

**THE SOFT-TISSUE PROFILE PREFERENCES OF A GROUP OF LAY  
PERSONS AND PROFESSIONALS**

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## DECLARATION

I, Shameela Haroon Suliman declare that this thesis entitled; **“THE SOFT-TISSUE PROFILE PREFERENCES OF A GROUP OF LAY PERSONS AND PROFESSIONALS”** is my own work and that all sources quoted have been indicated and acknowledged by means of references.

Signed:

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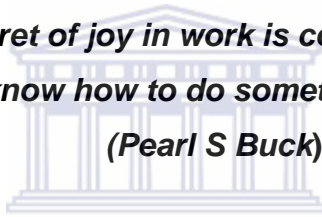
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***“The secret of joy in work is contained in one word – excellence. To know how to do something well is to enjoy it.”***

***(Pearl S Buck)***



When I read these words I think about my mentor, Dr M.G. Samsodien as he always told us mediocracy was never an option. He taught us to strive for excellence in everything we do and this is a lesson I will carry with me in everything I do in life.

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***“The impact of family and friends in our lives is like that of our heartbeats. Though they are not always visible they silently support our life.”***

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## ABSTRACT

Although facial aesthetics has always been a part of orthodontic diagnosis and treatment planning, the criteria for facial evaluation have been somewhat arbitrary. They are often based on parameters from the field of art or from evaluating faces chosen by orthodontists or other professionals (Olds, 1992).

**Aim and objectives of the study:** To determine the soft-tissue profile preference of a group of lay persons and professionals. To compare the preferences of the male and female assessors (lay persons group) with regard to the preferred profiles for the male and female patient respectively. To test similarities and differences in the professional's perceptions of the various profiles. **Method:** This qualitative study was undertaken at the orthodontic clinic at UWC using post-treatment soft-tissue profile photographs of patients who had attended the orthodontic clinic. A specially designed questionnaire containing the predetermined profile types was given to each participant. Two A5 booklets, each containing ten profile types were supplied, one for the preferred profile for the male and the other for the female. The same booklet was used for male and female profiles as the gender of the profile could not be distinguished from the manipulated photographs. The pages were one sided in an attempt to prevent bias by comparison with adjacent profiles during the rating process. The Visual Analogue Scale (VAS) and Likert scales were placed separately below each of the specially edited soft-tissue profile photographs. The rater was hence required to complete each scale independently of the other. **Analysis:** The Kruskal-Wallis One-Way ANOVA on Ranks Hypotheses tests were carried out to compare the preferences for the respective genders in each category. The Spearman's Correlation was also done to determine whether there were any significant relationships in the perceptions of the profiles. The various profiles tested were *straight profile, straight convex profile, straight concave profile, anterior divergent convex profile, anterior divergent concave profile, anterior divergent straight profile, posterior divergent convex profile (thick lips), posterior divergent convex profile (thin lips), posterior divergent straight profile and the posterior divergent concave profile.* **Conclusions:** The professionals (orthodontists) and lay persons found the straight profile, followed by the

posterior divergent straight profile to be the most pleasing profile for the males, whereas the posterior divergent convex (thin lips) profile was selected as the most attractive for the females. The most unattractive profile was not as clearly identified in the study. The profiles chosen as unattractive included: anterior divergent convex profile, posterior divergent convex profile (thick lips), posterior divergent concave profile and the anterior divergent concave profile. None of the male profiles were interpreted by the participants as being similar. For the female profiles there was a similarity in the perception of the anterior divergent concave profile and the straight profile, the straight profile and the anterior divergent straight profile, and the anterior divergent concave profile and the anterior divergent straight profile. Thus, for the female profiles the number of profiles can actually be decreased as there was a high percentage of perceived similarities between these profiles.



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# INTRODUCTION



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## **1. Introduction**

Of the many formulations that define orthodontic treatment objectives, the triad of Jackson which included “structural balance, functional efficiency, and aesthetic harmony”, is perhaps the most encompassing (Jackson, 1904 cited in Mantzikos, 1998). Whilst this definition may be quite descriptive, it could mean different things to different people, to the extent that the orthodontist planning treatment “would start out in different directions toward different objectives by different orthodontic means” (Mantzikos, 1998).

The orthodontic patient population consists of persons with a heterogeneous mixture of genetic backgrounds, yet as orthodontists, we frequently attempt to force them into a homogenous mould (Matoula, 2006). Our goal should be in finding common ground, on which we could meet to embrace reasonable objectives and common standards to judge patients “solely by an orthodontic interpretation of aesthetic harmony” (Matoula and Pancherz, 2006).

In recent years, there has been an increasing emphasis on facial aesthetics as an important outcome of orthodontic treatment (Yehezkel and Turley, 2004). Interestingly, Farkas et al (1985), found a large discrepancy between the aesthetic profile depicted in art and that in the mass media. Additionally researchers have shown that lay people might have a different concept of facial beauty to that of orthodontists (Hall et al, 2000 and Bell et al, 1985). Furthermore, it has been reported that the public view of facial beauty was not constant but continuously changing throughout the Twentieth century (Yehezkel and Turley, 2004).

Facial aesthetics whilst having considerable importance in orthodontics is a subject of interest that embraces people everywhere (Peck and Peck, 1970). As orthodontists, we forget that the ultimate source of our aesthetic values should be the patient and not the orthodontist (Peck and Peck, 1970). We do not need to

look very far to see that facial harmony and facial beauty have assumed enormous significance within the fabric of our society. We are constantly bombarded with images of facial beauty through the print and electronic media, through cinema and through billboard advertising (Stenvik et al, 1997).

As a society, we often judge others by their physical attractiveness (Kiekenes et al, 2006). Indeed, we live in a 'beauty oriented' society and if we choose to function within it, especially if our treatment can affect it, then we need to be aware of and sensitive to those criteria that society regard as important or desirable in the area of beauty, particularly of facial beauty (Araujo, 2005).

The human face is perhaps one of the defining factors of both individuality and beauty and nothing captures our attention more and nothing rivals it in its communicative power (Araujo, 2005). It is often stated that "beauty is in the eye of the beholder", yet studies show that people from diverse ethnic backgrounds agree on what is considered a beautiful face (Riedel, 1957; Deloach, 1978). This raises an interesting question; if beauty is universal, then what makes a face aesthetic? (Araujo, 2005).

In searching for a philosophy of beauty there is, surprisingly, agreement that beauty is a reflection of order, symmetry and harmony of individual features (Peck and Peck, 1970). For many artists, such as Durer, Botticelli, and da Vinci, beauty ultimately resided in proportion and symmetry. Even today we are still studying the ancient canons and applying them to the concept of beauty (Araujo, 2005).

Beauty in the orthodontic context, perhaps, may be defined as a state of harmony and balance of facial proportions, that is, a balanced relationship amongst skeletal structures, teeth and soft tissue (Dierkes, 1987). Dierkes suggested that optimal beauty was not possible where skeletal disharmonies,

dental irregularities, or soft tissue strain or laxity existed. He defined beauty as the relative measure of balance and harmony.

To improve facial aesthetics, orthodontists must be aware of what the public considers an ideal profile. Olds (1992), suggested that the standards of facial beauty depicted in classical and modern art have remained the same through the past several thousand years, and that those ideals were still representative of the current concept of beauty. On the contrary, others (Hambleton 1964, Farkas et al, 1984, 1985, and Pogrel 1991), have reported a discernible discrepancy in the aesthetic profile depicted in art and that depicted in the mass media, with a trend towards a more fuller profile. These findings were substantiated by Auger and Turley (1999), who studied profile photographs of adult Caucasian females from periodical magazines spanning one hundred years. They concluded that ideals in facial aesthetics have changed through the Twentieth century, with a trend toward more protrusive lips and an increase in vermilion display. Sutter and Turley (1998), also found this trend towards a fuller profile in White male models, and suggested that factors such as changing demographics and an emphasis on youth, as possible reasons for this trend.

The present study will test whether this trend towards a fuller profile is shared by the study population and to test for similarities and differences in the assessors' (laypersons/ professionals) perceptions of various profiles.



# LITERATURE REVIEW

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## **2.1 Facial Aesthetics: Historical Perspective**

The term aesthetics first appeared in the literature in 1753 in Alexander Baumgarten's "Reflections on Poetry" (Baumgarten, 1753 cited in Powell and Rayson, 1976). Baumgarten had recognized the need to include sensory and perceptual cognition in certain areas of art, and, drawing on the Greek word for perception namely "aisthesis", he coined the word "aesthetics" for the science of perceptual cognition. However, Powell and Rayson (1976), emphasized that the development and conceptualization of the principles underlying the appreciation of those qualities that are pleasing to the eye, dated back to the ancient Greeks.

As early as 1907, Angle incorporated the concept of "a good face" into his treatment goal as something to be attained in orthodontic treatment. He also noted that, "The study of orthodontia is indissolvably connected with that of art as related to the human face. The mouth is a most potent factor in making or marring the beauty and character of the face" (Angle, 1907).

Aesthetics has often been defined as the science of the beautiful, as applied to works of art, with a view to the understanding, explanation and, perhaps, evaluation thereof (Pepper, 1974). The Merriam-Websters Collegiate dictionary (1994), defined aesthetics as "the branch of philosophy dealing with the beautiful, chiefly with respect to theories of its essential character, tests by which it may be judged, and its relation to the human mind" (Websters dictionary, 1994). According to Powell and Rayson (1976), facial aesthetics is the study of the variations that may occur in facial appearance, and the individual response of the observer to these variations.

Egyptian artists, beginning in the Old Kingdom dynasties (2600 to 2000 BC), used a simplified grid system to draw figures to ideal proportions (Peck and Peck, 1970). Several horizontal lines marked the location of key points of the body from the top of the head to the baseline. Lines representing the crown of

the head, the hairline, and the junction of the neck and shoulders guided the proportional construction of the head (Peck and Peck, 1970). One vertical axial line, registered on the ear position, divided the traditionally profiled figure into two parts.

With the advent of the Middle and New Kingdoms, a squared grid composed of regularly spaced horizontal and vertical lines was in use (Peck and Peck, 1995). An additional facial horizontal now appeared near the base of the nose, and many verticals were added. The head was usually depicted within a grid block consisting of twelve squares. This squared grid system, perhaps the oldest forerunner of the proportional mesh diagram designed by Moorrees et al (1976) for cephalometric analysis, guided the ancient Egyptians in applying their canon of ideal proportions to the pictorial representation of the human figure (Peck and Peck, 1995).

The Egyptian proportional canon was only slightly modified over the 3,000 years of Egyptian civilization. Facial proportions were generally the same for representations of men and women throughout this period (Peck and Peck, 1970). They further suggested that aesthetic awareness probably developed some 35,000 years ago in Paleolithic man. However, ancient Egypt, nearly 5,000 years ago, appeared to be the first culture to have recorded aesthetic attitudes in art, while classical Greece became the first to sensitively express the qualities of facial beauty through philosophy and sculpture (Peck and Peck, 1970).

During the early Grecian period, the human body was considered the most perfect example of symmetry and eurhythmy (Seghers et al, 1964). This was amply illustrated by Ricketts (1981), in his application of the Golden number (Golden proportion), described as the point at which division of a line segment is such that the ratio of the larger segment to that of the smaller segment, equals the ratio of the original segment to the length of the longer segment. The value of the ratio called Phi ( $\theta$ ) approximated 1.618, and was given the Greek symbol  $\theta$ .



Ricketts (1981), suggested that many relations which were conceived to be beautiful to the human eye or which were comforting or pleasing to the human psyche, followed these proportions. He further noted that the face appeared to show the best harmonic proportions according to the Golden section.

While our aesthetic heritage owed much to the classical Greeks for brilliantly interpreting beauty; it was to the Romans to whom we are indebted for profusely documenting beauty (Peck and Peck, 1970). Unfortunately, Roman sculpture was never really formalized or idealized, so no new concepts of facial aesthetics are found in these works (Peck and Peck, 1970).

Peck and Peck (1970) also noted that art seemingly traced a recurring pattern of "classical movement" followed by "anticlassical movement", from the Renaissance to the present. The contemporary art form, however, did not provide much insight into aesthetic preferences in facial beauty. Many of the faces rendered in modern art seemed to defy objective study, as they tended to be abstract interpretations by the artist, rather than concrete representations. Powell and Rayson (1976), attributed this to the great diversity of art works from other parts of the world, which profoundly influenced the thinking and the judgments of Western art.

## **2.2 Aesthetics and orthodontics**

Facial aesthetics was considered early in the history of orthodontics (Stoner, 1955). John Hunter (1803), often regarded as the father of orthodontics, had by the turn of the Nineteenth century, already suggested that the prime objective of such treatment was to beautify the appearance of the mouth (Stoner, 1955).

Two eminent clinicians, namely, Calvin Case (1921), cited in Arnett & Bergman, 1993) and Edward Hartley Angle (1907), made significant contributions during the pioneering days of orthodontics. They were widely quoted for their preoccupation with aesthetics, the fine arts, and its influence on orthodontic thinking (Downs, 1948; Goldsman, 1959; Neger, 1959).

In 1907, Angle wrote that "the study of orthodontia is indissolubly connected with that of art as related to the human face. The mouth is a most potent factor in making or marring the beauty and character of the face" (Angle, 1907 cited in Merrifield, 1966). In this regard, he appeared to have been considerably influenced by his friend, Wuerpel, an art teacher. He doubted the validity of using lines and rules in aesthetic evaluation, but firmly believed that excellence of occlusion was mandatory for proper facial harmony and balance. He used the Apollo Belvedere sculpture-work to assess ideal facial form (Matoula, 2006).

The Apollo Belvedere was a Greek sculpture that was greatly admired and popularized by the highly acclaimed Eighteenth century German art historian J.J. Winckelmann. However, today, it is regarded as a rather bland or poor Roman copy with no great artistic distinction, patterned after a lost Greek sculpture from the 4th century BC. Since its discovery around 1500 near Rome, it has been housed in the Belvedere courtyard of the Vatican Museum. Winckelmann's enchantment with the Greek aesthetic ideal embodied in the Apollo Belvedere, gave the mediocre statue far-reaching fame and importance for more than a century and a half. This statue's declared reputation for universal beauty,

significantly influenced the facial aesthetic preferences of the early orthodontists in Twentieth century America (Peck and Peck, 1970).

Wuerpel (1937), outlined the need for the orthodontist to appreciate the facial type being treated, namely, Greek, Roman, Greco-Roman, Semitic or Mongoloid. He warned against distorting the face during orthodontic treatment and also stressed the need to consider the length and direction of the line forming the upper lip, from the end of the nose to the beginning of the lip (Stoner, 1955).

Weurpel (1937) rejected Angle's simplistic, literal comprehension of classical aesthetics. He counseled Angle to discard his one-standard method for judging facial aesthetics in the heterogeneous population of the United States (Stoner, 1955). Later, Angle (1907), admitted that beauty, balance, and harmony were not limited to just one facial type, like Apollo, but might be found in many different facial types. Nonetheless, he upheld the Apollo type as the most aesthetically pleasing facial form (Stoner et al, 1955).

Angle (1907) incorporated another error in his concept of beauty by assuming an association between his ideal of facial aesthetics, the Apollo Belvedere, and the notion that proper occlusion of the dentition required a full complement of teeth "as nature intended". He vigorously defended his bias against orthodontic tooth extraction, especially toward the end of his career (Moorrees et al, 1998).

Calvin Case (1921 cited in Arnett & Bergman, 1993), a contemporary of Angle and depicted as a progressive thinker, was a leading proponent of facial aesthetic pluralism (Moorrees et al, 1998). In 1921, he pleaded that the "standard of beauty should not be confined to a fixed idea of facial outlines of classical art shown in that of Apollo Belvedere, but it should be one which may at times be adjusted to the different types of Physiognomies which present for treatment." Despite the Angle concept for ideal occlusion, other clinicians (Cryer, 1904 &

Case, 1908 cited in Downs, 1948), have since stated that functional and aesthetic harmony of the teeth and face were more important than having a full complement of teeth (Moorrees, 1998).

Facial imperfections are more commonly created and tolerated in the world of art than the world of medicine (Farkas et al, 1985; Farkas and Kolal, 1987). Ocular and mental disorders limiting the vision of many famous artists are well documented. Such distortions could become confusing when the viewer perceived the art literally. This is represented in the work of the Pre-Raphaelite movement who were active in England during the mid-to-late 1800s (Peck and Peck, 1970).

These artists, including Dante Gabriel Rossetti, were inspired by early Italian traditions as a basis for their art. In 1870, Rossetti drew a portrait of his paramour, Jane Morris, using a photograph taken a few years earlier. The existence of the photograph provided a rare opportunity to compare the real image with the image created by the artist. In the drawing, Rossetti dramatically transformed Jane Morris's facial appearance to conform to his classical notions of beauty. It was as if he performed an advancement genioplasty, collagen injections of the upper lip, a rhinoplasty, and a mid-facial reduction. Her Class I bimaxillary protrusion was revised to nearly a Class III facial profile. To the Pre-Raphaelite artists and their patrons, beauty tended to favor a Class III facial pattern, not a Class I pattern. Fortunately, orthodontists and surgeons of that era did not adopt this distorted ideal as a goal in treating patients (Peck and Peck, 1970).

