000	10.000
		28	1	-.600	.714	-2.247	1.047
			2	4.000	.000	4.000	4.000

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Max	F	29	1	-.200	.566	-1.504	1.104
			2	2.500	.000	2.500	2.500
		30	1	1.000	.608	-.403	2.403
			2	7.000	.000	7.000	7.000
	R	1	1	-1.000	.529	-2.220	.220
			2	-2.000	.000	-2.000	-2.000
		2	1	.300	.412	-.651	1.251
			2	2.000	.000	2.000	2.000
		3	1	-.200	.917	-2.313	1.913
			2	1.800	.000	1.800	1.800
		4	1	2.200	.566	.896	3.504
			2	8.000	.000	8.000	8.000
		5	1	.200	.837	-1.729	2.129
			2	-2.000	.000	-2.000	-2.000
		6	1	3.300	.851	1.337	5.263
			2	9.000	.000	9.000	9.000
		7	1	.000	.316	-.729	.729
			2	-1.800	.000	-1.800	-1.800
		8	1	1.200	.316	.471	1.929
			2	3.000	.000	3.000	3.000
		9	1	.600	.283	-.052	1.252
			2	8.000	.000	8.000	8.000
		10	1	2.800	.700	1.186	4.414
			2	10.000	.000	10.000	10.000
		11	1	2.400	.616	.978	3.822
			2	8.000	.000	8.000	8.000
		12	1	2.200	.592	.836	3.564
			2	7.600	.000	7.600	7.600
		13	1	6.900	.689	5.311	8.489
			2	10.500	.000	10.500	10.500
		14	1	.000	.500	-1.153	1.153
			2	2.000	.000	2.000	2.000
		15	1	2.600	.714	.953	4.247
			2	.000	.000	.000	.000
		16	1	.000	.316	-.729	.729
			2	2.000	.000	2.000	2.000
		17	1	4.400	.632	2.942	5.858
			2	5.500	.000	5.500	5.500
		18	1	1.800	.520	.602	2.998
			2	7.700	.000	7.700	7.700

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Max	R	19	1	4.500	.453	3.456	5.544
			2	4.300	.000	4.300	4.300
		20	1	1.300	.346	.501	2.099
			2	4.000	.000	4.000	4.000
		21	1	8.327E-17	.693	-1.598	1.598
			2	9.000	.000	9.000	9.000
		22	1	5.400	.783	3.595	7.205
			2	11.000	.000	11.000	11.000
		23	1	3.100	.458	2.043	4.157
			2	9.000	.000	9.000	9.000
		24	1	.200	.300	-.492	.892
			2	7.000	.000	7.000	7.000
		25	1	1.500	.354	.685	2.315
			2	3.300	.000	3.300	3.300
		26	1	.400	.387	-.493	1.293
			2	1.500	.000	1.500	1.500
		27	1	.000	.648	-1.494	1.494
			2	10.000	.000	10.000	10.000
		28	1	1.600	.714	-.047	3.247
			2	4.000	.000	4.000	4.000
		29	1	1.000	.566	-.304	2.304
			2	2.500	.000	2.500	2.500
		30	1	2.200	.608	.797	3.603
			2	7.000	.000	7.000	7.000

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Mand	F	1	1	.600	.400	-.322	1.522
			2	-2.500	.000	-2.500	-2.500
		2	1	2.600	.602	1.211	3.989
			2	.400	.000	.400	.400
		3	1	-2.400	.935	-4.557	-.243
			2	.500	.000	.500	.500
		4	1	1.800	.755	.059	3.541
			2	.000	.000	.000	.000
		5	1	.200	1.183	-2.529	2.929
			2	-10.300	.000	-10.300	-10.300
		6	1	4.200	.663	2.670	5.730
			2	7.000	.000	7.000	7.000
		7	1	1.200	.724	-.471	2.871
			2	-6.000	.000	-6.000	-6.000
		8	1	2.200	.520	1.002	3.398
			2	-1.500	.000	-1.500	-1.500
		9	1	.400	.505	-.764	1.564
			2	3.000	.000	3.000	3.000
		10	1	3.200	.800	1.355	5.045
			2	6.200	.000	6.200	6.200
		11	1	2.800	.652	1.297	4.303
			2	6.100	.000	6.100	6.100
		12	1	1.000	.671	-.547	2.547
			2	5.000	.000	5.000	5.000
		13	1	4.400	.579	3.065	5.735
			2	3.000	.000	3.000	3.000
		14	1	.400	.453	-.644	1.444
			2	.000	.000	.000	.000
		15	1	4.800	.539	3.558	6.042
			2	-4.000	.000	-4.000	-4.000
		16	1	3.800	.406	2.863	4.737
			2	3.000	.000	3.000	3.000
		17	1	3.400	.529	2.180	4.620
			2	-.500	.000	-.500	-.500
		18	1	2.000	.480	.894	3.106
			2	4.000	.000	4.000	4.000
		19	1	5.400	.837	3.471	7.329
			2	3.000	.000	3.000	3.000
		20	1	-.200	.592	-1.564	1.164
			2	-6.000	.000	-6.000	-6.000

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Mand	F	21	1	-.400	1.245	-3.271	2.471
			2	2.500	.000	2.500	2.500
		22	1	.200	.671	-1.347	1.747
			2	.000	.000	.000	.000
		23	1	2.600	.781	.799	4.401
			2	3.400	.000	3.400	3.400
		24	1	4.400	.458	3.343	5.457
			2	7.000	.000	7.000	7.000
		25	1	2.200	.566	.896	3.504
			2	-4.000	.000	-4.000	-4.000
		26	1	1.000	.608	-.403	2.403
			2	-3.700	.000	-3.700	-3.700
		27	1	1.400	.500	.247	2.553
			2	4.000	.000	4.000	4.000
		28	1	2.000	.612	.588	3.412
			2	.300	.000	.300	.300
		29	1	1.000	.616	-.422	2.422
			2	-3.500	.000	-3.500	-3.500
		30	1	1.400	.529	.180	2.620
			2	6.000	.000	6.000	6.000

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Mand	R	1	1	1.600	.400	.678	2.522
			2	-2.500	.000	-2.500	-2.500
		2	1	3.840	.602	2.451	5.229
			2	.400	.000	.400	.400
		3	1	.300	.935	-1.857	2.457
			2	.500	.000	.500	.500
		4	1	3.000	.755	1.259	4.741
			2	.000	.000	.000	.000
		5	1	.100	1.183	-2.629	2.829
			2	-10.300	.000	-10.300	-10.300
		6	1	5.800	.663	4.270	7.330
			2	7.000	.000	7.000	7.000
		7	1	.640	.724	-1.031	2.311
			2	-6.000	.000	-6.000	-6.000
		8	1	3.000	.520	1.802	4.198
			2	-1.500	.000	-1.500	-1.500
		9	1	.500	.505	-.664	1.664
			2	3.000	.000	3.000	3.000
		10	1	3.800	.800	1.955	5.645
			2	6.200	.000	6.200	6.200
		11	1	3.900	.652	2.397	5.403
			2	6.100	.000	6.100	6.100
		12	1	2.000	.671	.453	3.547
			2	5.000	.000	5.000	5.000
		13	1	4.900	.579	3.565	6.235
			2	3.000	.000	3.000	3.000
		14	1	1.500	.453	.456	2.544
			2	.000	.000	.000	.000
		15	1	4.200	.539	2.958	5.442
			2	-4.000	.000	-4.000	-4.000
		16	1	3.700	.406	2.763	4.637
			2	3.000	.000	3.000	3.000
		17	1	4.000	.529	2.780	5.220
			2	-.500	.000	-.500	-.500
		18	1	2.100	.480	.994	3.206
			2	4.000	.000	4.000	4.000
		19	1	6.800	.837	4.871	8.729
			2	3.000	.000	3.000	3.000
		20	1	1.600	.592	.236	2.964
			2	-6.000	.000	-6.000	-6.000