Bishara et al (1985), observed that despite the early concern for, and preoccupation with facial aesthetics, no attempts were made to either quantify the static facial pattern or to quantify growth changes. They suggested that Simon (1926, cited in Bishara et al 1995), with his technique of "photostatics", was probably the first to attempt such an approach. By means of photographs,

this method related the contour of the profile to the Frankfort horizontal and orbital planes.

Milo Hellman (1927, cited in Gosman and Vineland, 1950), who adapted physical anthropology to orthodontic research, noted that faces could be categorised into specific types, based on certain recognisable parameters. In his studies, he made use of graphic methods to represent his data, hence the "profilogram", a diagrammatic polygon representing the face in midsagittal section and incorporating measurements of depth and height, but not width. This midsagittal profile could be used as a measure of prognathism. Later, he abandoned the "profilogram" for the "wiggle", which incorporated measures of height, width and depth (Hellman, 1939). The latter represented a plot of an individual's data relative to a symmetrical polygon constructed from the average range.

With the introduction of the cephalometer by Broadbent in 1931, and the application of his original technique to the analysis of cephalometric radiographs, a new era in orthodontic thinking developed (Moorrees et al, 1998). The Broadbent analysis was followed by several important and outstanding methods (Wylie, 1947; Downs, 1948; Steiner, 1953; Tweed, 1954; Coben, 1955; Sassouni, 1955; Ricketts, 1960; Jacobson, 1975, Holdaway; 1983), for analysing the dentofacial pattern.

Charles H. Tweed in 1944 finally "cut the Gordian knot that Angle had so tightly tied". Tweed, a student at the Angle School in the late 1920s, abandoned Angle's nonextraction dogma and obtained excellent treatment results with extraction therapy (Tweed, 1944). He modified Angle's diagnostic belief by linking facial aesthetics to the need for extraction. His diagnostic indicator was the new tool of cephalometrics, rather than man-made "laws".

Unfortunately, Tweed retained Angle's ideal of a flat Apollo-like profile and designed his new cephalometric standards to fit this narrow aesthetic model (Downs, 1956). His philosophy was perceived around the relationship of the lower incisors to their supporting basal bone. He applied the average Frankfort mandibular incisor angle (FMIA) of his successful cases as a treatment goal to establish both stability and improved facial appearance. Though he proposed the use of his "diagnostic triangle" in treatment planning and diagnosis, Tweed (1944), felt that the "eye of the orthodontist" should become the deciding factor in determining whether the desired facial harmony had been achieved. It is notable that he had a preference for a straight profile (Downs, 1956).

From a study of twenty individuals with excellent occlusion, Downs (1948), concluded that there was a definite facial pattern for persons possessing excellent occlusions. Those cases with poor functional or aesthetic balance were the result of faulty dentoskeletal patterns and could be detected using his cephalometric analysis. He recognised the need for his dentoskeletal analysis to be representative of the external soft-tissue contours and hence described a photographic method using the Frankfort horizontal as a reference plane (Downs, 1956). Three facial types were described, namely, mesio gnathic, retrognathic and prognathic. He also emphasized the significance of applying the angle of convexity for typing a face. These and other studies, notably that of Steiner (1953) and Holdaway (1956), though not directly involving the soft-tissues, would by inference appear to implicate and, at the same time recognise the importance of these structures in diagnosis and treatment planning (Downs, 1956).

Following the publication of Tweed's articles, Bishara et al (1985), reviewing the literature, observed that the 1950's saw a spate of research involving cephalometric skeletal analyses and facial aesthetics. Most of the studies dealt with aesthetics and with dentoskeletal analyses, with the assumption that the soft-tissue profile configuration was intimately related to the underlying structures. However, the work of Burstone (1958) and Subtelny (1959),

highlighted the necessity of doing an independent soft-tissue analysis during diagnosis and treatment planning (Bishara et al, 1985).

The concept of how facial harmony is influenced by the interrelations of the dentofacial complex, while consistently occupying the attention of dentists, and orthodontists in particular, has always been elusive. This is because of the wide diversity inherent in the morphogenetic pattern of the individual, and also due to the nebulous and indefinite nature of the subject itself (Goldsman, 1959). However, just as general rules have been proposed for tooth positions, so standardized linear and angular measures have been put forward for the evaluation of the soft-tissues (Burstone, 1958; Steiner, 1962; Merrifield, 1966; Ricketts, 1968 and Holdaway, 1983). These values were prescribed to indicate to the observer whether the facial profile was balanced and harmonious (Powell and Rayson, 1976).

Today, Greek classicism has almost vanished from the general conscious. Instead it has been replaced by television, films, and photography which now emphasise the visual realities of the present, not images from an ancient past (Moorrees, 1998).

### **2.3 Soft-tissue profile quantification in orthodontics**

Over the years profiles have been evaluated by using anthropologic, cephalometric, photometric linear or angular measurements (Barrer and Ghafari, 1985). These linear measurements were used to determine size, distance and proportion, while the angular measures were primarily used to describe relationships among planes in the face.

According to Lucker (1980), two general approaches to the study of facial aesthetics were adopted. The one approach endeavored to identify those persons considered physically attractive and, thereafter, to determine the physical attributes that made them attractive. These individuals were photographed or radiographed in standardized positions, and measurements were then obtained from these records. Quite often, the desired average values or selected anthropometric measures served as norms representing the public's aesthetic taste.

The other approach commonly employed, required one group of individuals to evaluate the attractiveness of another group from line drawings, silhouettes or facial photographs. The individuals being evaluated were often chosen either to represent a "normal" random population sample or to represent variability on specific facial dimensions. Variability in anthropometric measures were correlated with variability in attractiveness judgments, so as to determine which physical dimensions were related to aesthetic judgments (Lucker, 1980).

A third approach, and probably the forerunner to facial quantification was based almost entirely on dentoskeletal norms. These early dentoskeletal analyses (Downs, 1948; Steiner, 1953; Tweed, 1954), assumed that balance and harmony of the hard structures would result in an ideal aesthetic facial form. The numerous formulae for facial balance represented early attempts at profile quantification and prescription.



Quantification of the facial profile for scientific application could be traced to the early Eighteenth century when anthropologists first attempted to categorize races and to describe evolutionary changes occurring in man (Camper, 1774). Milo Hellman (1927), reported on the growth and development of the human face using anthropometric methods.

At about the same time, Simon (1926) developed his concept of "photostatics" to quantify changes in the facial profile. He divided the head into planes and related the contour of the profile to the Frankfort horizontal and orbital planes. Using this method, he measured soft-tissue growth and other changes. On the contrary, when Hellman (1939) analysed the soft-tissues of the face, he found that the facial features of sixty-two males with normal occlusion had extremely variable faces and that the dimensions of the facial features studied did not follow a standard correlation with other craniofacial measurements.

Following the Broadbent analysis (1931), the study of facial aesthetics either by cephalometrics or the photographic method proliferated, and consideration of the soft-tissue profile assumed greater importance (Jacobson, 1975).

Riedel (1950), studied soft-tissue profile outlines and submitted them to orthodontists for aesthetic evaluation. He found a high level of agreement as to what constituted a pleasing face. Soft-tissue profiles which were considered to be pleasing revealed skeletal parts arranged in a straight line, with little or no dental protrusion. However, soft-tissue profiles judged as poor had convex skeletal patterns and dental protrusion. It was noted that it was far easier to recognize a poor profile, than identifying what constituted a good profile.

Later, in a cephalometric appraisal of thirty candidates of the 1955 Seattle Seafair beauty contest, Riedel (1957), found that almost half of the contestants had the upper lip, lower lip and the chin aligned in a straight line. However, in no instance did the chin, upper and lower lip, and nose contact a single straight line.

This was in contradiction to the accepted norms of artists who proposed that the nose, lips and chin should lie in a straight line. He concluded from quantitative assessment of the soft-tissues that the profile was closely related to the underlying skeletal and dental structures. The skeletal patterns of these Seafair princesses were similar to those determined in earlier studies by orthodontists on the basis of occlusion alone (Downs, 1948; Riedel, 1950). It was therefore postulated that the public's concept of acceptable aesthetics was similar to those of orthodontists, on the basis of occlusion alone (Riedel, 1957).

In 1952 Hertzberg used photographs to describe the profiles of those subjects he considered to be "in balance". He noted that the chin, upper lip and lower lip fell on a vertical line through subnasale. Much later Spradley et al (1981), observed, however, that no mention was made of any horizontal plane or the method by which the vertical reference line was constructed on these photographs.

Stoner (1955), described a quantitative analysis of the soft-tissues which could be applied either to a cephalogram or directly to a profile photograph. He related the lower lip to the chin, the upper lip to the lower lip and then related these tangents to the facial plane (Nasion-pogonion). The facial plane was also related to Frankfort horizontal. A number of angular measurements were prescribed as standard values for profile evaluation.

Edmondo Muzj in 1956, presented a simplified profile analysis based on the correlation between the upper and lower parts of the face. This correlation between those parts of the profile, extending from the frontal point to subnasale and then downwards to gnathion, was made possible by dividing the common "frontal-facial angle" into two by the Bolton-subnasale plane. This analysis which took into account the "total profile" was verified statistically. Using this analysis, Muzj was able to describe various profile types. The author also highlighted some of the problems of using the Frankfort horizontal. He noted that the perpendicular line from point nasion to the Frankfort horizontal moved forward

and backward, according to the plane's variations, and lost relation with other facial anatomic points from which it can indicate neither normal or abnormal states. Also he noted that this perpendicular line touched points which were different according to the various types of profiles, and thus led to diagnostic errors (Muzj, 1956).

In a later article Muzj (1982), outlined the development and application of his profile analysis. He described the four types of morphological characteristics that constituted the facial system, namely, fundamental generic characters, constitutional characters, racial factors and physiognomic characters. In terms of his treatise, a correlation represented a ratio of quantitative and qualitative reciprocity between body organs. Hence, profile studies performed on only one part of the face were invalid as "every character contributing to a system of the body, including the facial system, is a function of one or more other characters". In this article, Muzj replaced the Bolton-subnasale palatal plane as he felt that the variability in the position of the anterior nasal spine (ANS) was due to the fact that the anterior parts of the palatal vault and the nasal floor could be directed upward or downward with an effect as large as 5mm. Thus, the ANS cannot be used to indicate the end of the palatal plane. Instead, the plane must be determined in the horizontal part of the plane. The anterior most point of the plane corresponding to ANS was obtained by drawing a short vertical line from ANS to the palatal plane. This point which was independent of the vertical variations in the anterior part of the nasal cavity was called "virtual ANS" or VANS. This artificially constructed point separated the upper and lower parts of the face. Muzj observed that the two sides of the "frontal facial angle" kept the same relationship of inclination in the Caucasian race. The degree of opening, however, varied. The relationship of other "key characters" of the profile lines namely, gnathion, incision, nasion and their application to race classification, were also described. According to this study, normality was judged by the proportional relations between the naso-frontal segments that constituted the upper face and the dental region that constituted the lower face (Muzj, 1982).

Poulton (1957), performed a statistical test to determine which angles on a lateral cephalogram would present a strong correlation to facial aesthetics. He concluded from his study that the angle of convexity, the angle SNA, the angle between the lower incisor and the mandibular plane, and the angle between the SN plane and the mandibular plane could together be employed as a useful indicator of good or poor facial aesthetics.

Ricketts (1957), felt that the nose and chin were the most convenient areas from which the lips could be evaluated. Ricketts (1968), defined the "Esthetic plane (E-plane)" as a line drawn from the tip of the nose to the soft tissue pogonion. The "esthetic or E-plane" connected these two landmarks. This study revealed that the upper lip was 4mm and the lower lip 2mm posterior to the plane.

Ricketts (1968), culminated his research on the "E-plane" with an article entitled "Esthetics, environment, and lower lip relation" in which he attempted to organize, clarify and classify lip conditions for analytic value. In White adults, the lower lip should lie  $4 \pm 3$  mm behind this plane. The upper lip was slightly behind the lower lip. In children, the lower lip was on this plane or slightly behind it as a result of the delayed development of the chin and the nose. In African American and Chinese adults, the lower lip was 1 to 3 mm ahead of the E-plane. The author also studied oblique and frontal dimensions of the face and constructed lines referred to as cheek and papillary planes respectively. He noted, too, that individuals with prominent cheeks appeared more attractive with fuller lips, and vice versa. He also observed that most people objected to lips that protruded beyond the E-plane, but noted that prominence of the lips and mouth were characteristic of the young. Subsequently, Ricketts (1981), described the use of an instrument called the "Golden divider" to assist in quantitative analysis of the facial profile.

Burstone (1958) noted that marked variation existed in the soft-tissues covering the dento-skeletal framework and believed it necessary to directly study the integumental contour of the face in order to adequately assess facial harmony. The author studied the profiles of forty individuals selected by three artists from the Herron Institute, and described a method of measuring the integumental profile by angular means. Two types of reading were used, namely, inclination angles which represented profile components relative to the nasal floor (skull), and contour angles representing profile components relative to each other. He suggested that graphic comparison to the Herron sample by means of his integumental profile grid would simplify facial analysis and the study of soft-tissue growth and treatment changes.

In the following year Burstone (1959), described a method of measuring horizontal and vertical soft-tissue extensions (thickness between two landmarks). From this study, he established "integumental extension" standards both for adults (post-retention age group) and adolescents (post-treatment age group). The findings revealed sex differences, with areas below the nose being generally thicker in the male. Burstone (1967), measured facial convexity as the angle between the lines glabella to subnasale and subnasale to soft tissue pogonion. In his sample on young adult Whites, the facial contour angle was  $11.3^\circ$ . The upper lip extended  $3.5 \pm 1.4$  mm beyond the line connecting subnasale and soft tissue pogonion, and the lower lip extended  $2.2 \pm 1.6$  mm beyond this line. He also defined two important angles, namely the naso-labial angle and the chin-throat angle, which were on average  $114^\circ$  in males,  $118^\circ$  in females, and  $114^\circ$  in males,  $106^\circ$  in females, respectively.

Burstone (1967), further suggested that in present day society, where conformity was appreciated and sometimes demanded, it appeared desirable for the orthodontist to stereotype faces. Dentoskeletal and soft-tissue standards of normal or desirable faces could serve as a guide in stereotyping the facial appearance of treated orthodontic patients (Burstone, 1958; 1959). In a study on

lip posture and its role in treatment planning, Burstone (1967), reported that a small vertical space or interlabial gap of about 1.8mm was present between the upper and lower lips in the "relaxed" lip. He showed from samples of dentulous and edentulous persons that the anteroposterior posture of the lips were independent of the dento-alveolar structures.

Lindquist (1958), evaluated the relationship of the lower incisors to facial aesthetics, and observed that many orthodontists regarded the proper position of the lower incisors to be fundamental for the attainment of a balanced facial profile. Many formulae were presented for improved facial aesthetics based on the position of the lower incisors, with the assumption that a correct position of these teeth would result in proper facial balance. The author evaluated Tweed's (1953) Frankfort mandibular incisor angle (FMIA), Steiner's (1953) lower incisor to NB plane (angular and linear), Down's (1956) lower incisor to A-Po plane, and Holdaway's (1956) lower incisor and chin point relationship to the NB plane. The results were found to be widely divergent, but consistent within each group. Lindquist (1958) recognised the need to consider the chin in aesthetic assessment for orthodontic purposes.

Bowker and Meredith (1959), described a quantitative method for assessing the integumental profile by relating certain points of the face to a "nasion pogonion line". These measurements perpendicular to the nasion-pogonion line through points nasion, tip of nose, concavity of upper lip, labiomental groove and convexity of the chin, were presented as standard values when evaluating the integumental profile of the face.

Neger (1959), introduced a method to evaluate or assess the soft-tissue profile in a quantitative manner from a profile photograph or a cephalogram. Using the Frankfort horizontal and nasion as a frame of reference, he described six angular relationships for the upper lip, lower lip and chin. The author interestingly related these components to a cranial reference; this study could be regarded as an

"upside-down" version of Stoner's (1955) study. The "pogonial angle" (inferior inner angle of Na-Pog to Frankfort horizontal) was similar to the facial angle described earlier by Downs (1948). Various standard measurements for these soft-tissue components were prescribed. The author concluded from his study that a proportionate change or improvement of the soft-tissue profile did not necessarily accompany extensive dental changes; hence one could not rely entirely on a dento-skeletal analysis for accurate information on the soft-tissues. Neger, therefore, stressed the need to evaluate the soft-tissue profile as a separate entity, apart from the dento-skeletal analysis.

Subtelny (1959), also indicated that the correlation between hard and soft-tissue changes was not strictly a linear one. He measured horizontal and vertical relationships and found that not all parts of the soft-tissue profile directly followed the underlying skeletal structures.

Steiner (1962), used the S-line to assess soft-tissue profile balance. This line was drawn tangent to the chin and through a point midway on the lower border of the nose. Steiner observed that in good Caucasian faces, the lips often fell on the S-line at average orthodontic age. Lips ahead of the S-line would on average be too full, whereas those falling behind it would be too flat, when related to other parts of the profile. This analysis where the lip position was more definitely defined, took into consideration a large or small nose and a large or small chin and harmonized them with the lips.

Hambleton (1964), was of the opinion that no formula or analysis could provide a soft-tissue line that would please all orthodontists. He quoted Subtelny (1961), who suggested that it existed only in the "mind's eye" of the individual practitioner. Hambleton (1964), further quoted numerous studies showing that the preference of the public was towards a flat or straight profile, an opinion also held by Riedel (1957). The inability to stereotype faces, as well as the variation in profile structures, necessitated an independent assessment of the soft-tissue

during treatment planning. He evaluated several soft-tissue analyses and found the Holdaway H-angle, formed by the intersection of the line NB to the H-line, most useful. This angle took into consideration the underlying structures by virtue of its relation to the NB line and the ANB angle (Hambleton, 1964).

Holdaway (1964), described the significance of the harmony line (H-line) in profile assessment, which passed tangent to the chin-point and the upper lip. Holdaway related the angle formed by this line and line NB (skeletal) with the ANB angle. If the ANB angle was greater or smaller than 1 to 3 degrees, the same number of degrees was added or subtracted from the H-angle. He concluded that for an ideal case, both the upper and lower lips should be on the H-line and the proportions of the nose to the upper lip formed a harmonious S-curve. This linear measurement, from the tip of the nose to the H-line for a patient 13 years of age with an average nose, was 9 mm.

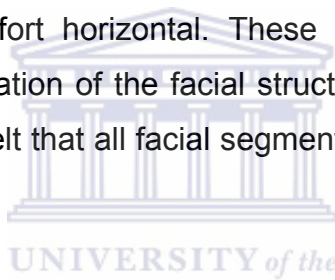
Holdaway (1983), described a comprehensive analysis on soft-tissue assessment wherein a number of different parameters were considered. Included in this analysis was a finding of 2.5 mm for upper lip curvature, with a value of 1.5 mm for thin lips and 4.0 mm for thick lips, which would still indicate balance. He also described a soft-tissue H-angle between the H-line and soft-tissue Nasion-Pogonion, which was shown to correlate with the angle of facial convexity. The upper sulcus depth to the H-line should ideally be 5mm, with a measurement of 3mm, for short and/or thin lips, and 7mm for thicker lipped individuals. The author also provided values for upper lip thickness and upper lip strain. Values of lower lip to H-line (0mm) and lower sulcus depth to H-line (5mm) were also provided.

Merrifield (1966), made use of the "profile line" and the Z-angle to give a critical description of lower face relationships and thereby supposedly eliminated the vagueness of so called "eye judgement". This line was tangent to the soft-tissue chin and the most anterior point of either the lower or upper lip, whichever was most procumbent, and extended to reach the Frankfort plane. He noted that in a



pleasing profile, the upper lip was tangent to this line, while the lower lip was similarly tangent or slightly behind the profile line (not more than 2mm). The Z-angle formed by the intersection of the profile line and Frankfort horizontal described an angular relationship for the lower face. In the 11 to 15 year age group, the average Z-angle was found to be  $78^{\circ} \pm 5^{\circ}$ , with females demonstrating higher Z-angle values than males. However, in adults the average Z-angle values were  $80^{\circ} \pm 5^{\circ}$ , with males exhibiting higher values than females. The author also believed that total chin thickness should be equal to or slightly greater than the upper lip thickness (Merrifield, 1966).

Gonzalez-Ulloa (1968), recognised the need for a vertical plane of reference to assess the facial profile. He constructed his Meridian  $0^{\circ}$  through nasion, running perpendicular to the Frankfort horizontal. These axial references provided a useful method for the evaluation of the facial structures. In faces recognised as being beautiful, the author felt that all facial segments should be tangential to the Meridian  $0^{\circ}$ .



Uesato (1968), used the Ricketts E-line and the Steiner S-line to illustrate his concept of facial aesthetics for North American Japanese subjects. He showed that an aesthetically balanced profile for this racial group was one in which the upper and lower lip were positioned between the E- and S-lines.

In a comprehensive study on facial aesthetics, Peck and Peck (1970), presented a photographic profilometric analysis to provide an objective view of the profile. Standard values for the facial angle, the maxillofacial angle, the nasomaxillary angle, the nasal angle, maxillary angle, mandibular angle, and total vertical dimension from nasion to pogonion were presented. The authors emphasized their consideration of the nose in their profilometric analysis.

Spradley et al (1981), described a method of soft-tissue evaluation making use of a true vertical reference plane passing through subnasale. The subjects were radiographed in the natural head position, thereby establishing a true horizontal reference plane. It was concluded from this study that the use of the subnasale vertical, perpendicular to the Frankfort horizontal plane was the most accurate method of profile assessment. The authors noted that this method of sagittal soft-tissue assessment was not dependent on the position of the chin, which in itself could be deficient.

Saxby and Freer (1985), in a statistical evaluation of the correlations among hard and soft-tissue reference points, concluded that the ANB angle was strongly related to the soft-tissue profile. They also observed that the Ricketts E-line, the Steiner S-line and the soft-tissue facial plane (soft-tissue nasion to soft-tissue pogonion, (Holdaway, 1983) were equally suitable as base references in the assessment of the soft-tissue profile. However, they felt that the soft-tissues were affected by a variety of variables such as skeletal relationships, dental positions, soft-tissue thickness, and function. The effects of growth during treatment further compounded the problem.

## **2.4 Comparison of Caucasian norms with other ethnic groups**

### **2.4.1 African American studies**

Sushner (1977), carried out a photographic study on one hundred attractive looking North American Blacks. This study, done on 8" x 10" black and white photographs, compared the Ricketts, Steiner and Holdaway soft-tissue values to the African American individual. He also described the use of his Nasion-Pogonion line to quantitate the lips and chin in a vertical and horizontal dimension. He concluded that African American male and females were more protrusive in soft-tissue profile than Caucasian males and females, while Black males were more protrusive than Black females. The Ricketts, Steiner and Holdaway values established for Caucasian patients were not applicable to the African American patient.

Though a "standardized photographic technique" was employed, it is unclear whether life-size photographs were being evaluated or whether consideration had been given for the magnification effect when carrying out linear measurements on these photographs. A line (S2 line) drawn from soft-tissue nasion to soft-tissue pogonion was developed by Sushner (1977). He reported that the upper and lower lips were anterior to this line in the Black population he analyzed.

Yehezkel and Turleyl (2004), evaluated changes in the profiles of African American women presented in fashion magazines during the twentieth century. Twenty-six variables were measured on a total of one hundred and nineteen profile photographs collected from various fashion magazines published in the 1940s through the 1990s. The photographs were divided into six groups corresponding to the decade in which they were published. Aesthetic standards for the African American female profile changed during the twentieth century

towards a trend for fuller and more anteriorly positioned lips, similar to the standards for the White profile (Yehezkel et al, 2004).

### **2.4.2 Asian Studies**

Satravaha et al (1987), performed a profile analysis on one hundred and eighty Thai female subjects, with ages ranging from sixteen to twenty one years. Of these seventy were of Chinese origin. These results were compared with Caucasian standards and with the findings of a previous study on a Javanese population. The sample showed more prognathic faces (75% to 84%).

According to Satravaha et al (1987) the position of pogonion formed the basis for the profile flow analysis. Pogonion was located, horizontally, midway between line A and B in an orthognathic profile. The soft-tissue profile results showed less convexity than those of the Caucasians. The lip analysis revealed a posterior position to the aesthetic line (Ricketts E-line) in 60% to 70% of both Thai groups with respect to the upper lip, and only 28% to 33% for the lower lip. The Javanese group, however, showed 90% anterior position of the upper lip and 93% of the lower lip to this line. It was significant that proper blending of the integumentary profile produced an aesthetically pleasing face and this varied in different ethnic groups (Satravaha et al, 1987).

In a study by Hsu (1993), one hundred and ten lateral facial profiles adjudged to be attractive, were selected from 1000 Taiwanese pupils by a panel of four men and three women from different educational backgrounds. The 110 in the attractive group were analyzed by using five analytic reference lines namely the Ricketts E-line, Holdaway's H-line, Steiner's S1-line, Burstone's B-line, and Sushner's S2-line. Comparisons of the "consistency" (the smaller the coefficient of variation the better the consistency) and the "sensitivity" (the power to differentiate the attractive lateral facial profiles from the unattractive ones) of the five analytic lines were undertaken.

The B-line was found to be best in terms of both consistency and sensitivity. From the point of view of convenience, the E- line was of great value, because its anterior location made it convenient for the clinician to use at the chairside. From the perspective of the reliability, those lines passing through part of the nose would be highly appreciated. The S1-line and the B-line were in this category. This finding was consistent with the idea that the nose should be taken into consideration when a line was to be used as a reference for beauty on the lateral facial profile (Hsu, 1993).

The purpose of the study by Scavone et al (2006), was to establish the norms of soft-tissue profile analysis for a sample of Japanese Brazilian adults. Facial profile photographs were taken of sixty Japanese Brazilians (thirty men, thirty women) with normal occlusions and balanced faces, ranging in age from eighteen to thirty years. Statistically significant differences were found in the Japanese Brazilian sample when compared with the White American norms. Japanese Brazilian women had more anteriorly positioned glabellae, smaller nasal projections, and more opened nasolabial angles than White American women. Japanese Brazilian men had more anteriorly positioned glabellae, smaller noses, larger protrusions of the upper and lower lips, less projected B points, and more obtuse nasolabial angles than White American men. A single norm for facial profile aesthetics does not apply to all ethnic groups. The accepted normative data for the Japanese ethnic group should be used as a guide for comparison during diagnosis. The orthodontist and the maxillofacial surgeon should also consider each patient's perception of beauty so as to establish an individualized treatment plan.

### 2.4.3 Turkish studies

The study by Erbay et al (2002), studied the horizontal lip position of Anatolian Turkish adults using the soft-tissue analyses of Steiner, Ricketts, Burstone, Sushner, Holdaway, and Merrifield. Ninety-six dental students with Angle Class I occlusal relationships were selected from the dentistry students at the University of Istanbul as the dentally normal group. Their lateral cephalometric radiographs were analyzed, and 44 subjects with normal anteroposterior and vertical skeletal relationships were selected from the dentally normal group, and called the dentally and skeletally normal group. The results of this study indicated that in Anatolian Turkish adults, the upper and lower lips were retrusive according to the norms of Steiner and Ricketts while both the upper and lower lip values were within the normal range according to the Burstone B-line. The upper lip was protrusive and the lower lip was retrusive compared with the norms developed by Sushner for a Black population. The value for the lower lip was similar to the standard proposed by Holdaway, while the values for the nasal prominence and the H-angle were greater than Holdaway's norms. They also found that the Z-angle was smaller than the norm established by Merrifield (Erbay et al, 2002).

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In a subsequent study by Erbay and Caniklioglu (2002), the soft-tissue analyses of Steiner, Ricketts, Burstone, Sushner, Holdaway, and Merrifield were examined to evaluate orthodontists' perceptions of Anatolian Turkish adults' beauty. The results demonstrated that the people having a high mandibular plane angle (SN-MP= 33.8; SD=1.9), a small nose, protrusive lips, and a retrusive profile were selected as attractive. Among the seven aesthetic lines used to evaluate the soft-tissue profile, only Ricketts' norms for upper and lower lips corresponded to the values that represented attractive profiles.

#### **2.4.4 Middle Eastern studies**

More recently, Al-Gunaid et al (2007), attempted to develop soft-tissue cephalometric standards for Yemeni men and compare them with the cephalometric standards of North American White people. Fifty Yemeni men with normal occlusion were selected. A sub-sample of aesthetically pleasing subjects (YPG) was selected (n=16 profiles). The remaining thirty four comprised the normal group (YNG). Lateral cephalometric radiographs of all subjects were analyzed according to the Legan-Burstone and the Holdaway analyses. The Yemeni aesthetically pleasing subjects (YPG) and the remaining subjects (YNG) showed significant differences with respect to mandibular prognathism, lower face-throat angle, nasolabial angle, mentolabial sulcus depth, and interlabial gap, when compared with the Legan-Burstone norms for White Americans. The YPG also had significantly less obtuse facial convexity angle than the YNG. Most values of both Yemeni groups were generally within the range of the values reported by Holdaway, except for 3 variables namely skeletal profile convexity, basic upper-lip thickness, and H-angle, which were all significantly larger than those of Holdaway. The YPG showed less skeletal profile convexity than the YNG. These results indicated that the soft-tissue facial profiles of Yemenis and White Americans were different in certain respects and therefore these racial differences should be considered during diagnosis and treatment planning. These results could be a useful reference for orthodontists and maxillofacial surgeons who treat Yemeni patients, and could also contribute to a more satisfactory diagnosis and treatment planning protocol.

In the light of what has been reviewed, it would be useful to reflect on the words of Fricker (1982). He suggested that in the fields of reconstructive surgery and orthodontics, it is of the utmost importance to define the needs of the patient not only in the provision of post-operative satisfaction, but also with regard to the assessment of the extent of the patient's expectations of change. He cautions that there is no absolute quantitative norm for beauty. An individual's concept of

beauty is based on many variables, including the person's ethnic, racial, and aesthetic influences, as well as personal experiences.





## **2.5 Soft-tissue profile preferences**

Early studies on profile preferences up until the 1960's, seemed to indicate a public bias toward the typical "Hollywood" profile, which was relatively straight or flat (Riedel, 1950, 1957; Goldsman, 1959; Neger, 1959; Hambleton, 1964). However, in an analysis of art form from the time of the Egyptians to the present, Hambleton (1964), demonstrated that there was a "constantly changing concept of profile beauty". Orthodontists notably concurred with the public in their appreciation of facial aesthetics (Riedel, 1957; Burstone, 1959). Nevertheless, a review of the literature revealed a wide range of opinions regarding the preferred soft-tissue profile.

### **2.5.1 Perceptions of Professionals**

Riedel (1950), traced the soft-tissue outline from the cephalometric radiographs of twenty four children and asked seventy two orthodontists to rate them as good, fair, or poor. He found that there was greater agreement on poor profiles than those that were considered good. He concluded that the relation of the maxillary and mandibular apical bases in an anteroposterior dimension (ANB angle), the convexity of the skeletal pattern (N-A-Pog angle) and the relation of anterior teeth to the face and their respective apical bases were important influences in the soft-tissue outline.

Cox and van der Linden (1971), found concurrence in the aesthetic judgment or preference between two professionally diverse groups of evaluators (ten orthodontists and ten laypersons). Using silhouette photography as the assessment instrument they concluded that persons with poor facial balance generally had a more convex face. Notably, good facial aesthetics could be found in persons having malocclusion, as well as those possessing normal occlusion. They observed that the range of variation within those groups possessing good

facial aesthetics, were larger than was generally accepted, and hence suggested that cephalometric standards may have been set too rigidly in the past.

Spradley et al (1981) used three orthodontists and two oral surgeons to select their sample of aesthetically pleasing or “normal” subjects. They felt that these professionals were routinely involved in diagnosis and treatment planning and hence no layperson was consulted. From their study, definite gender differences for the lower third of the face were observed. In general terms they found that females had slightly fuller lip regions, shallower labial sulci and chins that were relatively less prominent than those of males. The female chin appeared less prominent than that of the male because the lips of the female were more protrusive and the labial sulci shallower or less pronounced.

De Smit and Dermaut (1984), investigated the influence of the maxillomandibular relation, the lower facial height and the form of the dorsum of the nose on the profile preferences of 249 adults with varying orthodontic knowledge. Gender differences, as well as training in orthodontics, were found to have no significant influence on aesthetic ranking of the profile. Further, no statistical differences between the selected male and female profiles were evident, suggesting that the profile preference for the male and female subjects were similar. The nose dorsum induced significant differences only in Class II profiles, where a convex nose was less appreciated. Open-bite profile types were the least appreciated and the authors, therefore, warned against the creation of long-face features.

The research done by Czarnecki et al (1993), dealt with the assessment of the role of the nose, lips, and chin in achieving a balanced facial profile. A series of constructed androgynous facial silhouettes were evaluated by five hundred and forty five professionals. The silhouettes had changes effected to the nose, lips, and chin relationships, as well as changes in facial angle and angle of convexity. The varied facial profiles were graded on the basis of most preferred to least preferred. The data was computed, and it was found that in males, a straighter

profile was preferred in comparison with a slightly convex profile for the females. Among the various unfavorable combinations, the worst ones were either with an extremely recessive chin, or those with excessively convex faces. Increased lip protrusion was found acceptable, for both male and female faces, when either a large nose or a large chin was present. It is suggested that orthodontic treatment goals should be attuned to the achievement of balanced and harmonious facial features, rather than rigid adherence to standard average dental and skeletal parameters. Treatment of adolescent children should also take into account the changes in the thickness of the soft-tissue integument at the nose, lips, and chin.