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Mand	R	21	1	-.700	1.245	-3.571	2.171
			2	2.500	.000	2.500	2.500
		22	1	1.600	.671	.053	3.147
			2	.000	.000	.000	.000
		23	1	2.900	.781	1.099	4.701
			2	3.400	.000	3.400	3.400
		24	1	3.100	.458	2.043	4.157
			2	7.000	.000	7.000	7.000
		25	1	2.000	.566	.696	3.304
			2	-4.000	.000	-4.000	-4.000
		26	1	1.300	.608	-.103	2.703
			2	-3.700	.000	-3.700	-3.700
		27	1	1.800	.500	.647	2.953
			2	4.000	.000	4.000	4.000
		28	1	3.500	.612	2.088	4.912
			2	.300	.000	.300	.300
		29	1	.600	.616	-.822	2.022
			2	-3.500	.000	-3.500	-3.500
		30	1	2.000	.529	.780	3.220
			2	6.000	.000	6.000	6.000

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Chin	F	1	1	.400	.500	-.753	1.553
			2	5.500	.000	5.500	5.500
		2	1	.400	.400	-.522	1.322
			2	1.500	.000	1.500	1.500
		3	1	1.600	.949	-.588	3.788
			2	2.800	.000	2.800	2.800
		4	1	7.800	1.658	3.976	11.624
			2	9.000	.000	9.000	9.000
		5	1	4.600	1.369	1.442	7.758
			2	1.000	.000	1.000	1.000
		6	1	1.400	.600	.016	2.784
			2	4.000	.000	4.000	4.000
		7	1	1.600	.975	-.648	3.848
			2	1.000	.000	1.000	1.000
		8	1	.200	.412	-.751	1.151
			2	.000	.000	.000	.000
		9	1	2.200	.875	.183	4.217
			2	5.000	.000	5.000	5.000
		10	1	.600	.797	-1.238	2.438
			2	2.600	.000	2.600	2.600
		11	1	.400	.354	-.415	1.215
			2	2.000	.000	2.000	2.000
		12	1	1.600	.742	-.110	3.310
			2	3.500	.000	3.500	3.500
		13	1	-.800	.791	-2.623	1.023
			2	-6.500	.000	-6.500	-6.500
		14	1	1.000	.771	-.779	2.779
			2	3.000	.000	3.000	3.000
		15	1	1.200	.592	-.164	2.564
			2	-1.700	.000	-1.700	-1.700
		16	1	.200	.632	-1.258	1.658
			2	-.500	.000	-.500	-.500
		17	1	2.600	.981	.338	4.862
			2	2.000	.000	2.000	2.000
		18	1	2.200	.200	1.739	2.661
			2	4.500	.000	4.500	4.500
		19	1	1.200	.592	-.164	2.564
			2	3.000	.000	3.000	3.000
		20	1	1.200	.608	-.203	2.603
			2	1.800	.000	1.800	1.800

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Chin	F	21	1	3.200	1.068	.738	5.662
			2	6.700	.000	6.700	6.700
		22	1	.000	.787	-1.816	1.816
			2	3.000	.000	3.000	3.000
		23	1	1.600	.675	.045	3.155
			2	3.100	.000	3.100	3.100
		24	1	3.600	.911	1.499	5.701
			2	5.000	.000	5.000	5.000
		25	1	1.600	.616	.178	3.022
			2	.700	.000	.700	.700
		26	1	4.800	.548	3.537	6.063
			2	5.500	.000	5.500	5.500
		27	1	.800	.374	-.063	1.663
			2	2.000	.000	2.000	2.000
		28	1	.800	.686	-.781	2.381
			2	1.500	.000	1.500	1.500
		29	1	2.200	.686	.619	3.781
			2	.000	.000	.000	.000
		30	1	.200	.500	-.953	1.353
			2	.400	.000	.400	.400

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Chin	R	1	1	3.200	.500	2.047	4.353
			2	5.500	.000	5.500	5.500
		2	1	1.400	.400	.478	2.322
			2	1.500	.000	1.500	1.500
		3	1	1.200	.949	-.988	3.388
			2	2.800	.000	2.800	2.800
		4	1	7.100	1.658	3.276	10.924
			2	9.000	.000	9.000	9.000
		5	1	6.700	1.369	3.542	9.858
			2	1.000	.000	1.000	1.000
		6	1	2.600	.600	1.216	3.984
			2	4.000	.000	4.000	4.000
		7	1	1.800	.975	-.448	4.048
			2	1.000	.000	1.000	1.000
		8	1	2.000	.412	1.049	2.951
			2	.000	.000	.000	.000
		9	1	2.640	.875	.623	4.657
			2	5.000	.000	5.000	5.000
		10	1	.900	.797	-.938	2.738
			2	2.600	.000	2.600	2.600
		11	1	.700	.354	-.115	1.515
			2	2.000	.000	2.000	2.000
		12	1	2.200	.742	.490	3.910
			2	3.500	.000	3.500	3.500
		13	1	-1.100	.791	-2.923	.723
			2	-6.500	.000	-6.500	-6.500
		14	1	1.700	.771	-.079	3.479
			2	3.000	.000	3.000	3.000
		15	1	.400	.592	-.964	1.764
			2	-1.700	.000	-1.700	-1.700
		16	1	.100	.632	-1.358	1.558
			2	-.500	.000	-.500	-.500
		17	1	2.800	.981	.538	5.062
			2	2.000	.000	2.000	2.000
		18	1	2.700	.200	2.239	3.161
			2	4.500	.000	4.500	4.500
		19	1	2.400	.592	1.036	3.764
			2	3.000	.000	3.000	3.000
		20	1	2.000	.608	.597	3.403
			2	1.800	.000	1.800	1.800

7. Group * Images * Pairs

Measure	Group	Images	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Chin	R	21	1	5.800	1.068	3.338	8.262
			2	6.700	.000	6.700	6.700
		22	1	-1.300	.787	-3.116	.516
			2	3.000	.000	3.000	3.000
		23	1	1.500	.675	-.055	3.055
			2	3.100	.000	3.100	3.100
		24	1	4.000	.911	1.899	6.101
			2	5.000	.000	5.000	5.000
		25	1	.500	.616	-.922	1.922
			2	.700	.000	.700	.700
		26	1	4.600	.548	3.337	5.863
			2	5.500	.000	5.500	5.500
		27	1	.800	.374	-.063	1.663
			2	2.000	.000	2.000	2.000
		28	1	.000	.686	-1.581	1.581
			2	1.500	.000	1.500	1.500
		29	1	2.000	.686	.419	3.581
			2	.000	.000	.000	.000
		30	1	-.900	.500	-2.053	.253
			2	.400	.000	.400	.400

Andrew Thompson Ortho Thesis: 2w x 30w x 3b ANOVA on VAS Judging Diffs (Run-2, Corrected Data) 3-31-11

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Descriptive Statistics

	Fac,Res, or Lay	Mean	Std. Deviation	N
sta1	F	74.60	6.387	5
	L	76.40	14.170	5
	R	65.20	16.544	5
	Total	72.07	13.155	15
sta2	F	32.40	19.113	5
	L	37.80	23.113	5
	R	30.80	20.535	5
	Total	33.67	19.675	15
sta3	F	41.00	27.074	5
	L	64.40	25.706	5
	R	45.40	28.571	5
	Total	50.27	27.238	15
sta4	F	26.80	19.715	5
	L	33.20	19.460	5
	R	15.60	11.824	5
	Total	25.20	17.773	15
sta5	F	21.00	14.071	5
	L	37.00	18.111	5
	R	12.60	9.099	5
	Total	23.53	16.843	15
sta6	F	50.40	16.349	5
	L	59.00	11.136	5
	R	41.20	14.325	5
	Total	50.20	15.067	15
sta7	F	40.80	22.399	5
	L	62.00	22.204	5
	R	25.20	13.535	5
	Total	42.67	24.088	15
sta8	F	43.60	17.743	5
	L	56.80	16.407	5
	R	26.00	17.649	5
	Total	42.13	20.650	15

Descriptive Statistics

	Fac.Res. or Lay	Mean	Std. Deviation	N
sta9	F	36.60	16.727	5
	L	44.20	13.065	5
	R	21.60	13.667	5
	Total	34.13	16.630	15
sta10	F	50.40	18.474	5
	L	63.20	19.331	5
	R	38.40	14.993	5
	Total	50.67	19.452	15
sta11	F	49.00	19.596	5
	L	51.60	8.204	5
	R	41.60	11.610	5
	Total	47.40	13.663	15
sta12	F	50.80	24.712	5
	L	65.60	20.526	5
	R	51.60	19.680	5
	Total	56.00	21.331	15
sta13	F	27.40	15.274	5
	L	43.80	10.305	5
	R	29.40	13.088	5
	Total	33.53	14.252	15
sta14	F	44.20	17.470	5
	L	54.40	13.903	5
	R	49.80	16.589	5
	Total	49.47	15.482	15
sta15	F	37.60	15.126	5
	L	51.20	14.567	5
	R	16.60	14.536	5
	Total	35.13	20.085	15
sta16	F	46.80	21.112	5
	L	67.60	16.920	5
	R	27.60	16.832	5
	Total	47.33	23.999	15
sta17	F	41.60	12.759	5
	L	49.40	6.387	5
	R	23.60	9.290	5
	Total	38.20	14.418	15
sta18	F	38.20	18.349	5
	L	38.80	8.643	5
	R	24.60	5.771	5
	Total	33.87	13.158	15

Descriptive Statistics

	Fac.Res. or Lay	Mean	Std. Deviation	N
sta19	F	24.80	17.398	5
	L	59.60	10.164	5
	R	18.20	16.146	5
	Total	34.20	23.321	15
sta20	F	23.40	15.241	5
	L	38.60	11.803	5
	R	13.00	13.019	5
	Total	25.00	16.523	15
sta21	F	37.60	13.975	5
	L	45.80	11.323	5
	R	22.00	7.348	5
	Total	35.13	14.569	15
sta22	F	21.80	16.346	5
	L	38.60	10.213	5
	R	11.80	14.096	5
	Total	24.07	17.144	15
sta23	F	38.60	21.617	5
	L	49.60	12.857	5
	R	25.60	13.576	5
	Total	37.93	18.344	15
sta24	F	36.60	18.379	5
	L	44.80	10.035	5
	R	22.40	6.618	5
	Total	34.60	15.151	15
sta25	F	26.60	19.794	5
	L	37.20	10.474	5
	R	20.20	12.091	5
	Total	28.00	15.418	15
sta26	F	42.00	18.960	5
	L	47.80	7.727	5
	R	27.40	12.720	5
	Total	39.07	15.650	15
sta27	F	46.80	22.797	5
	L	46.00	9.874	5
	R	24.00	17.073	5
	Total	38.93	19.473	15
sta28	F	47.40	9.154	5
	L	45.40	10.597	5
	R	37.00	12.689	5
	Total	43.27	11.126	15

Descriptive Statistics

	Fac.Res. or Lay	Mean	Std. Deviation	N
sta29	F	33.40	18.379	5
	L	41.20	8.786	5
	R	28.00	16.926	5
	Total	34.20	15.228	15
sta30	F	60.80	15.834	5
	L	81.20	10.849	5
	R	70.80	26.508	5
	Total	70.93	19.503	15
morph1	F	70.40	17.242	5
	L	73.20	6.760	5
	R	76.60	16.303	5
	Total	73.40	13.447	15
morph2	F	37.20	19.435	5
	L	62.80	23.563	5
	R	67.20	17.782	5
	Total	55.73	23.331	15
morph3	F	50.80	26.846	5
	L	51.80	22.720	5
	R	55.40	20.120	5
	Total	52.67	21.754	15
morph4	F	51.00	27.019	5
	L	72.40	25.540	5
	R	63.40	15.646	5
	Total	62.27	23.396	15
morph5	F	66.60	6.542	5
	L	76.40	20.888	5
	R	64.80	5.404	5
	Total	69.27	13.155	15
morph6	F	57.20	17.254	5
	L	69.00	17.044	5
	R	66.20	21.347	5
	Total	64.13	18.039	15
morph7	F	66.00	16.971	5
	L	77.40	12.681	5
	R	73.80	14.481	5
	Total	72.40	14.574	15
morph8	F	74.80	10.035	5
	L	82.00	9.823	5
	R	72.60	16.334	5
	Total	76.47	12.241	15

Descriptive Statistics

	Fac.Res. or Lay	Mean	Std. Deviation	N
morph9	F	66.40	6.229	5
	L	73.00	24.413	5
	R	73.40	10.359	5
	Total	70.93	14.935	15
morph10	F	70.60	12.137	5
	L	83.00	9.327	5
	R	76.60	13.390	5
	Total	76.73	12.068	15
morph11	F	60.80	13.161	5
	L	73.80	18.226	5
	R	64.40	15.821	5
	Total	66.33	15.751	15
morph12	F	68.20	18.820	5
	L	84.00	11.640	5
	R	57.20	14.873	5
	Total	69.80	18.241	15
morph13	F	44.40	15.372	5
	L	59.40	20.403	5
	R	39.60	22.634	5
	Total	47.80	20.224	15
morph14	F	50.60	17.841	5
	L	71.80	15.547	5
	R	56.80	21.312	5
	Total	59.73	19.356	15
morph15	F	71.40	12.582	5
	L	88.60	10.213	5
	R	76.00	12.629	5
	Total	78.67	13.313	15
morph16	F	55.60	17.516	5
	L	67.20	17.810	5
	R	60.00	20.845	5
	Total	60.93	18.081	15
morph17	F	58.20	13.554	5
	L	73.00	10.223	5
	R	62.60	18.147	5
	Total	64.60	14.754	15
morph18	F	53.40	14.311	5
	L	67.00	14.248	5
	R	66.00	8.485	5
	Total	62.13	13.346	15

Descriptive Statistics

	Fac.Res. or Lay	Mean	Std. Deviation	N
morph19	F	30.40	18.716	5
	L	61.40	13.278	5
	R	24.00	21.494	5
	Total	38.60	23.838	15
morph20	F	38.40	18.968	5
	L	70.00	11.380	5
	R	44.20	20.801	5
	Total	50.87	21.577	15
morph21	F	50.40	28.192	5
	L	69.80	10.281	5
	R	50.40	16.502	5
	Total	56.87	20.608	15
morph22	F	49.00	11.314	5
	L	76.00	16.897	5
	R	48.60	23.755	5
	Total	57.87	21.344	15
morph23	F	60.80	21.845	5
	L	86.40	9.017	5
	R	74.40	13.183	5
	Total	73.87	18.067	15
morph24	F	49.20	17.641	5
	L	64.20	16.529	5
	R	58.80	16.131	5
	Total	57.40	16.809	15
morph25	F	50.80	13.664	5
	L	81.80	12.696	5
	R	70.40	13.334	5
	Total	67.67	18.050	15
morph26	F	63.80	18.499	5
	L	78.00	2.550	5
	R	66.40	14.223	5
	Total	69.40	14.080	15
morph27	F	82.20	13.027	5
	L	88.60	6.877	5
	R	85.60	10.621	5
	Total	85.47	10.077	15
morph28	F	73.60	11.014	5
	L	68.40	13.939	5
	R	78.60	6.580	5
	Total	73.53	11.006	15

Descriptive Statistics

	Fac.Res. or Lay	Mean	Std. Deviation	N
morph29	F	55.40	11.524	5
	L	72.00	8.367	5
	R	71.40	11.675	5
	Total	66.27	12.657	15
morph30	F	60.40	18.447	5
	L	78.40	11.589	5
	R	82.20	11.498	5
	Total	73.67	16.439	15

Multivariate Tests[d]