Peck and Peck (1970), suggested that the aesthetically attractive Caucasian face demonstrated fuller lips than the norm. Hence, lip augmentation has become common in aesthetic plastic surgery. However, little data exists on what comprised aesthetically beautiful lips (Bisson and Grobbelaar, 2004). In this study photographs of twenty eight models from fashion magazines were scanned to obtain digital images. A group of fourteen nonmodel hospital employees were used as controls. Bisson and Grobbelaar (2004), found the model group had fuller lips when compared with those of the non-model controls.

The aim of the study by Soh et al (2005), was to compare the assessments of Chinese facial profile attractiveness by orthodontists and oral surgeons. The sample comprised thirty one dental professionals (twenty orthodontists, eleven oral surgeons) in an Asian community. Facial profile photographs and lateral cephalometric radiographs of two Chinese adults (one man, one woman) with normal profiles, Class I incisor relationships, and Class I skeletal patterns were digitized. The images were manipulated to produce a bimaxillary protrusion, protrusive mandible, retrusive mandible, normal profile (Class I incisor with Class I skeletal pattern), retrusive maxilla, protrusive maxilla, and bimaxillary retrusion. A strong correlation was found in the profile assessment between orthodontists and oral surgeons. Normal and bimaxillary retrusive Chinese male and female profiles were judged to be highly attractive by orthodontists and oral surgeons.

Chinese male and female profiles with protrusive mandibles were judged the least attractive. However, there was a difference in professional opinion about the most attractive male profile, with orthodontists preferring a flatter profile and oral surgeons preferring a fuller Chinese profile. Additionally, the gender of dental professionals and number of years in clinical practice were found to affect profile rankings.



## 2.5.2 Perceptions of lay people

Peck and Peck (1970), analyzed the faces of fifty two professional models, beauty contest winners and other performing stars who were noted for their facial attractiveness. They found that the general public preferred a fuller and more protrusive dentofacial pattern than the cephalometric standards that Margolis (1947), Downs (1948) and Steiner (1953) had prescribed. However, Cox and van der Linden (1971) cautioned that this sample consisted of forty-nine females and only three males, a possible shortcoming of this study.

Iliffe (1960), reported that a common basis for judging facial beauty does exist. His conclusions were drawn from a study done in Britain where 4,355 participants assessed twelve female faces. These findings were shared by men and women of all ages in all parts of England and from varying social backgrounds. Furthermore, he suggested that some intrinsic characteristic like harmony or balance found in the human face, and common to all beautiful things probably resulted in these findings.



Martin (1964) and Linn (1976), who examined cross-cultural differences, showed that American Whites and Blacks shared a common aesthetic standard for the female face when judging beauty, namely, the Caucasian facial model. Peck and Peck (1970) suggested that cultural factors, as well as other commercial reinforcing agencies such as television, newspapers, and motion pictures may have contributed toward the creation of this "attractiveness stereotype".

Udry (1965), duplicated Iliffe's (1960) study on an American sample and reported similar results. Foster (1973), agreed that television and other mass media may have been responsible for the acceptance of this universal aesthetic norm.

In a review of the literature, Kiyak (1981), noted that while there was consistency across some ethnic groups in perceptions of facial aesthetics, very little work had been done on the effects of individual and cultural differences on aesthetic appreciation. The author compared the aesthetic values and preferences of Caucasians with those of Pacific Asian immigrants to the U.S.A. and found that while differences emerged, aesthetic ratings were unrelated to racial typology or to the individual's own malocclusion. Pacific Asians chose bimaxillary protrusions as least attractive, despite there being a high frequency of this condition in their community. In this study, it was surprising that the so-called "normal" or straight profile was ranked second in attractiveness by the two groups. The Pacific Asians (42%) selected bimaxillary retrusion as being most attractive, while the Caucasoids (41%) chose vertical deficiency as the most attractive facial type.

The study by Turkkahraman and Gokalp (2004), evaluated the aesthetic preference of a Turkish population, and assessed the effect of sex, age, education, social status, geographic location, or personal profile on these findings. Eight profile estimates for each sex were morphed by a video imaging technique and then scored by four hundred participants. The orthognathic profile in both sexes was selected as the most preferred profile, whereas the convex profile with a prognathic maxilla and a retrognathic mandible were the least preferred. The public also admired fuller and protrusive lips in females and retrusive lips with a prominent nose and chin in males. Sex, age, education, social status, geographic location, and personal profile were also shown to affect the public's profile preferences.

Beukes et al (2007), evaluated the perceptions of Black South African students on the facial profile of Black South African subjects with bimaxillary protrusion. Silhouetted lateral facial profiles of thirty Black South Africans with bimaxillary dento-alveolar protrusion were subjected to an initial evaluation process by one hundred and twenty eight students selected from secondary schools, junior and senior tertiary university institutions. These evaluators were asked to choose the

five most attractive and five most unattractive profiles. No significant difference could be found between the male and female profile preferences. The three different groups of evaluators all chose the same profiles as the most attractive and profiles; however scholars had a slightly different view of what the unattractive profiles should look like, whereas the more mature students (junior and senior tertiary students) chose on average the same profile for the most unattractive profile. Profile preference among their sample of Black South Africans favoured a fuller profile of bimaxillary protrusion, with a normal overjet and overbite relationship and lip competence.

### **2.5.3 Comparison of perceptions of lay people vs professionals**

Cox and Van der Linden (1971), compared the aesthetic standards of ten orthodontists and ten lay persons. After grading full-head silhouettes for good facial balance in grades from best to worst, it was concluded that the cephalometric radiographic analysis did not reveal any statistically different evaluations between the two groups. The persons with poor facial aesthetics had convex faces.

Sassouni (1971), believed that society accepted deep-bite skeletal types easier than open-bite facial types. Later Dongieux and Sassouni (1980), using a Class II deep-bite subject, created seven other facial types by varying the mandibular position. A group of observers from different cultural backgrounds including orthodontists, artists and a peer-group were asked to judge each picture on a five-point scale. An important finding was the consistency of opinion between the three groups of observers who evaluated the soft-tissue profile photographs. The authors concluded from their study that the Class III open-bite was the least pleasing facial profile type. This study showed that vertical and antero-posterior variation of mandibular position undoubtedly influenced the opinion of observers when assessing facial aesthetics.

Foster (1973), used diversified groups of people including general dentists, art students, orthodontists, a Black lay group, a Chinese lay group and a White lay group, to judge seven silhouette facial profiles created from a single cephalogram. Each silhouette drawing was only altered in the lip region, such that the "full" profile had a protrusion of 12mm from the "straight" face. Each judge was asked to choose the most pleasing profile for males and females at ages 8, 12, 16 and adult. The silhouette drawings were analysed by using the S-, H- and E-lines. Results from this study supported earlier work (Martin, 1964; Linn, 1976), suggesting that diversified groups shared a common aesthetic standard for the posture of the lips. All groups were consistent in assigning fuller lips for younger ages. However, significant sex differences were evident only in the adult sample. Although the adult female face, was 3mm fuller than the adult male face, it was still found to be retrusive according to established profile norms. Orthodontists preferred a fuller male face in comparison with the other groups of evaluators. Public preference toward a straighter male adult profile might preempt changes to existing norms. According to the Ricketts (1968), the lower lip was prescribed a value of  $4\text{mm} \pm 3\text{mm}$  to the E-plane. In Foster's study the preferred lip position was a value of about -8mm. Foster, however, warned that this straighter profile standard be established only in the mature or adult face.

Lines et al (1978), compared the facial profile components considered desirable for males, with those considered desirable for females. He further assessed the profile preferences of a large group of participants possessing varying degrees of training in facial aesthetics. These judges were divided into three main categories representing moderately trained (orthodontists), slightly trained (oral surgeons) and untrained individuals (dentists, dental hygienists, dental and medical students and non-professional persons). The authors reported significant differences in the assessments of male and female profiles. However, there was no difference between the scores of the different groups of persons who participated in the study, except that orthodontists preferred both men and women to have slightly more prominent lips than did the oral surgeons. The



surgeons preferred profiles with more prominent chins and longer columella lengths than the other groups. Based on these findings, the authors felt that differential treatment planning for the sexes was therefore necessary (Lines et al, 1978).

Kerr and O'Donnell (1990) evaluated the full face and profile photographic transparencies of sixty subjects (thirty males, thirty females) divided equally among Angle Class I, Class II Division 1, and Class III malocclusions, taken before and after orthodontic treatment. These images were randomly distributed in projector carousels and shown to four panels consisting of orthodontists, dental students, art students, and the parents of children undergoing orthodontic treatment. The faces were rated using the Visual Analogue Scale (VAS). Full face views were generally rated more attractive than profile views. Class II and Class III malocclusion subjects were rated lower than Class I malocclusion subjects. While the art students and parent panels were less critical in their appraisal of facial attractiveness, they were less sensitive to the changes brought about by orthodontic treatment than the orthodontists and dental student panels, although the groups did demonstrate an appreciation of an improvement in the Class II Division 1 patients.

Farrow et al (1993) in their study attempted to identify what Black Americans found attractive about their profile. Fifteen Black patients (eight males, seven females) were selected at random and used as models. Lateral photographs were taken on each patient, and a computer was used to alter the profiles to depict different levels of bimaxillary protrusion. Each patient profile was manipulated into four different profile types according to specific numerical guidelines. A vertical reference line from soft-tissue glabella, perpendicular to Frankfort horizontal, was used to measure the lip position. In each profile type only the horizontal lip position was altered. The profile types ranged from straight to extremely convex. The photographs were surveyed among Black and White laypersons, general dentists, and orthodontists. The slightly convex profile was

found to be the most attractive. This was consistent for all the groups surveyed and this indicated that a slightly convex profile was preferred to the existing White orthodontic norms.

Hall et al (2000) designed a study to assess the perceived optimal profiles of African Americans versus White Americans. A survey was conducted using profile silhouettes of thirty African American and thirty White patients, their ages ranging from seven to seventeen years. Twenty White orthodontists, eighteen African American orthodontists, twenty White laypersons, and twenty African American lay persons evaluated the profiles. The preference of each rater for each of the sixty profiles was scored on an attached Visual Analog Scale (VAS). All raters preferred the African American sample to have a greater profile convexity than that preferred for the White sample. White orthodontists and laypersons selected more profiles as acceptable, than did African American orthodontists and laypersons. African American orthodontists preferred more prominent upper and lower lips for the African American sample than for the White sample.



Later White and his co-workers (2006), carried out a study to establish the profile preferences of Black female patients. He also tested to see whether they could recognize their own profile images before and after orthodontic treatment. Fifteen Black orthodontists, fifteen White orthodontists, and fifteen Black female patients were asked to indicate the images they considered most pleasing for three Black female profiles. Raters used a specially designed computer program called "perceptometrics" (Health Programs International, Wellesley, Mass). In addition, the fifteen patients were asked to identify their pre-treatment and post-treatment profile images. Results showed that the White orthodontists preferred flatter profiles than the Black women, who in turn preferred fuller profiles than the Black orthodontists. All fifteen Black women recalled having fuller profiles than they actually did before treatment, but they could correctly identify their own profile images after treatment.

## ***2.6 The influence of race on the appraisal of beauty***

Prior to the introduction of cephalometrics, several early anthropologic studies revealed significant skeletal, dental and soft-tissue differences between the races (Fonseca and Klein, 1978). One such study by Hrdlicka (1928), noted that the face and mouth of the American Black was larger than that of the American White, while the nose was broader, shorter and flatter. He concluded that the profile of the Black male was straight, whereas that of the White male demonstrated a more concave profile (Hrdlicka, 1928).

With the advent of cephalometrics in 1931, several analyses for the skull have been presented by various authors. Cotton et al (1951), used the Downs (1948) analysis to compare Blacks to three other ethnic groups, including American Whites. Blacks demonstrated a protrusion of the maxilla, a convex profile, a steep mandibular plane and flared upper and lower incisors when compared with Whites.

Martin (1964), examined the differences in the perception of beauty between Blacks and Whites. He showed ten selected pictures of Black women to fifty White and fifty Black college-age American men, and another fifty Black Nigerian men of similar age. The observers were asked to rank the photos in terms of attractiveness. The author found that there was consistent agreement between American Blacks and Whites as to which faces were the most attractive; while the Nigerians disagreed with both groups. Further, the two American groups ranked those faces deemed the most Caucasian in appearance by another group of judges to have the highest attractiveness. From these data Martin (1964), concluded that a "Caucasian facial model" was the "single cultural model in a poly-racial American society." This strongly suggested that European Americans and African Americans perceived Caucasian faces to be more attractive than Black faces.

Indeed, even part of Peck and Peck's (1970) work would seem to confirm these findings. Their study compared the cephalometric measurements of people already considered beautiful by society at large, to commonly accepted norms. They found neither of their two "beautiful" Black female subjects seemed to "exhibit the anthropological characteristics of her race"; as each seemed to "posses many Caucasian-type features." Thus Martin (1964), might have been correct in suggesting that all Americans looked at beauty through a White standard; however, the other half of the Peck and Peck (1970) study appeared to be in conflict with this contention.

With regard to the sample of "beautiful people" that were White, Peck and Peck (1970), found that their profiles were significantly fuller than the accepted White cephalometric norms. Therefore, it is not completely accurate to state as Martin (1964) did, and as Peck and Peck (1970) reiterated that there was a universal preference for a "Caucasian facial model."

Deloach in 1978 evaluated the preferences of two hundred and twenty four African American females who had been asked to rate ten profiles. A great majority of the respondents preferred straight profiles. There was a concerted disapproval of the Class II deep bite, extreme bimaxillary protrusive and Class III profile types. What is shown most convincingly is that the most attractive faces may not be as flat or as full as their respective norms. The fact that a person is Black or White may not mean that he or she found the most attractive African American faces as full as the Black norm, or European American faces as flat as the White norm. This observation is to be taken into consideration when orthodontic treatment is undertaken to change these characteristics (Farrow et al, 1993). Also, the prevailing assessments seem to show orthodontists generally agree with laypersons (Farrow et al, 1993).

To some, (Oynick, 1988; Spadafore, 1995) it may seem that Peck and Peck (1970), showed that orthodontists were in disagreement with the general public as to types of faces which were most aesthetically pleasing. However, this interpretation did not come from a direct comparison between the appraisals of orthodontists and laypersons, but rather from Peck and Peck's (1970), observation that cephalometric measures of media stars were different, that is fuller, than the customary cephalometric norms.

A more direct comparison came from Prah-Andersen and co-workers (1979), who asked parents, orthodontists, and general dentists to rate intraoral photographs and line drawings of profiles. The groups were to rate each profile and photograph as being normal; deviating from normal but not needing orthodontic treatment or deviating from normal and needing orthodontic treatment. The results indicated that the orthodontists and general dentists generally agreed with each other, but not with the parents. The orthodontists and general dentists were more likely than the parents to think that the subject needed orthodontic treatment. This study indicated that there were perceived differences between professionals and the public.

More often, studies have reflected the opinion that orthodontists and laypersons generally concur about the concept of attractiveness. Before Peck and Peck (1970), Riedel's (1957) study on beauty contest winners, revealed that those judged to be most attractive were, indeed, similar to established cephalometric norms. By the same logic mentioned for Peck and Peck (1970), this would therefore imply that orthodontists and laypersons were in agreement.

In their study on "facial harmony" from the Netherlands, Cox and van der Linden (1971), showed no significant difference between the orthodontists and laypersons, both groups having similar ideas as to which profiles were regarded as being the most attractive.

These conclusions of Cox and van der Linden's (1971), were supported by the findings of De Smit and Dermaut (1984) in Belgium. The latter used silhouette profiles to compare the responses of those who had orthodontic training, to those who did not. They found no significant differences in the way the profiles were evaluated. The orthodontists ranked the given selection similarly to non-orthodontists.

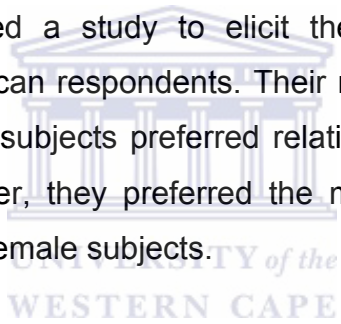
Orthodontists and laypersons have also been shown to share similar preferences when the profiles of patients are changed in some way. Dunlevy et al (1978), showed pre- and post-treatment photos of orthognathic surgery patients to panels of laypersons, orthodontists, and oral surgeons. When the panels were asked to rank the subjects by the amount of improvement, there was general agreement among the groups. Each group indicated the same patients, namely, those with the most surgical advancement as showing the most improvement.