Effect		Value	F	Hypothesis df	Error df
Pairs	Pillai's Trace	.925	147.261[a]	1.000	12.000
	Wilks' Lambda	.075	147.261[a]	1.000	12.000
	Hotelling's Trace	12.272	147.261[a]	1.000	12.000
	Roy's Largest Root	12.272	147.261[a]	1.000	12.000
Pairs * Group	Pillai's Trace	.473	5.386[a]	2.000	12.000
	Wilks' Lambda	.527	5.386[a]	2.000	12.000
	Hotelling's Trace	.898	5.386[a]	2.000	12.000
	Roy's Largest Root	.898	5.386[a]	2.000	12.000
Images	Pillai's Trace	.[c]	.	.	.
	Wilks' Lambda	.[c]	.	.	.
	Hotelling's Trace	.[c]	.	.	.
	Roy's Largest Root	.[c]	.	.	.
Images * Group	Pillai's Trace	.[c]	.	.	.
	Wilks' Lambda	.[c]	.	.	.
	Hotelling's Trace	.[c]	.	.	.
	Roy's Largest Root	.[c]	.	.	.
Pairs * Images	Pillai's Trace	.[c]	.	.	.
	Wilks' Lambda	.[c]	.	.	.
	Hotelling's Trace	.[c]	.	.	.
	Roy's Largest Root	.[c]	.	.	.
Pairs * Images * Group	Pillai's Trace	.[c]	.	.	.
	Wilks' Lambda	.[c]	.	.	.
	Hotelling's Trace	.[c]	.	.	.
	Roy's Largest Root	.[c]	.	.	.

a. Exact statistic

c. Cannot produce multivariate test statistics because of insufficient residual degrees of freedom.

d. Design: Intercept + Group
Within Subjects Design: Pairs + Images + Pairs * Images

Multivariate Tests[d]

Effect		Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Pairs	Pillai's Trace	.000	.925	147.261	1.000
	Wilks' Lambda	.000	.925	147.261	1.000
	Hotelling's Trace	.000	.925	147.261	1.000
	Roy's Largest Root	.000	.925	147.261	1.000
Pairs * Group	Pillai's Trace	.021	.473	10.771	.735
	Wilks' Lambda	.021	.473	10.771	.735
	Hotelling's Trace	.021	.473	10.771	.735
	Roy's Largest Root	.021	.473	10.771	.735
Images	Pillai's Trace	.	.	.	.
	Wilks' Lambda	.	.	.	.
	Hotelling's Trace	.	.	.	.
	Roy's Largest Root	.	.	.	.
Images * Group	Pillai's Trace	.	.	.	.
	Wilks' Lambda	.	.	.	.
	Hotelling's Trace	.	.	.	.
	Roy's Largest Root	.	.	.	.
Pairs * Images	Pillai's Trace	.	.	.	.
	Wilks' Lambda	.	.	.	.
	Hotelling's Trace	.	.	.	.
	Roy's Largest Root	.	.	.	.
Pairs * Images * Group	Pillai's Trace	.	.	.	.
	Wilks' Lambda	.	.	.	.
	Hotelling's Trace	.	.	.	.
	Roy's Largest Root	.	.	.	.

b. Computed using alpha = .05

d. Design: Intercept + Group
Within Subjects Design: Pairs + Images + Pairs * Images

Tests of Within-Subjects Effects

Measure:VAS_Score

Source		Type III Sum of Squares	df	Mean Square	F
Pairs	Sphericity Assumed	138632.111	1	138632.111	147.261
	Greenhouse-Geisser	138632.111	1.000	138632.111	147.261
	Huynh-Feldt	138632.111	1.000	138632.111	147.261
	Lower-bound	138632.111	1.000	138632.111	147.261

Tests of Within-Subjects Effects

Measure:VAS_Score

Source		Sig.	Partial Eta Squared	Noncent. Parameter
Pairs	Sphericity Assumed	.000	.925	147.261
	Greenhouse-Geisser	.000	.925	147.261
	Huynh-Feldt	.000	.925	147.261
	Lower-bound	.000	.925	147.261

Tests of Within-Subjects Effects

Measure:VAS_Score

Source		Observed Power[a]
Pairs	Sphericity Assumed	1.000
	Greenhouse-Geisser	1.000
	Huynh-Feldt	1.000
	Lower-bound	1.000

a. Computed using alpha = .05

Tests of Within-Subjects Effects

Measure:VAS_Score

Source		Type III Sum of Squares	df	Mean Square	F
Pairs * Group	Sphericity Assumed	10140.149	2	5070.074	5.386
	Greenhouse-Geisser	10140.149	2.000	5070.074	5.386
	Huynh-Feldt	10140.149	2.000	5070.074	5.386
	Lower-bound	10140.149	2.000	5070.074	5.386
Error(Pairs)	Sphericity Assumed	11296.873	12	941.406	
	Greenhouse-Geisser	11296.873	12.000	941.406	
	Huynh-Feldt	11296.873	12.000	941.406	
	Lower-bound	11296.873	12.000	941.406	
Images	Sphericity Assumed	71053.116	29	2450.107	11.736
	Greenhouse-Geisser	71053.116	5.832	12182.408	11.736
	Huynh-Feldt	71053.116	13.861	5126.241	11.736
	Lower-bound	71053.116	1.000	71053.116	11.736
Images * Group	Sphericity Assumed	15577.798	58	268.583	1.286
	Greenhouse-Geisser	15577.798	11.665	1335.445	1.286
	Huynh-Feldt	15577.798	27.721	561.943	1.286
	Lower-bound	15577.798	2.000	7788.899	1.286
Error(Images)	Sphericity Assumed	72654.087	348	208.776	
	Greenhouse-Geisser	72654.087	69.989	1038.075	
	Huynh-Feldt	72654.087	166.328	436.812	
	Lower-bound	72654.087	12.000	6054.507	
Pairs * Images	Sphericity Assumed	36939.622	29	1273.780	12.184
	Greenhouse-Geisser	36939.622	7.351	5025.354	12.184
	Huynh-Feldt	36939.622	23.285	1586.418	12.184
	Lower-bound	36939.622	1.000	36939.622	12.184
Pairs * Images * Group	Sphericity Assumed	8001.718	58	137.961	1.320
	Greenhouse-Geisser	8001.718	14.701	544.286	1.320
	Huynh-Feldt	8001.718	46.570	171.822	1.320
	Lower-bound	8001.718	2.000	4000.859	1.320
Error(Pairs*Images)	Sphericity Assumed	36381.527	348	104.545	
	Greenhouse-Geisser	36381.527	88.208	412.452	
	Huynh-Feldt	36381.527	279.419	130.204	
	Lower-bound	36381.527	12.000	3031.794	

Tests of Within-Subjects Effects

Measure:VAS_Score

Source		Sig.	Partial Eta Squared	Noncent. Parameter
Pairs * Group	Sphericity Assumed	.021	.473	10.771
	Greenhouse-Geisser	.021	.473	10.771
	Huynh-Feldt	.021	.473	10.771
	Lower-bound	.021	.473	10.771
Images	Sphericity Assumed	.000	.494	340.332
	Greenhouse-Geisser	.000	.494	68.447
	Huynh-Feldt	.000	.494	162.663
	Lower-bound	.005	.494	11.736
Images * Group	Sphericity Assumed	.090	.177	74.615
	Greenhouse-Geisser	.248	.177	15.006
	Huynh-Feldt	.168	.177	35.662
	Lower-bound	.312	.177	2.573
Pairs * Images	Sphericity Assumed	.000	.504	353.338
	Greenhouse-Geisser	.000	.504	89.561
	Huynh-Feldt	.000	.504	283.705
	Lower-bound	.004	.504	12.184
Pairs * Images * Group	Sphericity Assumed	.070	.180	76.539
	Greenhouse-Geisser	.209	.180	19.400
	Huynh-Feldt	.092	.180	61.455
	Lower-bound	.303	.180	2.639

Tests of Within-Subjects Effects

Measure:VAS_Score

Source		Observed Power[a]
Pairs * Group	Sphericity Assumed	.735
	Greenhouse-Geisser	.735
	Huynh-Feldt	.735
	Lower-bound	.735
Images	Sphericity Assumed	1.000
	Greenhouse-Geisser	1.000
	Huynh-Feldt	1.000
	Lower-bound	.881
Images * Group	Sphericity Assumed	.997
	Greenhouse-Geisser	.653
	Huynh-Feldt	.926
	Lower-bound	.227
Pairs * Images	Sphericity Assumed	1.000
	Greenhouse-Geisser	1.000
	Huynh-Feldt	1.000
	Lower-bound	.893
Pairs * Images * Group	Sphericity Assumed	.998
	Greenhouse-Geisser	.751
	Huynh-Feldt	.992
	Lower-bound	.231

a. Computed using alpha = .05

Tests of Between-Subjects Effects

Measure:VAS_Score
Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	2506311.151	1	2506311.151	451.033	.000	.974
Group	40533.936	2	20266.968	3.647	.058	.378
Error	66681.913	12	5556.826			

Tests of Between-Subjects Effects

Measure:VAS_Score
Transformed Variable:Average

Source	Noncent. Parameter	Observed Power[a]
Intercept	451.033	1.000
Group	7.294	.557

a. Computed using alpha = .05

Estimated Marginal Means

1. Fac,Res, or Lay

Measure:VAS_Score

Fac,Res, or Lay	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
F	48.850	4.304	39.473	58.227
L	62.217	4.304	52.839	71.594
R	47.247	4.304	37.869	56.624

2. Pairs

Measure:VAS_Score

Pairs	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	40.360	2.720	34.433	46.287
2	65.182	2.653	59.401	70.963

3. Images

Measure:VAS_Score

Images	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	72.733	3.029	66.135	79.332
2	44.700	4.975	33.861	55.539
3	51.467	6.203	37.952	64.982
4	43.733	4.848	33.171	54.296
5	46.400	2.970	39.930	52.870
6	57.167	3.783	48.923	65.410
7	57.533	3.268	50.414	64.653
8	59.300	3.207	52.312	66.288
9	52.533	3.571	44.752	60.314
10	63.700	3.601	55.854	71.546
11	56.867	3.224	49.841	63.892
12	62.900	3.870	54.469	71.331
13	40.667	3.600	32.824	48.510
14	54.600	4.070	45.733	63.467
15	56.900	2.634	51.161	62.639
16	54.133	4.268	44.834	63.433
17	51.400	2.933	45.009	57.791
18	48.000	2.651	42.224	53.776
19	36.400	4.202	27.245	45.555
20	37.933	3.822	29.605	46.261
21	46.000	3.297	38.817	53.183
22	40.967	3.560	33.211	48.722

3. Images

Measure:VAS_Score

Images	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
23	55.900	3.644	47.961	63.839
24	46.000	3.280	38.853	53.147
25	47.833	2.866	41.589	54.078
26	54.233	2.826	48.076	60.391
27	62.200	2.494	56.766	67.634
28	58.400	2.324	53.337	63.463
29	50.233	2.644	44.473	55.994
30	72.300	3.316	65.075	79.525

4. Fac,Res, or Lay * Pairs

Measure:VAS_Score

Fac,Res, or Lay	Pairs	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
F	1	39.767	4.712	29.500	50.033
	2	57.933	4.596	47.920	67.946
L	1	51.073	4.712	40.807	61.340
	2	73.360	4.596	63.347	83.373
R	1	30.240	4.712	19.974	40.506
	2	64.253	4.596	54.240	74.266

5. Fac,Res, or Lay * Images

Measure:VAS_Score

Fac,Res, or Lay	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
F	1	72.500	5.246	61.071	83.929
	2	34.800	8.616	16.026	53.574
	3	45.900	10.744	22.492	69.308
	4	38.900	8.396	20.606	57.194
	5	43.800	5.144	32.593	55.007
	6	53.800	6.553	39.522	68.078
	7	53.400	5.660	41.068	65.732
	8	59.200	5.555	47.097	71.303
	9	51.500	6.186	38.023	64.977
	10	60.500	6.237	46.910	74.090
	11	54.900	5.585	42.731	67.069
	12	59.500	6.703	44.896	74.104
	13	35.900	6.235	22.315	49.485
	14	47.400	7.049	32.042	62.758
	15	54.500	4.563	44.559	64.441

5. Fac,Res, or Lay * Images

Measure:VAS Score

Fac.Res. or Lay	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
F	16	51.200	7.393	35.092	67.308
	17	49.900	5.081	38.831	60.969
	18	45.800	4.591	35.796	55.804
	19	27.600	7.278	11.743	43.457
	20	30.900	6.620	16.476	45.324
	21	44.000	5.711	31.558	56.442
	22	35.400	6.165	21.967	48.833
	23	49.700	6.311	35.949	63.451
	24	42.900	5.682	30.521	55.279
	25	38.700	4.964	27.884	49.516
	26	52.900	4.895	42.235	63.565
	27	64.500	4.320	55.088	73.912
	28	60.500	4.025	51.730	69.270
	29	44.400	4.579	34.423	54.377
	30	60.600	5.744	48.085	73.115

5. Fac,Res, or Lay * Images

Measure:VAS_Score

Fac.Res. or Lay	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
L	1	74.800	5.246	63.371	86.229
	2	50.300	8.616	31.526	69.074
	3	58.100	10.744	34.692	81.508
	4	52.800	8.396	34.506	71.094
	5	56.700	5.144	45.493	67.907
	6	64.000	6.553	49.722	78.278
	7	69.700	5.660	57.368	82.032
	8	69.400	5.555	57.297	81.503
	9	58.600	6.186	45.123	72.077
	10	73.100	6.237	59.510	86.690
	11	62.700	5.585	50.531	74.869
	12	74.800	6.703	60.196	89.404
	13	51.600	6.235	38.015	65.185
	14	63.100	7.049	47.742	78.458
	15	69.900	4.563	59.959	79.841
	16	67.400	7.393	51.292	83.508
	17	61.200	5.081	50.131	72.269
	18	52.900	4.591	42.896	62.904
	19	60.500	7.278	44.643	76.357
	20	54.300	6.620	39.876	68.724
	21	57.800	5.711	45.358	70.242
	22	57.300	6.165	43.867	70.733
	23	68.000	6.311	54.249	81.751
	24	54.500	5.682	42.121	66.879
	25	59.500	4.964	48.684	70.316
	26	62.900	4.895	52.235	73.565
	27	67.300	4.320	57.888	76.712
	28	56.900	4.025	48.130	65.670
	29	56.600	4.579	46.623	66.577
	30	79.800	5.744	67.285	92.315

5. Fac,Res, or Lay * Images

Measure:VAS_Score

Fac,Res, or Lay	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
R	1	70.900	5.246	59.471	82.329
	2	49.000	8.616	30.226	67.774
	3	50.400	10.744	26.992	73.808
	4	39.500	8.396	21.206	57.794
	5	38.700	5.144	27.493	49.907
	6	53.700	6.553	39.422	67.978
	7	49.500	5.660	37.168	61.832
	8	49.300	5.555	37.197	61.403
	9	47.500	6.186	34.023	60.977
	10	57.500	6.237	43.910	71.090
	11	53.000	5.585	40.831	65.169
	12	54.400	6.703	39.796	69.004
	13	34.500	6.235	20.915	48.085
	14	53.300	7.049	37.942	68.658
	15	46.300	4.563	36.359	56.241
	16	43.800	7.393	27.692	59.908
	17	43.100	5.081	32.031	54.169
	18	45.300	4.591	35.296	55.304
	19	21.100	7.278	5.243	36.957
	20	28.600	6.620	14.176	43.024
	21	36.200	5.711	23.758	48.642
	22	30.200	6.165	16.767	43.633
	23	50.000	6.311	36.249	63.751
	24	40.600	5.682	28.221	52.979
	25	45.300	4.964	34.484	56.116
	26	46.900	4.895	36.235	57.565
	27	54.800	4.320	45.388	64.212
	28	57.800	4.025	49.030	66.570
	29	49.700	4.579	39.723	59.677
	30	76.500	5.744	63.985	89.015