Farrow et al (1993), on the other hand did not actually surgically treat patients, but asked groups of Black and White laypersons, orthodontists, and general dentists to evaluate digitally altered photographs. They found that all groups responded most favorably to the same type of profile. Additionally judges from different educational backgrounds would most likely choose similarly, when asked to distinguish between "good" profiles and "bad" profiles, race, sex, age profile type and dental knowledge made no significant difference in selecting the profile.

Studies by Oynick (1988) and Spadafore (1995), were similar in that they asked groups of laypersons and orthodontists to evaluate pre- and post-treatment profiles. In Oynick's study (1988), it was found that there were no significant differences in the perceptions of aesthetic improvement by either orthodontists or laypersons. Each group judged the profiles of those patients who had significant reduction in lip procumbency as being most pleasing.

Spadafore (1995), too, found similarities in the absolute choices made by orthodontists and laypersons. Both groups preferred treated faces better than non-treated faces, and faces treated by non-extraction better than faces treated by extraction. There were, however, differences in the magnitude of the judges' responses. The scores of the orthodontists showed the greatest variance between non-extraction and extraction profiles, with the scores becoming markedly lower for the latter. They rated the extraction profiles lower than any of the other groups. Thus, Spadafore (1995) showed that there were general similarities between those with orthodontic training and laypersons. He concluded that the effect of premolar extraction on aesthetics must be considered, as well as the influence of orthodontic training.

Polk et al (1995), designed a study to elicit the current soft-tissue profile preference of African American respondents. Their results indicated that African American male and female subjects preferred relatively flat profiles, with varied fullness of the lips. However, they preferred the male subjects to have more protrusive profiles than the female subjects.



# AIMS AND OBJECTIVES



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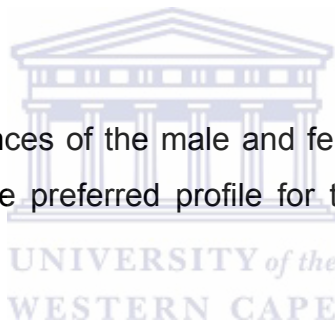


### **3.1 The aim of the study is:**

To determine the soft-tissue profile preferences of a group of lay persons and professionals.

### **3.2 The objectives of the study are:**

1. To assess the profile preferences of orthodontists (professional group) based on profile silhouettes.
2. To assess the profile preferences of orthodontic patients (lay persons) based on profile silhouettes.
3. To compare the preferences of the male and female assessors (lay persons group) with regard to the preferred profile for the male and female patient respectively.
4. To compare the level of preference of the professionals and the lay persons for various profiles.
5. To test for similarities and differences in the perceptions of the professional group of assessors between various profiles.





# **MATERIALS AND METHOD**

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#### **4.1 Introduction**

This study was undertaken using post-treatment soft-tissue profile photographs of patients who had attended the orthodontic clinic at the University of the Western Cape (UWC).

Patients seeking treatment at the UWC orthodontic clinics were considered as being representative of the lay public. Selection was random within subgroups and comprised patients from the Tygerberg and Mitchells Plain teaching facilities.

#### **4.2 Study Design, Study site and sampling**

This was a qualitative study which included the participation of both laypersons and professionals.

The professional group comprised orthodontists, who were attending a lingual orthodontic course at the Hilton hotel in Johannesburg in 2006. All the participants at the course (n=70) were requested to partake in the study. However, only thirty two orthodontists responded. Also, very few females attended the course, and hence this group could not be separated by gender.

Patients seeking treatment at the UWC orthodontic clinics were considered as being representative of the lay public. The sample comprised a group of forty males and forty female participants who assessed the male and female profiles.

A specially designed questionnaire (appendix 1) containing the predetermined profile types was given to each participant. Two A5 booklets, each containing ten profile types were supplied, one for the preferred profile for the male and the other for the female. The same booklet was used for male and female profiles as the gender of the profile could not be distinguished from the manipulated

photographs. The booklet layout presented only one image at a time in an attempt to prevent bias by comparison with adjacent profiles. The Visual Analogue Scale (VAS) and Likert Scale were placed separately below each of the specially edited soft-tissue profile photographs. The rater was required to complete each scale independently of the other.

### **4.3 Soft-tissue profile types**

Ten profile types were identified for the purpose of this study, based on the concepts of facial divergence and facial convexity, as proposed by Proffit et al (2000). These include:

1. Straight (Orthofacial)
2. Straight convex
3. Straight concave
4. Anterior divergent convex
5. Anterior divergent concave
6. Anterior divergent straight
7. Posterior divergent convex (thick lips)
8. Posterior divergent convex (thin lips)
9. Posterior divergent straight
- 10. Posterior divergent concave**

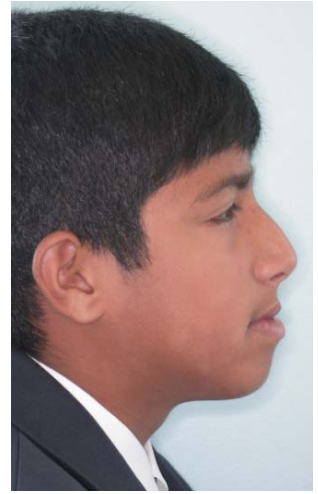
Seven of these profile types were selected from patient post-treatment photographic records in the department of Orthodontics. The remaining three profiles were morphed from existing photographs to create the desired profile as no suitable profile was found from past post-treatment records. These were the straight profile (fig 1), the anterior divergent concave profile (fig 5) and the posterior divergent straight profile (fig 9). The seven profile photographs identified from the records are presented below:



Straight convex



Anterior divergent straight



Anterior divergent convex



Straight concave



Posterior divergent concave



Posterior divergent convex (thick lips)



Posterior divergent convex (thin lips)

#### **4.4 Photograph editing procedure**

The colour profile photographs were edited as outlined below using the Photoshop CS2 software (Adobe) program. These photographs were edited to maintain anonymity, to eliminate any ethnic or gender bias and to accentuate the profile line.

##### **4.4.1 Step One**

This shows the original photograph



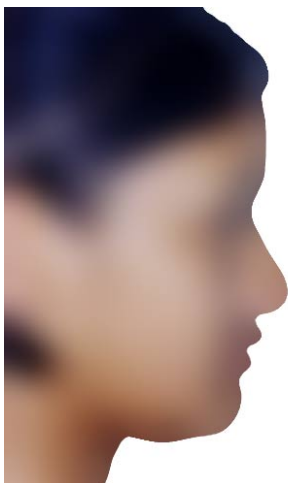
##### **4.4.2 Step Two**

Removal of all the background colours and effects



##### **4.4.3 Step three**

“Blurring” the photograph to assure anonymity



##### **4.4.4 Step Four**

Removal of all the colour from the photograph (making it a black and white photograph)



#### 4.4.5 Step Five

Smoothing the profile silhouette



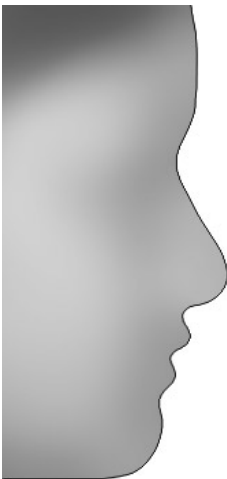
#### 4.4.6 Step Six

A border was drawn to the outside of the picture, to better define the profile. The picture was then lightened to give more emphasis to the profile outline.



#### 4.4.7 Step Seven

The hairline and neckline were removed so that only the profile remains.



Process Finished.



#### 4.5 Edited pictures



Fig 1 Straight



Fig 2 Straight Convex



Fig 3 Straight Concave



Fig 4 Anterior divergent Convex



Fig 5 Anterior Divergent concave



Fig 6 Anterior divergent straight



Fig 7 Posterior divergent convex



Fig 8 Posterior divergent concave



Fig 9 Posterior divergent straight



Fig 10 Posterior divergent concave



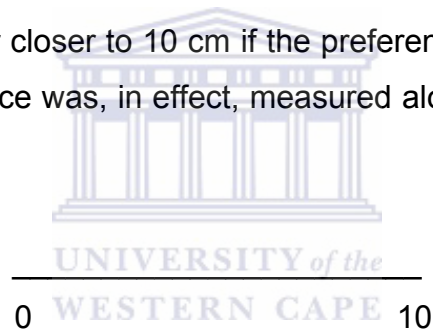
#### 4.6 Data Instrument

The soft-tissue profile was evaluated by the lay person (patient) and the professional (orthodontist), using the following two scales:

- The long ordinal scale: Visual Analogue Scale (VAS) and
- The short ordinal scale: Likert Scale.

##### *The Visual Analogue Scale (VAS)*

This is a 10 cm line anchored by 0 cm on the left side and 10 cm on the right on the line. This measured the strength of each observer's preference for the test profile by placing a mark on the VAS line. This would be closer to 0 cm if there was a poor preference or closer to 10 cm if the preference was strong. Thus, the impact of profile preference was, in effect, measured along a 10 cm scale from 0 cm to 10 cm.



##### *Likert Scale*

The second scale used was the Likert scale. This scale uses descriptive terms ranging from unacceptable to very attractive.

Unacceptable	Mildly acceptable	Attractive	Very attractive
--------------	-------------------	------------	-----------------

Each participant was asked to complete two separate questionnaires (Appendix 1) recording their preference for each of the male and the female profiles respectively. They were coached on how to use the VAS and Likert Scale prior to completion of the questionnaire. In total each participant rated twenty profiles. (ten with the VAS scale and ten with the Likert Scale).

#### ***4.7 Data Management***

The data was captured by the University statistician using Microsoft Office Excel 2003. The statistics package used was NCSS 2001 (Number Cruncher Statistical System developed by Jerry Nitze).

#### ***4.8 Statistical Analysis***

For the purpose of this study, the statistical analysis was applied to only the data gathered from the preferences recorded on the long ordinal scale (VAS).

The data gathered was ordinal and therefore it was necessary to carry out the Kruskal Wallis test.

The Spearman's Correlation Matrix was also used to determine whether there were any significant relationships among the profiles, for the professional group.

#### ***4.9 Intra-examiner variability***

To test intra-examiner variability twenty five percent of the participants (lay persons and professionals) in this study, were requested to repeat the test one month from the previous tests and results were compared using the kappa analysis. Intra-examiner reliability was determined by rescoring twenty five

percent of the sample. The kappa values indicated excellent agreement for all categories ( $k=0.95$ ).

#### ***4.10 Ethical considerations***

All the participants in this study were informed of the purpose of this study and of their right to refuse participation. Confidentiality was assured in every case. Written consent (Appendix 2) as well as verbal consent was obtained.





## **5.1 Introduction**

The first set of results that follows will be for the professional group (orthodontists). Thereafter the laypersons (patients) results will follow.

The sample size in the professional group was thirty two. This is sufficient to carry out the required test. Very few females were amongst the sample; hence this group was not separated by gender.

The sample size in the lay persons (patients) group was eighty.

An average rating of 5 and below on the VAS considered to be undesirable. Scores in the range above 5 will therefore be considered as acceptable.

## **5.2 Results for Professional Group (Orthodontists)**

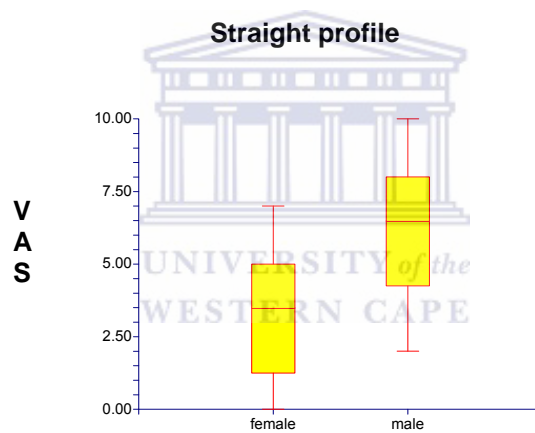
The VAS scale was analysed using box plots which illustrates the distribution of the assessments of the male and female profiles.

The Kruskal Wallis Test was used to test whether there was a significant difference in the preference for each of these profiles, for either the males or females.

### 5.2.1 Straight profile

The box plots (fig 11) indicate that the professional's opinion of the straight profile for males and that for females differ. Since the estimated median for females is three and a half and that of males is six and a half we can deduce that the straight profile is more preferred for males than it is for females. Males with straight profiles are regarded as more attractive compared with females with straight profile.

The majority of the assessors (>50%) rated this profile as being undesirable for the females.



Profile

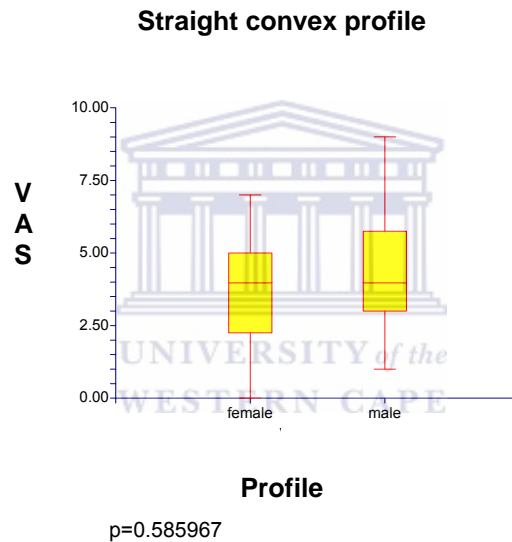
p=0.000045

Fig 11

### 5.2.2 Straight convex profile

The graph below indicates that the professional's opinion of the straight convex profile for males and females was similar. Since the estimated median for males and females is four (fig 12) we can conclude that this profile was not considered to be the preferred profile for neither the males nor the females.

The majority of the assessors (>50%) rated this profile as being undesirable for the female and male profile.

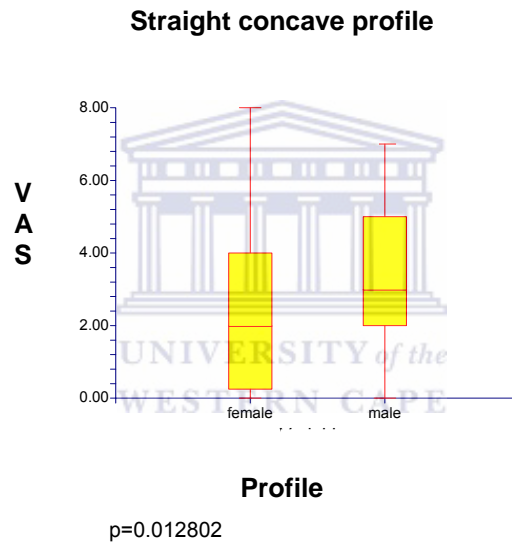


**Fig 12**

### 5.2.3 Straight concave profile

The professionals' opinions of the straight convex profile for males and females varied slightly. Since the estimated median for females is two and that of males is three (fig 13) we can deduce that male straight concave profile is marginally more preferred than when seen in females.

The majority of the assessors rated this profile above these medians for both the male and female profile.

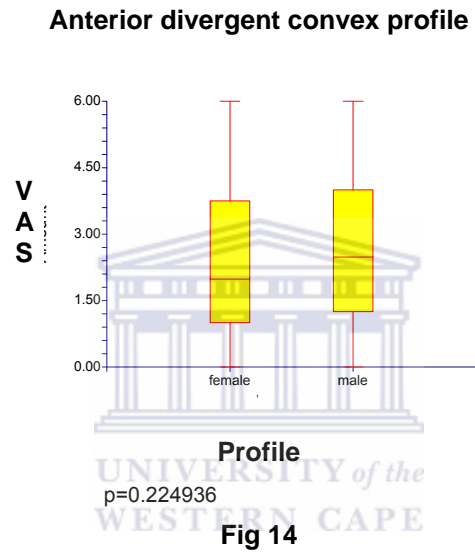


**Fig 13**



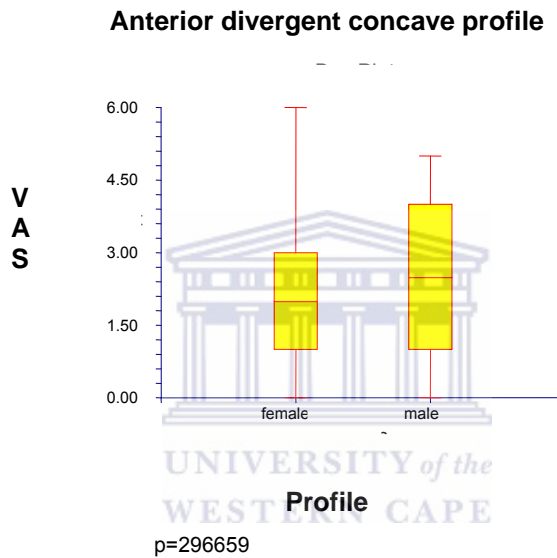
## 5.2.4 Anterior divergent convex profile

There is concurrence regarding the professionals' opinion of the anterior divergent convex profile in males and females. Although the estimated median for males is two and a half and of females is two (fig 14), the Kruskal Wallis Test indicated that this profile was not considered to be the preferred profile for neither males nor females.