6. Pairs * Images

Measure:VAS_Score

Pairs	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
1	1	72.067	3.384	64.694	79.440
	2	33.667	5.418	21.861	45.473
	3	50.267	7.008	34.997	65.536
	4	25.200	4.490	15.417	34.983

6. Pairs * Images

Measure:VAS_Score

Pairs	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1	5	23.533	3.678	15.519	31.547
	6	50.200	3.641	42.267	58.133
	7	42.667	5.116	31.519	53.814
	8	42.133	4.461	32.414	51.853
	9	34.133	3.763	25.934	42.333
	10	50.667	4.570	40.710	60.624
	11	47.400	3.609	39.537	55.263
	12	56.000	5.616	43.764	68.236
	13	33.533	3.369	26.193	40.874
	14	49.467	4.146	40.432	58.501
	15	35.133	3.807	26.838	43.429
	16	47.333	4.750	36.984	57.683
	17	38.200	2.538	32.670	43.730
	18	33.867	3.144	27.017	40.716
	19	34.200	3.849	25.814	42.586
	20	25.000	3.468	17.445	32.555
	21	35.133	2.896	28.823	41.444
	22	24.067	3.560	16.311	31.822
	23	37.933	4.261	28.650	47.217
	24	34.600	3.274	27.467	41.733
	25	28.000	3.794	19.734	36.266
	26	39.067	3.593	31.238	46.896
	27	38.933	4.494	29.142	48.724
	28	43.267	2.817	37.129	49.404
	29	34.200	3.948	25.597	42.803
	30	70.933	4.879	60.303	81.563

6. Pairs * Images

Measure:VAS_Score

Pairs	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
2	1	73.400	3.678	65.386	81.414
	2	55.733	5.269	44.254	67.213
	3	52.667	6.040	39.507	65.827
	4	62.267	6.013	49.165	75.368
	5	69.267	3.361	61.944	76.589
	6	64.133	4.816	53.639	74.627
	7	72.400	3.825	64.065	80.735
	8	76.467	3.211	69.470	83.463
	9	70.933	4.061	62.085	79.781
	10	76.733	3.032	70.128	83.339
	11	66.333	4.098	57.405	75.262
	12	69.800	3.975	61.140	78.460
	13	47.800	5.088	36.714	58.886
	14	59.733	4.747	49.390	70.077
	15	78.667	3.063	71.994	85.340
	16	60.933	4.850	50.366	71.501
	17	64.600	3.704	56.529	72.671
	18	62.133	3.265	55.019	69.248
	19	38.600	4.687	28.388	48.812
	20	50.867	4.526	41.004	60.729
	21	56.867	5.105	45.744	67.990
	22	57.867	4.661	47.710	68.023
	23	73.867	4.034	65.077	82.656
	24	57.400	4.332	47.961	66.839
	25	67.667	3.418	60.220	75.114
	26	69.400	3.499	61.776	77.024
	27	85.467	2.707	79.568	91.365
	28	73.533	2.824	67.380	79.687
	29	66.267	2.745	60.286	72.248
	30	73.667	3.672	65.666	81.668

7. Fac,Res, or Lay * Pairs * Images

Measure:VAS_Score

Fac,Res, or Lay	Pairs	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
F	1	1	74.600	5.861	61.830	87.370
		2	32.400	9.385	11.952	52.848
		3	41.000	12.138	14.553	67.447
		4	26.800	7.777	9.856	43.744

7. Fac,Res, or Lay * Pairs * Images

Measure:VAS_Score

Fac,Res, or Lay	Pairs	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
F	1	5	21.000	6.371	7.119	34.881
		6	50.400	6.306	36.660	64.140
		7	40.800	8.862	21.492	60.108
		8	43.600	7.727	26.765	60.435
		9	36.600	6.518	22.398	50.802
		10	50.400	7.915	33.154	67.646
		11	49.000	6.251	35.381	62.619
		12	50.800	9.727	29.606	71.994
		13	27.400	5.836	14.685	40.115
		14	44.200	7.182	28.552	59.848
		15	37.600	6.594	23.232	51.968
		16	46.800	8.227	28.874	64.726
		17	41.600	4.396	32.021	51.179
		18	38.200	5.445	26.337	50.063
		19	24.800	6.667	10.274	39.326
		20	23.400	6.006	10.314	36.486
		21	37.600	5.017	26.670	48.530
		22	21.800	6.165	8.367	35.233
		23	38.600	7.380	22.521	54.679
		24	36.600	5.670	24.245	48.955
		25	26.600	6.571	12.283	40.917
		26	42.000	6.224	28.440	55.560
		27	46.800	7.783	29.842	63.758
		28	47.400	4.879	36.769	58.031
		29	33.400	6.839	18.500	48.300
		30	60.800	8.450	42.388	79.212

7. Fac,Res, or Lay * Pairs * Images

Measure:VAS_Score

Fac,Res, or Lay	Pairs	Images	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
F	2	1	70.400	6.371	56.519	84.281
		2	37.200	9.125	17.317	57.083
		3	50.800	10.462	28.006	73.594
		4	51.000	10.415	28.308	73.692
		5	66.600	5.821	53.917	79.283
		6	57.200	8.342	39.024	75.376
		7	66.000	6.626	51.564	80.436
		8	74.800	5.562	62.682	86.918
		9	66.400	7.034	51.075	81.725
		10	70.600	5.251	59.159	82.041
		11	60.800	7.098	45.335	76.265
		12	68.200	6.884	53.200	83.200
		13	44.400	8.812	25.199	63.601
		14	50.600	8.223	32.684	68.516
		15	71.400	5.305	59.842	82.958
		16	55.600	8.400	37.297	73.903
		17	58.200	6.416	44.220	72.180
		18	53.400	5.656	41.077	65.723
		19	30.400	8.118	12.712	48.088
		20	38.400	7.840	21.318	55.482
		21	50.400	8.842	31.134	69.666
		22	49.000	8.074	31.409	66.591
		23	60.800	6.987	45.576	76.024
		24	49.200	7.504	32.851	65.549
		25	50.800	5.920	37.901	63.699
		26	63.800	6.061	50.595	77.005
		27	82.200	4.689	71.984	92.416
		28	73.600	4.891	62.942	84.258
		29	55.400	4.755	45.041	65.759
		30	60.400	6.360	46.542	74.258

7. Fac,Res, or Lay * Pairs * Images

Measure:VAS Score

Fac,Res, or Lay	Pairs	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
L	1	1	76.400	5.861	63.630	89.170
		2	37.800	9.385	17.352	58.248
		3	64.400	12.138	37.953	90.847
		4	33.200	7.777	16.256	50.144
		5	37.000	6.371	23.119	50.881
		6	59.000	6.306	45.260	72.740
		7	62.000	8.862	42.692	81.308
		8	56.800	7.727	39.965	73.635
		9	44.200	6.518	29.998	58.402
		10	63.200	7.915	45.954	80.446
		11	51.600	6.251	37.981	65.219
		12	65.600	9.727	44.406	86.794
		13	43.800	5.836	31.085	56.515
		14	54.400	7.182	38.752	70.048
		15	51.200	6.594	36.832	65.568
		16	67.600	8.227	49.674	85.526
		17	49.400	4.396	39.821	58.979
		18	38.800	5.445	26.937	50.663
		19	59.600	6.667	45.074	74.126
		20	38.600	6.006	25.514	51.686
		21	45.800	5.017	34.870	56.730
		22	38.600	6.165	25.167	52.033
		23	49.600	7.380	33.521	65.679
		24	44.800	5.670	32.445	57.155
		25	37.200	6.571	22.883	51.517
		26	47.800	6.224	34.240	61.360
		27	46.000	7.783	29.042	62.958
		28	45.400	4.879	34.769	56.031
		29	41.200	6.839	26.300	56.100
		30	81.200	8.450	62.788	99.612

7. Fac,Res, or Lay * Pairs * Images

Measure:VAS Score

Fac.Res. or Lay	Pairs	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
L	2	1	73.200	6.371	59.319	87.081
		2	62.800	9.125	42.917	82.683
		3	51.800	10.462	29.006	74.594
		4	72.400	10.415	49.708	95.092
		5	76.400	5.821	63.717	89.083
		6	69.000	8.342	50.824	87.176
		7	77.400	6.626	62.964	91.836
		8	82.000	5.562	69.882	94.118
		9	73.000	7.034	57.675	88.325
		10	83.000	5.251	71.559	94.441
		11	73.800	7.098	58.335	89.265
		12	84.000	6.884	69.000	99.000
		13	59.400	8.812	40.199	78.601
		14	71.800	8.223	53.884	89.716
		15	88.600	5.305	77.042	100.158
		16	67.200	8.400	48.897	85.503
		17	73.000	6.416	59.020	86.980
		18	67.000	5.656	54.677	79.323
		19	61.400	8.118	43.712	79.088
		20	70.000	7.840	52.918	87.082
		21	69.800	8.842	50.534	89.066
		22	76.000	8.074	58.409	93.591
		23	86.400	6.987	71.176	101.624
		24	64.200	7.504	47.851	80.549
		25	81.800	5.920	68.901	94.699
		26	78.000	6.061	64.795	91.205
		27	88.600	4.689	78.384	98.816
		28	68.400	4.891	57.742	79.058
		29	72.000	4.755	61.641	82.359
		30	78.400	6.360	64.542	92.258

7. Fac,Res, or Lay * Pairs * Images

Measure:VAS_Score

Fac,Res, or Lay	Pairs	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
R	1	1	65.200	5.861	52.430	77.970
		2	30.800	9.385	10.352	51.248
		3	45.400	12.138	18.953	71.847
		4	15.600	7.777	-1.344	32.544
		5	12.600	6.371	-1.281	26.481
		6	41.200	6.306	27.460	54.940
		7	25.200	8.862	5.892	44.508
		8	26.000	7.727	9.165	42.835
		9	21.600	6.518	7.398	35.802
		10	38.400	7.915	21.154	55.646
		11	41.600	6.251	27.981	55.219
		12	51.600	9.727	30.406	72.794
		13	29.400	5.836	16.685	42.115
		14	49.800	7.182	34.152	65.448
		15	16.600	6.594	2.232	30.968
		16	27.600	8.227	9.674	45.526
		17	23.600	4.396	14.021	33.179
		18	24.600	5.445	12.737	36.463
		19	18.200	6.667	3.674	32.726
		20	13.000	6.006	-.086	26.086
		21	22.000	5.017	11.070	32.930
		22	11.800	6.165	-1.633	25.233
		23	25.600	7.380	9.521	41.679
		24	22.400	5.670	10.045	34.755
		25	20.200	6.571	5.883	34.517
		26	27.400	6.224	13.840	40.960
		27	24.000	7.783	7.042	40.958
		28	37.000	4.879	26.369	47.631
		29	28.000	6.839	13.100	42.900
		30	70.800	8.450	52.388	89.212

7. Fac,Res, or Lay * Pairs * Images

Measure:VAS_Score

Fac.Res. or Lay	Pairs	Images	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
R	2	1	76.600	6.371	62.719	90.481
		2	67.200	9.125	47.317	87.083
		3	55.400	10.462	32.606	78.194
		4	63.400	10.415	40.708	86.092
		5	64.800	5.821	52.117	77.483
		6	66.200	8.342	48.024	84.376
		7	73.800	6.626	59.364	88.236
		8	72.600	5.562	60.482	84.718
		9	73.400	7.034	58.075	88.725
		10	76.600	5.251	65.159	88.041
		11	64.400	7.098	48.935	79.865
		12	57.200	6.884	42.200	72.200
		13	39.600	8.812	20.399	58.801
		14	56.800	8.223	38.884	74.716
		15	76.000	5.305	64.442	87.558
		16	60.000	8.400	41.697	78.303
		17	62.600	6.416	48.620	76.580
		18	66.000	5.656	53.677	78.323
		19	24.000	8.118	6.312	41.688
		20	44.200	7.840	27.118	61.282
		21	50.400	8.842	31.134	69.666
		22	48.600	8.074	31.009	66.191
		23	74.400	6.987	59.176	89.624
		24	58.800	7.504	42.451	75.149
		25	70.400	5.920	57.501	83.299
		26	66.400	6.061	53.195	79.605
		27	85.600	4.689	75.384	95.816
		28	78.600	4.891	67.942	89.258
		29	71.400	4.755	61.041	81.759
		30	82.200	6.360	68.342	96.058

APPENDIX B

IRB

University of Pittsburgh
Institutional Review Board

3500 Fifth Avenue
Pittsburgh, PA 15213
(412) 383-1480
(412) 383-1508 (fax)
http://www.irb.pitt.edu

Memorandum

To: Andrew Thompson, DMD

From: Sue Beers, PhD, Vice Chair

Date: 1/13/2011

IRB#: PRO10060338

Subject: A Soft Tissue Arc to assess balance of the lower facial third.

The University of Pittsburgh Institutional Review Board reviewed and approved the above referenced study by the expedited review procedure authorized under 45 CFR 46.110. Your research study was approved under 45 CFR 46.110 (7).

The IRB has determined the level of risk to be minimal.

Approval Date: 1/13/2011

Expiration Date: 1/12/2012

For studies being conducted in UPMC facilities, no clinical activities can be undertaken by investigators until they have received approval from the UPMC Fiscal Review Office.

Please note that it is the investigator's responsibility to report to the IRB any unanticipated problems involving risks to subjects or others [see 45 CFR 46.103(b)(5)]. The IRB Reference Manual (Chapter 3, Section 3.3) describes the reporting requirements for unanticipated problems which include, but are not limited to, adverse events. If you have any questions about this process, please contact the Adverse Events Coordinator at 412-383-1480.

The protocol and consent forms, along with a brief progress report must be resubmitted at least one month prior to the renewal date noted above as required by FWA00006790 (University of Pittsburgh), FWA00006735 (University of Pittsburgh Medical Center), FWA00000600 (Children's Hospital of Pittsburgh), FWA00003567 (Magee-Womens Health Corporation), FWA00003338 (University of Pittsburgh Medical Center Cancer Institute).

Please be advised that your research study may be audited periodically by the University of Pittsburgh Research Conduct and Compliance Office.

B.1 CONSENT FORMS

B.1.1 Consent for judges

CONSENT TO ACT AS A PARTICIPANT IN A RESEARCH STUDY

TITLE: The use of a Soft Tissue Arc to identify soft tissue discrepancies in the lower face

PRINCIPAL INVESTIGATOR: Andrew Thompson, D.M.D.
Orthodontic Resident
University of Pittsburgh
Department of Orthodontics
Telephone: 412-648-8689

CO-INVESTIGATORS: Janet Robison, D.M.D.
Orthodontic Faculty
University of Pittsburgh
Department of Orthodontics
Telephone: 412-648-8689

We invite you to take part in a research study "The use of a Soft Tissue Arc to identify soft tissue discrepancies in the lower face" at The University of Pittsburgh, Department of Orthodontics, which seeks to identify a more effective means of planning orthodontic therapy. Taking part in this study is entirely voluntary. We urge you discuss any questions about this study with our staff members. Talk to your family and friends about it and take your time to make your decision. If you decide to participate you must sign this form to show that you want to take part.

Why is this research being done?

This research study is being done to evaluate a proposed aid in orthodontic treatment planning. Specifically, it may help to identify a pleasing profile (side view of an individual's face).

Who is being asked to take part in this research study?

Laypersons, orthodontists and orthodontic residents will be asked to judge attractiveness of morphed (altered) profile pictures.

What procedures will be performed for research purposes?

Patient profile pictures have been morphed (changed) in a variety of ways. You will be asked to rate the attractiveness of these changed profiles on a visual analogue scale.

What are the possible risks, side effects, and discomforts of this research study?