### 5.2.5 Anterior divergent concave profile

The medians for both sexes were similar. There is consensus regarding the professionals' opinion of the anterior divergent convex profile of males and females. Since the estimated median for males is two and a half and that for females is two (fig 15) it can be concluded that this profile was not considered to be the preferred profile for neither males nor females.

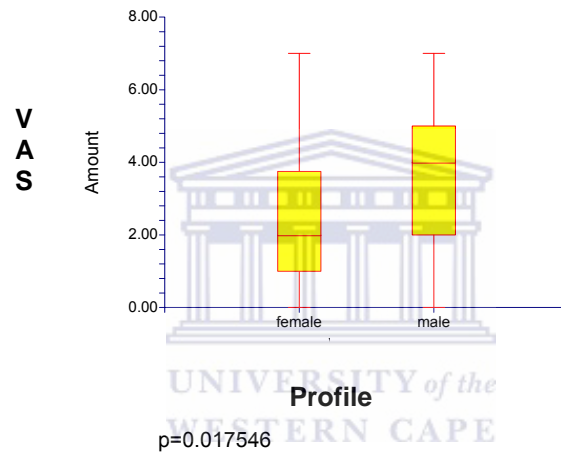


**Fig 15**

## 5.2.6 Anterior divergent straight profile

This profile was not considered to be a favourable profile for both the males and females. Since the estimated median for females is two and that for males is four (fig 16) it can be deduced that anterior divergent straight profile is rated marginally better for males.

**Anterior divergent straight profile**



**Fig 16**

### 5.2.7 Posterior Divergent Convex profile (thick lips)

There was a wider dispersion amongst the values assigned to males than those for females. There is agreement regarding the professionals' opinion of the convex thick lips profile of males and females. Although the estimated median for males is three and that of females is two (fig 17), the Kruskal Wallis Test indicated that there was preference of this profile for neither male nor female.

Posterior Divergent Convex profile (thick lips)

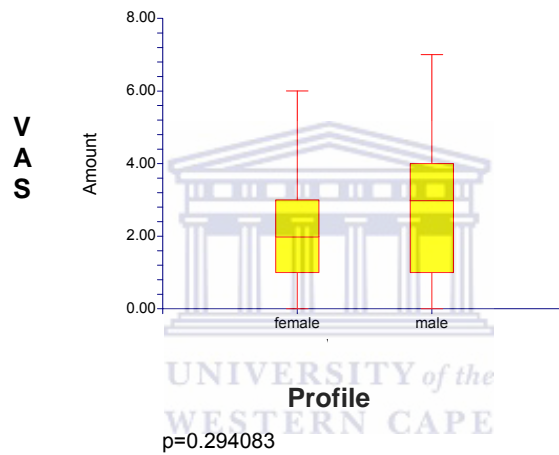


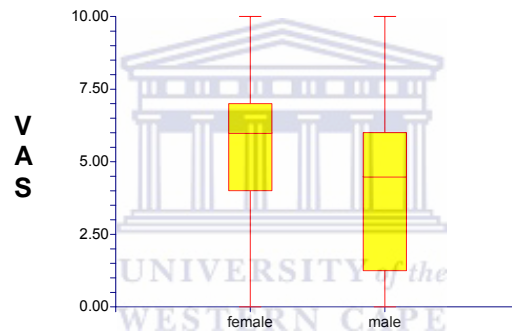
Fig 17

### 5.2.8 Posterior Divergent Convex profile (thin lips)

The professionals' opinion of the posterior divergent convex profile (thin lips) for males and females varied. Since the estimated median for females is six and that of males is four and a half (fig 18) it can be deduced that convex thin lips profile is more acceptable for females and less desirable for males.

The majority of assessors rated this profile for both male and female below the median values.

Posterior Divergent Convex profile (thin lips)



Profile

p=0.02194

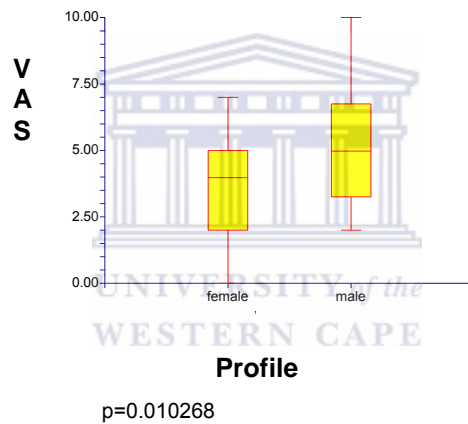
Fig 18

### 5.2.9 Posterior divergent straight profile

There appeared to be no concurrence regarding the professionals' opinion of the posterior divergent straight profile for males and females. Since the estimated median for females is four and that of males is five (fig 19) it can be deduced that the posterior divergent straight profile is more preferred in males than females.

This is further supported by noting that the majority of the assessors rated this profile above five for males and below median for females.

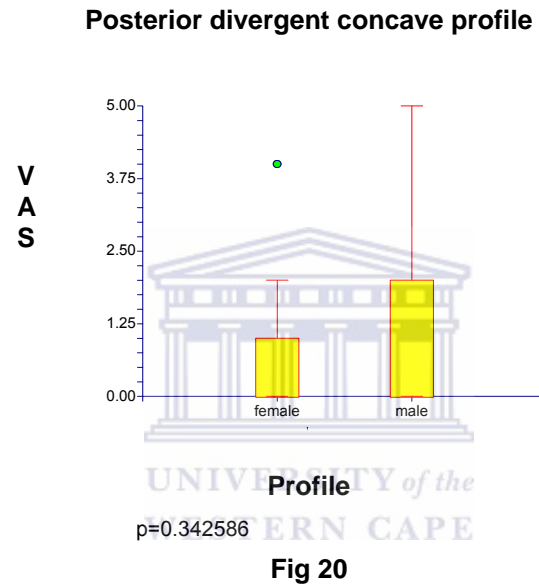
**Posterior divergent straight profile**



**Fig 19**

### 5.2.10 Posterior divergent concave profile

There was consensus regarding the professionals' opinion of the posterior divergent concave profile for males and females. Since the estimated median for males and females is zero (fig 20) it can be concluded that there was preference for neither the male nor female profile.



## Summary of the professional group

<b>Profile</b>	<b>Males Median</b>	<b>Females Median</b>
<b>Straight profile</b>	6.5	3.5
<b>Straight convex profile</b>	4	4
<b>Straight concave profile</b>	3	2
<b>Anterior divergent convex profile</b>	2.5	2
<b>Anterior divergent concave profile</b>	2.5	2
<b>Anterior divergent straight profile</b>	4	2
<b>Posterior divergent convex profile (thick lips)</b>	3	2
<b>Posterior divergent convex profile (thin lips)</b>	4.5	6
<b>Posterior divergent straight profile</b>	5	4
<b>Posterior divergent concave profile</b>	0	0

The undesirable profiles among the professional group include; the anterior divergent concave profile, anterior divergent convex profile, posterior divergent convex profile (thick lips), posterior divergent concave profile.

The most preferred profile for the male is the straight profile followed by the posterior divergent straight profile. The most preferred profile for the female is the posterior divergent convex profile (thin lips) according to the professionals.



### **5.3 Results for the Lay Person Group (Patients)**

The VAS scale was analysed using box plots which illustrates the assessments of the male and female profile for each of the variables (profiles).

#### **Key**

F Obs F Pat: female observer (F Obs); female patient (profile) (F Pat)

F Obs M Pat: female observer (F Obs); male patient (profile) (M Pat)

M Obs F Pat: male observer (M Obs); female patient (profile) (F Pat)

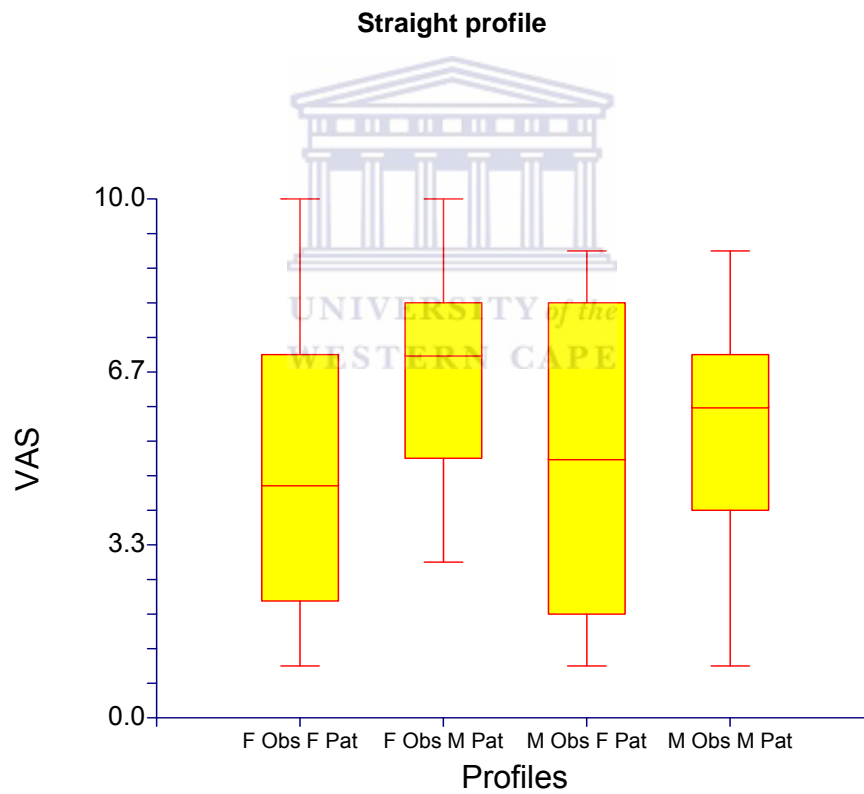
M Obs M Pat: male observer (M Obs); male patient (profile) (M Pat)



### 5.3.1 Straight profile

Both male and female observers (lay person) preferred the straight profile for the males over than for the females.

Although the median for the male profiles is seven and six as rated by the female and male observers respectively. The majority of the assessors rated this profile below these medians. The female profile recorded a median of four and a half and five as rated by the female and male observers respectively. Half of the assessors rated this profile for the females above the median.



**Fig 21**

### 5.3.2 Straight convex profile

There was a difference regarding the lay persons' opinions of the straight convex profile for males and females. Since the estimated median for females is higher than that for males it can be deduced that female straight convex profile is more preferred than when seen in males (fig 22).

The medians for the male profiles are three and a half and three as rated by the female and male observers respectively, the majority of the assessors rated this profile below these medians. The female profile is rated as four and a half and five by the female and male observers respectively, most of the assessors rated this profile below the medians.

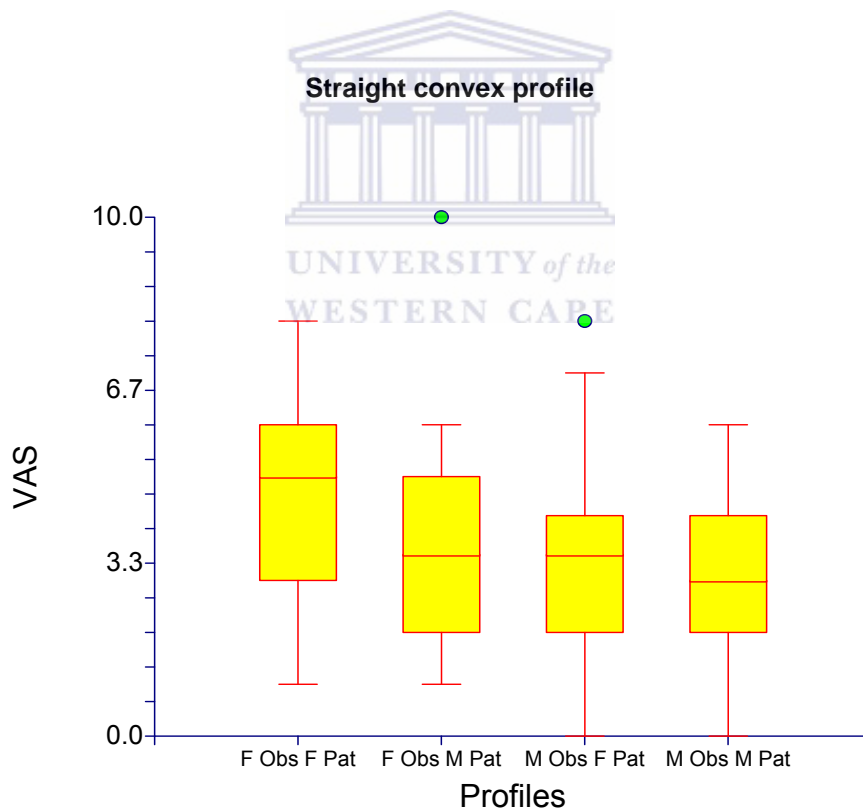


Fig 22

### 5.3.3 Straight concave profile

The medians for the male and female observers for the straight concave profile are similar, with no apparent significant differences (fig 23).

The median for the male profiles is four and a half and three and a half as rated by the female and male observers respectively. The female profile is rated five and three by the female and male observers respectively.

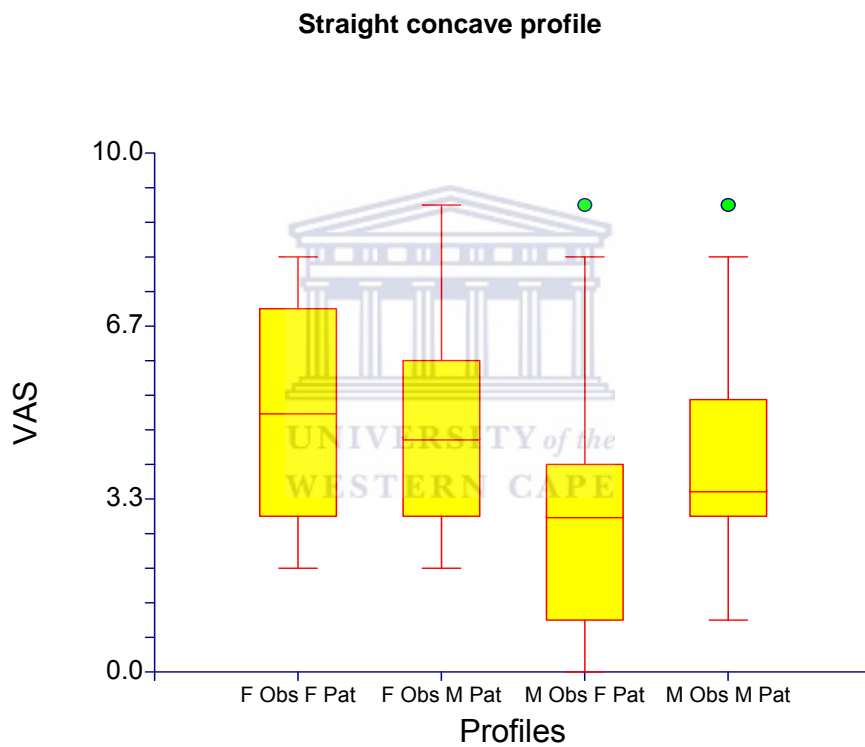
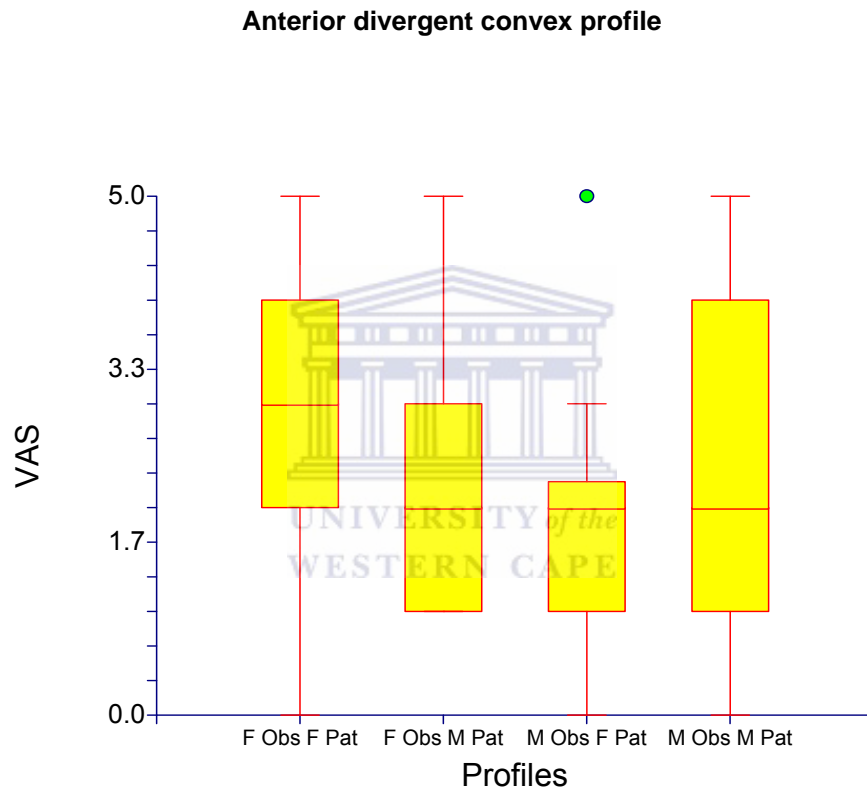