The possible risk is a breach of confidentiality. Specifically for those physicians who participate, your professional reputation could be altered if your ratings of facial esthetics were below standard. Please refer to the following question "Who will know about my participation in this research study?" to see steps taken to minimize this risk.

Who will know about my participation in this research study?

Any information about you obtained from this research will be kept as confidential (private) as possible. The only research document with directly identifies you will be this signed consent form. All records related to your involvement in this research study will be stored in a locked file cabinet. Once you have given your opinion, your identity will not be kept with the records, only your category of participation will be associated with them (e.g., Orthodontist, orthodontic resident or layperson).

What are possible benefits from taking part in this study?

There are no known benefits to you. However, this research may potentially benefit orthodontists in future diagnosis and treatment planning of patients.

Is there any cost for participation?

There is no cost associated with participation.

Will I be paid if I take part in this research study?

No.

Will this research study involve the use or disclosure of my identifiable medical information?

No

Who will have access to identifiable information related to my participation in this research study?

In addition to the investigators listed on the first page of this authorization (consent) form and their research staff, authorized representatives of the University of Pittsburgh Research Conduct and Compliance Office may review your identifiable research information (which may include your identifiable medical information) for the purpose of monitoring the appropriate conduct of this research study.

Is my participation in this research study voluntary?

Yes! You may refuse to take part in it, or you may stop participating at any time, even after signing this form. Your decision will not affect your relationship with The University of Pittsburgh or the care your child receives from the UPMC Department of Orthodontics.

May I withdraw, at a future date, my consent for participation in this research study?

Yes. To do so, you must contact the investigators who are listed on the first page of this consent form. If you withdraw from this study, we will continue to use the information we have collected from your ratings of these pictures.

Confidentiality Statement: You may recognize an individual from pictures you see in this study. If you do recognize anyone, please respect their privacy and do not disclose this to anyone.

VOLUNTARY CONSENT

The above information has been explained to me and all of my current questions have been answered. I understand that I am encouraged to ask questions about any aspect of this research study during the course of this study, and that such future questions will be answered by a qualified individual or by the investigator(s) listed on the first page of this consent document at the telephone number(s) given. I understand that I may always request that my questions, concerns or complaints be addressed by a listed investigator.

I understand that I may contact the Human Subjects Protection Advocate of the IRB Office, University of Pittsburgh (1-866-212-2668) to discuss problems, concerns, and questions; obtain information; offer input; or discuss situations that have occurred during my participation.

By signing this form, I agree to participate in this research study. A copy of this consent form will be given to me.

____

Participant’s Signature

__________________________ ____________

Printed Name of Participant Date

CERTIFICATION of INFORMED CONSENT

I certify that I have explained the nature and purpose of this research study to the above-named individual(s), and I have discussed the potential benefits and possible risks of study participation. Any questions the individual(s) have about this study have been answered, and we will always be available to address future questions as they arise.

________________________________ ______________________

Printed Name of Person Obtaining Consent Role in Research Study

______________________________ ____________

Signature of Person Obtaining Consent Date

B.1.2 Consent for Morphers

CONSENT TO ACT AS A PARTICIPANT IN A RESEARCH STUDY

TITLE: The use of a Soft Tissue Arc to identify soft tissue discrepancies in the lower face

PRINCIPAL INVESTIGATOR: Andrew Thompson, D.M.D.

Orthodontic Resident
University of Pittsburgh
Department of Orthodontics
Telephone: 412-648-8689

CO-INVESTIGATORS: Janet Robison, D.M.D.
Orthodontic Faculty
University of Pittsburgh
Department of Orthodontics
Telephone: 412-648-8689

We invite you to take part in a research study "The use of a Soft Tissue Arc to identify soft tissue discrepancies in the lower face" at The University of Pittsburgh, Department of Orthodontics, which seeks to identify a more effective means of planning orthodontic therapy. Taking part in this study is entirely voluntary. We urge you discuss any questions about this study with our staff members. If you decide to participate you must sign this form to show that you want to take part.

Why is this research being done?

This research study is being done to evaluate a proposed aid in orthodontic treatment planning. Specifically, it may help to identify a pleasing profile.

Who is being asked to take part in this research study?

Orthodontists and orthodontic residents will be asked to morph profile pictures.

What procedures will be performed for research purposes?

You will be asked to morph 30 patient profile pictures using Dolphin imaging software. Specifically, you will be asked to advance or setback the upper lip, lower lip and chin.

What are the possible risks, side effects, and discomforts of this research study?

The possible risk is a breach of confidentiality. Your professional reputation could be altered if your morphed images convey your appreciation of facial esthetics were below standard. Please refer to the following question "Who will know about my participation in this research study?" to see steps taken to minimize this risk.

Who will know about my participation in this research study?

Any information about you obtained from this research will be kept as confidential (private) as possible. The only research document with directly identifies you will be this signed consent form. All records related to your involvement in this research study will be stored in a locked file cabinet. Once you have completed morphing, your identity will not be kept with the records, only your category of participation will be associated with them (ie- Orthodontist or orthodontic resident).

What are possible benefits from taking part in this study?

There are no known benefits to you. However, this research may potentially benefit orthodontists in future diagnosis and treatment planning of patients.

Is there any cost for participation?

There is no cost associated with participation.

Will I be paid if I take part in this research study?

No.

Will this research study involve the use or disclosure of my identifiable medical information?

No

Who will have access to identifiable information related to my participation in this research study?

In addition to the investigators listed on the first page of this authorization (consent) form and their research staff, authorized representatives of the University of Pittsburgh Research Conduct and Compliance Office may review your identifiable research information (which may include your identifiable medical information) for the purpose of monitoring the appropriate conduct of this research study.

Is my participation in this research study voluntary?

Yes! You may refuse to take part in it, or you may stop participating at any time, even after signing this form. Your decision will not affect your relationship with The University of Pittsburgh.

May I withdraw, at a future date, my consent for participation in this research study?

Yes. To do so, you must contact the investigators who are listed on the first page of this consent form. If you withdraw from this study, we will continue to use the information we have collected from your ratings of these pictures.

VOLUNTARY CONSENT

The above information has been explained to me and all of my current questions have been answered. I understand that I am encouraged to ask questions about any aspect of this research study during the course of this study, and that such future questions will be answered by a qualified individual or by the investigator(s) listed on the first page of this consent document at the telephone number(s) given. I understand that I may always request that my questions, concerns or complaints be addressed by a listed investigator.

I understand that I may contact the Human Subjects Protection Advocate of the IRB Office, University of Pittsburgh (1-866-212-2668) to discuss problems, concerns, and questions; obtain information; offer input; or discuss situations that have occurred during my participation.

By signing this form, I agree to participate in this research study. A copy of this consent form will be given to me.

______________________________ ______________________________ ____________

Participant's Signature Printed Name of Participant Date

CERTIFICATION of INFORMED CONSENT

I certify that I have explained the nature and purpose of this research study to the above-named individual(s), and I have discussed the potential benefits and possible risks of study participation. Any questions the individual(s) have about this study have been answered, and we will always be available to address future questions as they arise."

______________________________________ __________________________

Printed Name of Person Obtaining Consent Role in Research Study

____________________________________ ____________

Signature of Person Obtaining Consent Date

Consent to Use of Records

For the purpose of advancing medical/dental education, I give permission for observers to view my treatment in the orthodontic clinic. Also, I hereby give my permission for the use of any records (including photographs, x-rays, dental casts) made in the process of treatment for the purposes of professional consultations, research, education or publication in professional journals.

_______________________________ Patient/Parent or Guardian Signature

_______________ Date:

_______________________________ Witness Signature

_______________ Date:

Pre-Treatment Orthodontic Retention Agreement

I, _____________, understand that when my braces are removed I am responsible for keeping my teeth in their final position by wearing my retainers constantly (unless eating or brushing) for three to six months as recommneded by my orthodontist. Thereafter I must wear them nightly. I realize my teeth will regress if I do not wear my retainers.

_______________ Date:

_______________________________ Witness Signature

_______________ Date:

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