Fig 23

### 5.3.4 Anterior divergent convex profile

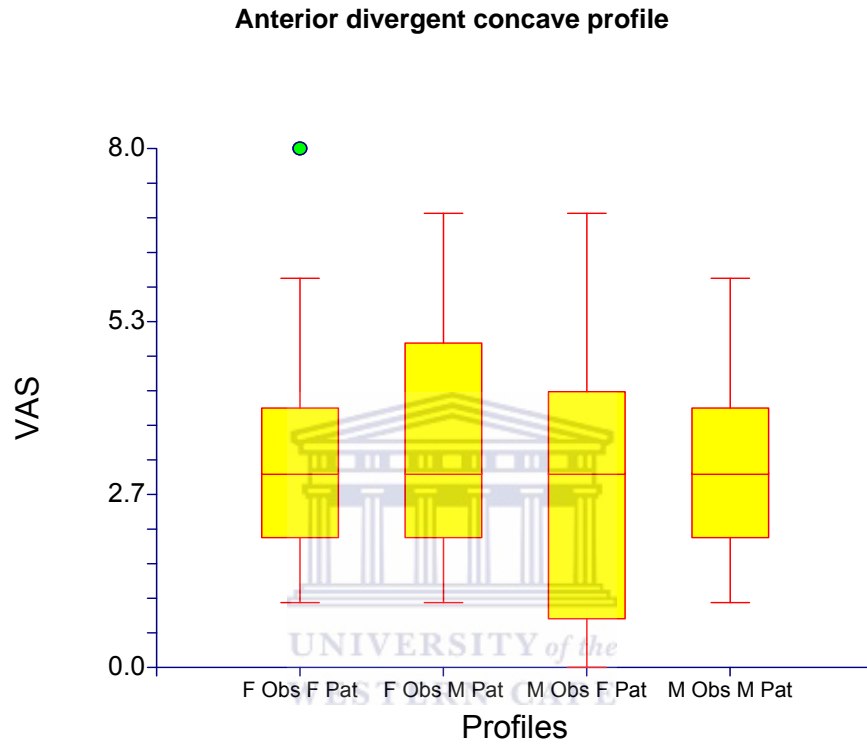
There is consensus regarding the lay person's opinion of the anterior divergent convex profile of males and females. The Kruskal Wallis Test indicated that there was no preference of this profile for neither males nor for females (fig 24).



**Fig 24**

### 5.3.5 Anterior divergent concave profile

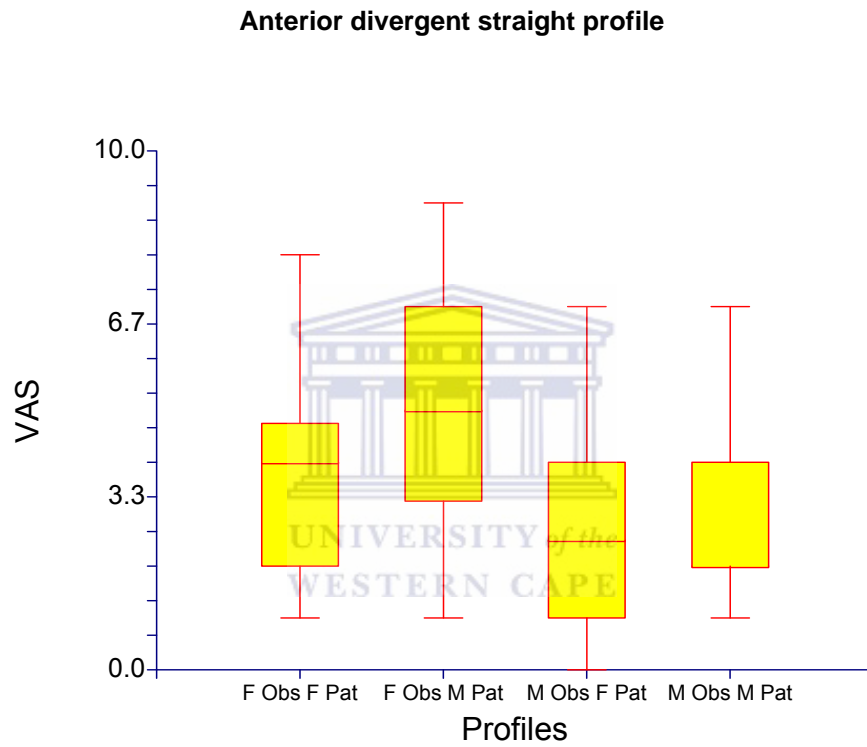
The medians for both male and females are the same. The anterior divergent concave profile was preferred for neither male nor female profiles (fig 25).



**Fig 25**

### 5.3.6 Anterior divergent straight profile

There is concurrence regarding the lay person's opinion of the anterior divergent straight profile for both genders. There was preference for neither male nor female profiles (fig 26).



**Fig 26**

### 5.3.7 Posterior divergent convex profile (thick lips)

There does not appear to be much difference between the genders regarding the lay person's opinion of the posterior divergent convex profile (thick lips). There was preference for neither male nor female profiles (fig 27).

The median for the male profiles is two and two as rated by the female and male observers respectively, most of whom rated this profile above the medians. The female profile is rated as three and one by the female and male observers respectively, most of whom rated this profile above the medians.

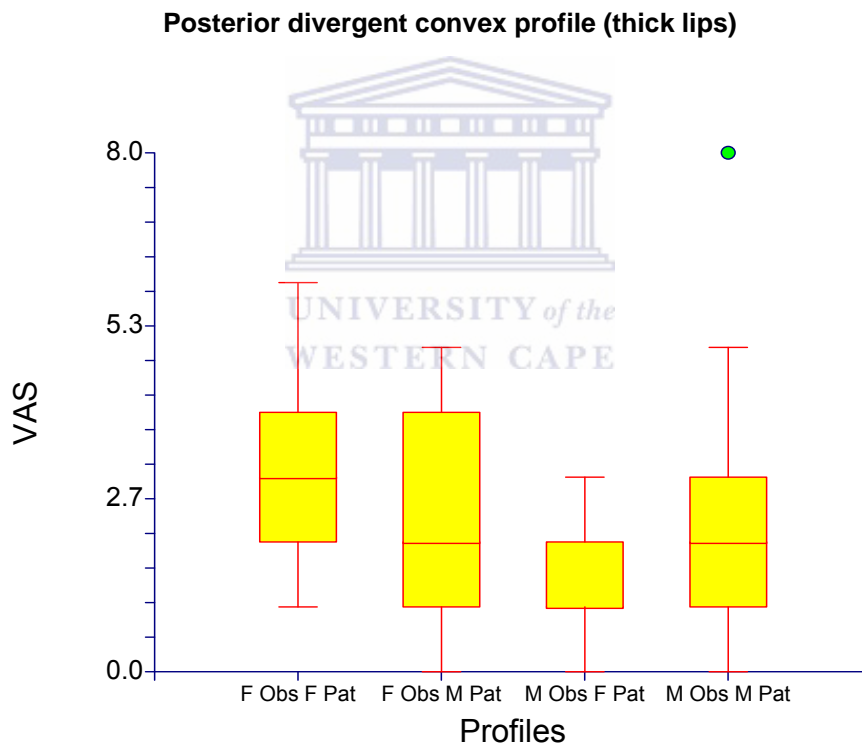


Fig 27



### 5.3.8 Posterior divergent convex profile (thin lips)

Both the male and female observers preferred the posterior divergent convex thin lips profile more for females than males. Females with posterior divergent convex profile (thin lips) are regarded as more attractive compared to males (fig 28)

The median for the male profiles is five and a half and five as rated by the female and male assessors respectively and majority. Most of the male assessors rated this profile above the median, whilst the majority of the female assessors rated this profile below the median. The female profile is rated as six and a half and five by the female and male observers respectively. The majority of the assessors rated this profile above these medians.

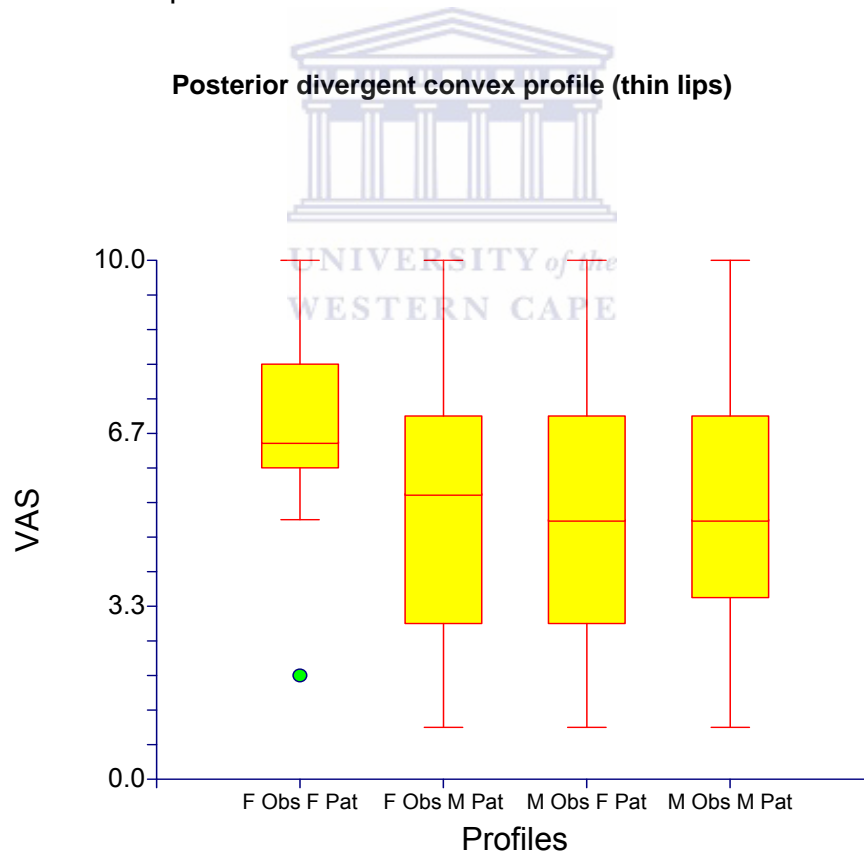
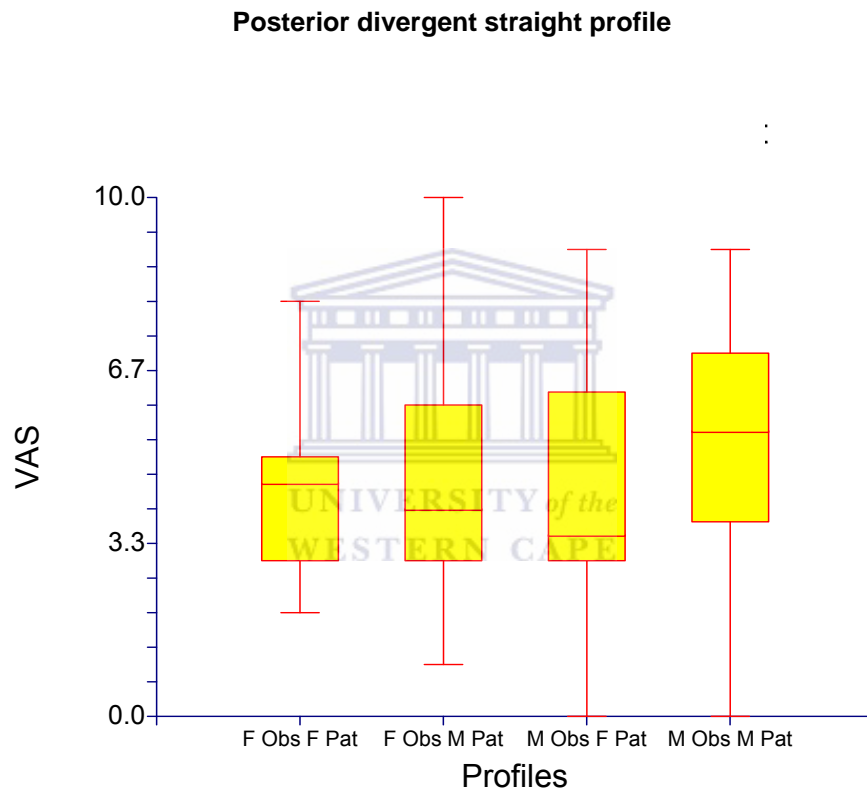


Fig 28

### 5.3.9 Posterior divergent straight profile

There appeared to be a difference regarding the lay person's opinion of the posterior divergent straight profile of males and females. The posterior divergent straight profile is more preferred for males than for females (fig 29).



**Fig 29**

### 5.3.10 Posterior divergent concave profile

Both the male and female observers have a very low median for the posterior divergent concave profile. There was preference for neither the male nor female profile (fig 30).

Posterior divergent concave profile

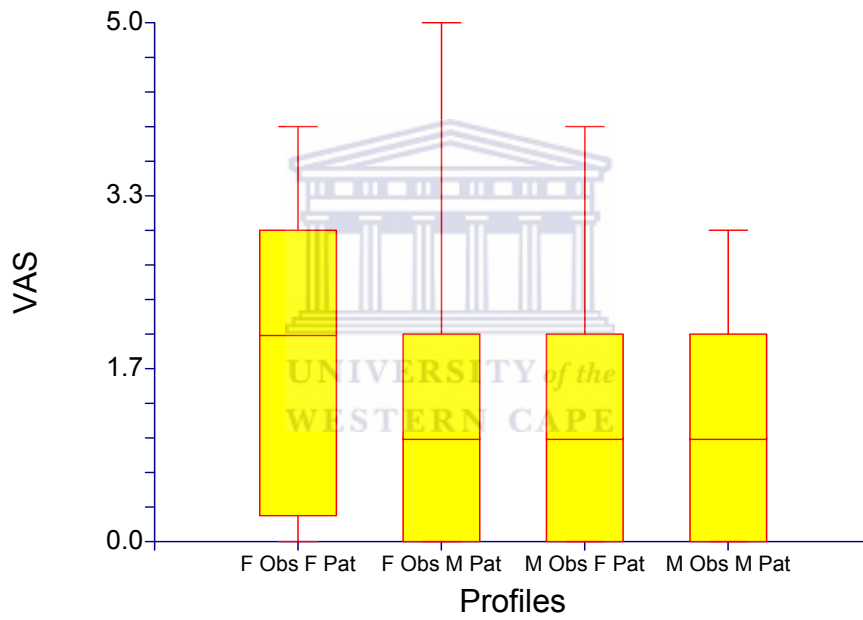


Fig 30

## Summary of the male observers

<b>Profiles</b>	<b>Males Median</b>	<b>Females Median</b>
<b>Straight profile</b>	6	5
<b>Straight convex profile</b>	3	3.5
<b>Straight concave profile</b>	3.5	3
<b>Anterior divergent convex profile</b>	2	2
<b>Anterior divergent concave profile</b>	3	3
<b>Anterior divergent straight profile</b>	2	2.5
<b>Posterior divergent convex profile (thick lips)</b>	1	1
<b>Posterior divergent convex profile (thin lips)</b>	5	5
<b>Posterior divergent straight profile</b>	5.5	3.5
<b>Posterior divergent concave profile</b>	1	1

The profiles considered undesirable by the male observers include; the anterior divergent convex profile, posterior divergent convex profile (thick lips), posterior divergent concave profile.

The most preferred profile for the male is the straight profile followed by the posterior divergent straight profile. The most preferred profile for the female is the posterior divergent convex profile (thin lips) followed by the straight profile.

## Summary of female observers

<b>Profile</b>	<b>Males Median</b>	<b>Females Median</b>
<b>Straight profile</b>	7	4.5
<b>Straight convex profile</b>	3.5	5
<b>Straight concave profile</b>	4.5	5
<b>Anterior divergent convex profile</b>	2	3
<b>Anterior divergent concave profile</b>	3	3
<b>Anterior divergent straight profile</b>	5	4
<b>Posterior divergent convex profile (thick lips)</b>	2	3
<b>Posterior divergent convex profile (thin lips)</b>	5.5	6.5
<b>Posterior divergent straight profile</b>	4	4.5
<b>Posterior divergent concave profile</b>	1	2

The profiles considered undesirable by the female observers include; the anterior divergent convex profile, posterior divergent convex profile (thick lips), posterior divergent concave profile.

The most preferred profile for the male is the straight profile. The most preferred profile for the female is the posterior divergent convex profile (thin lips).

## 5.4 Comparison of professional and lay persons' opinions

### 5.4.1 Straight profile

According to both the professionals and the lay persons, males with straight profiles are regarded as more attractive compared with females (Fig 31).

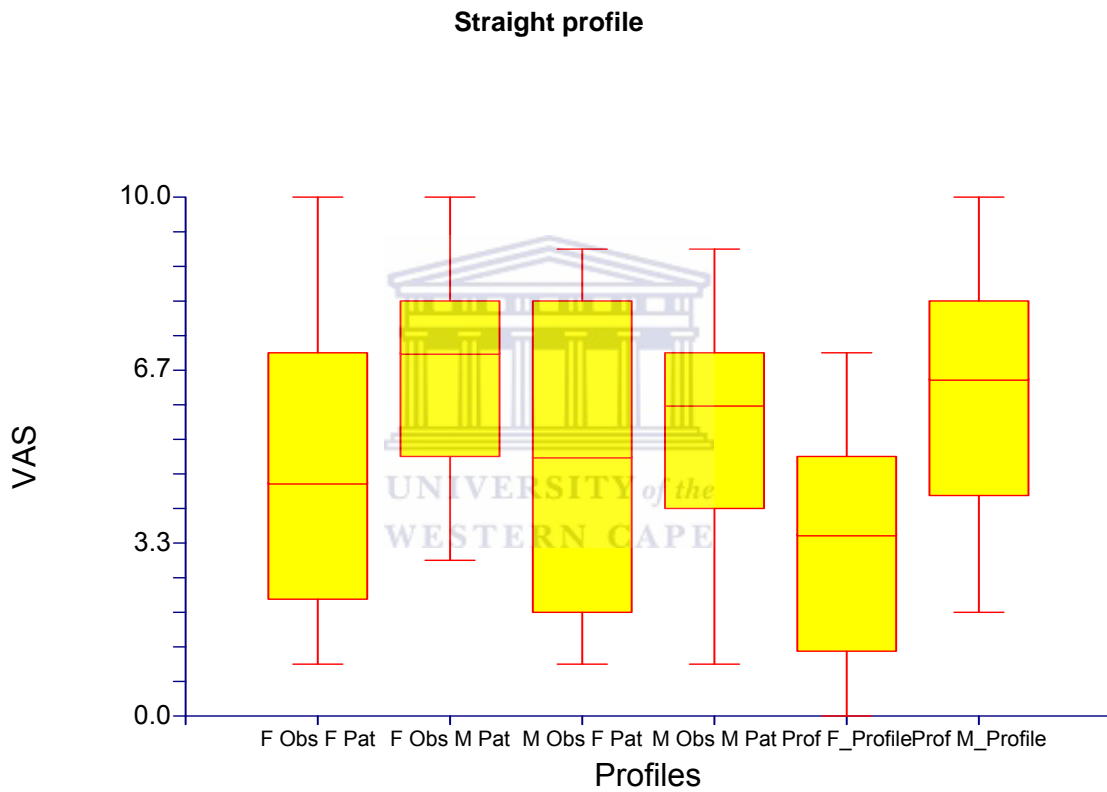
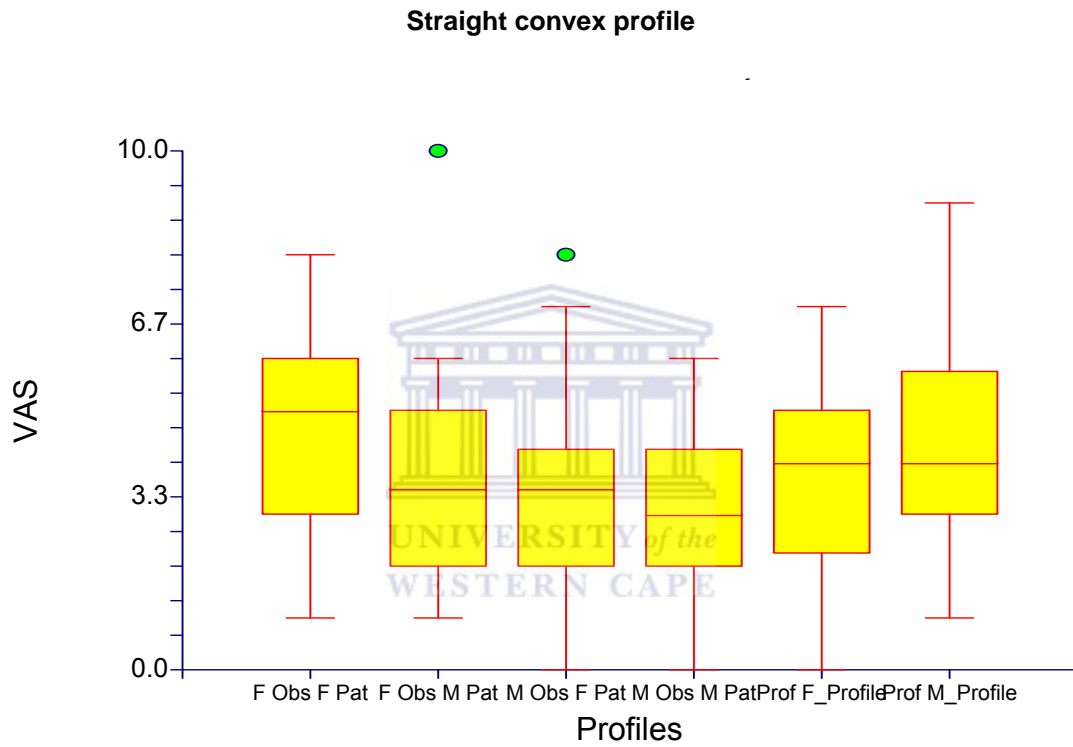


Fig 31

### 5.4.2 Straight convex profiles

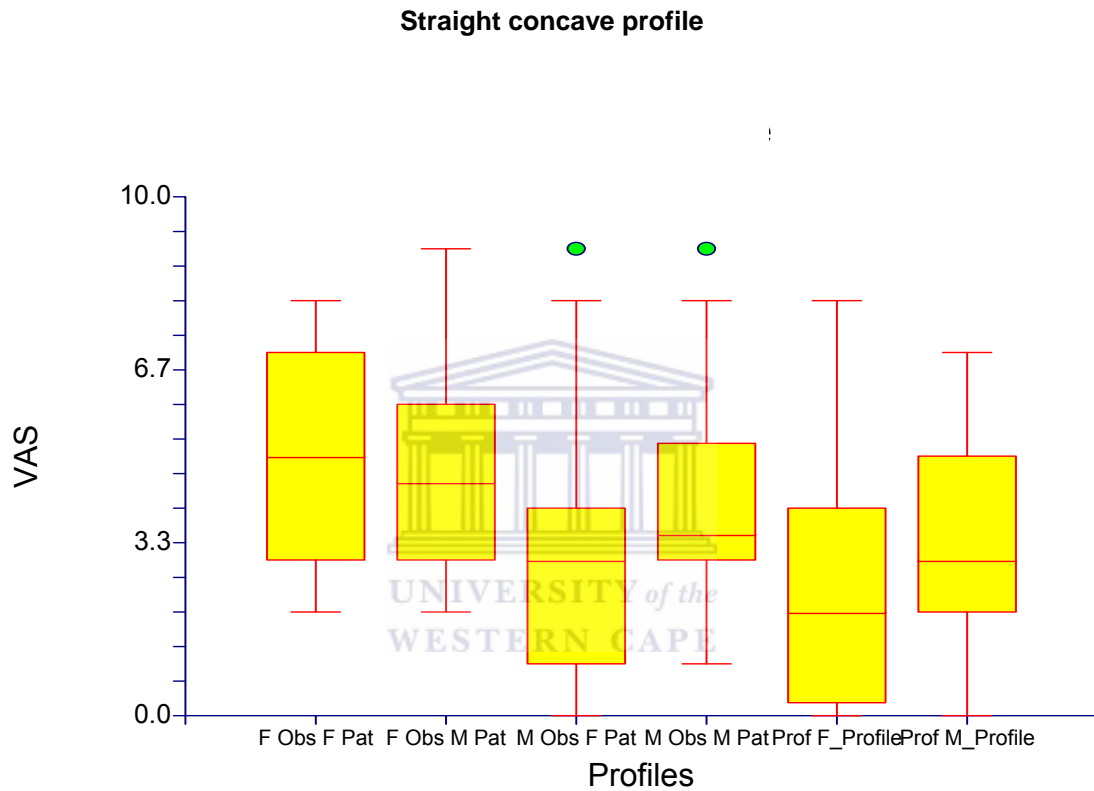
According to the professionals there was preference for neither the male nor female straight convex profile, while according to the laypersons, females with straight convex profiles are regarded as more attractive compared with males (fig 32).



**Fig 32**

### 5.4.3 Straight concave profile

According to the professionals the male straight concave profile is marginally preferred over that of females whilst the lay persons had preference for this profile for neither male nor female (fig 33).



**Fig 33**



#### 5.4.4 Anterior divergent convex profile

The box plots (fig 34) indicate that according to both the professionals and the lay persons females there was preference for neither male nor female anterior divergent convex profile.

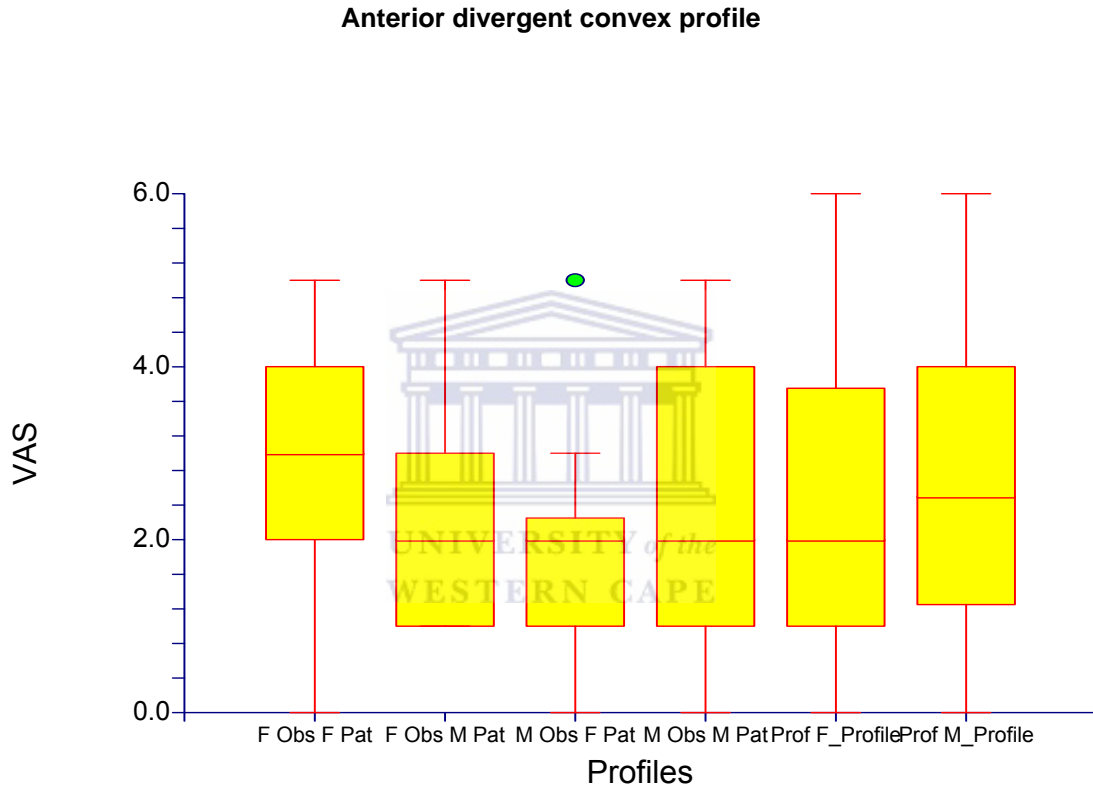
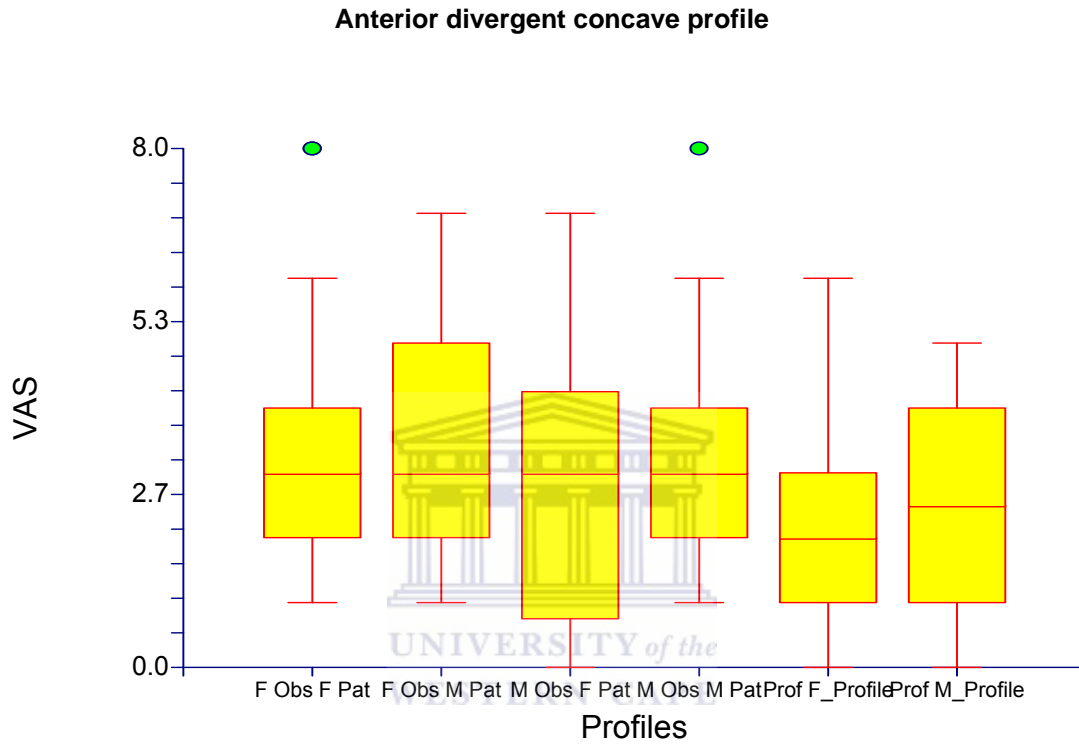


Fig 34

### 5.4.5 Anterior divergent concave profile

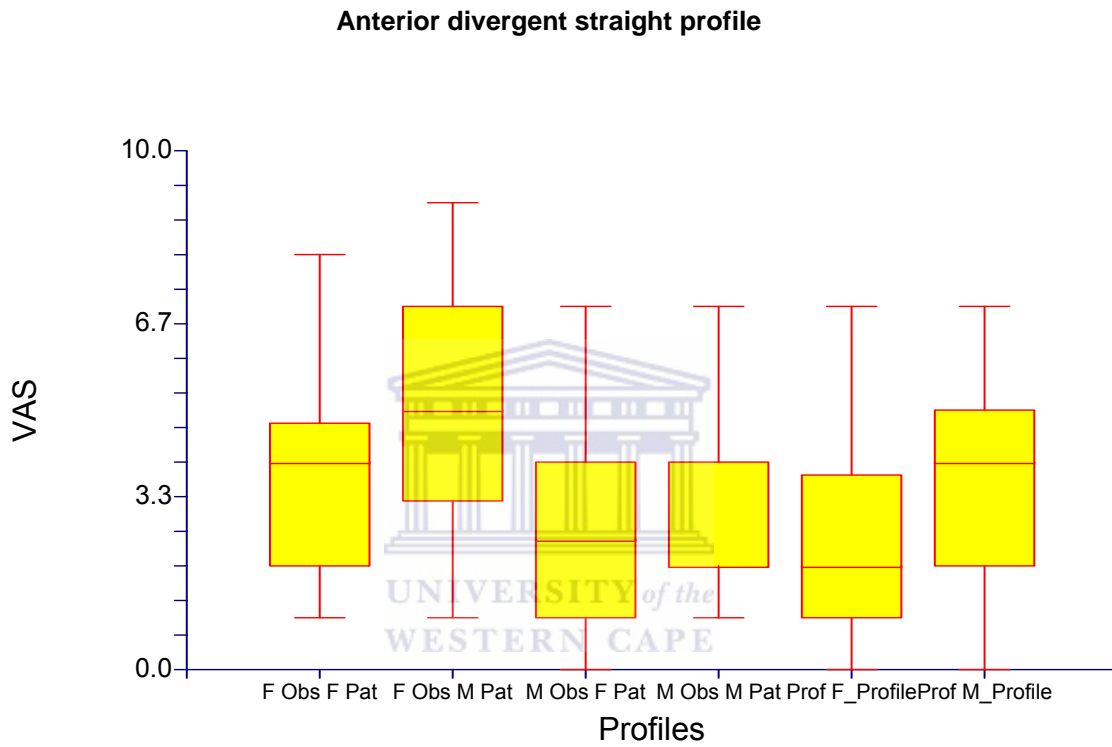
According to both the professionals and the lay persons females there was preference for neither male nor female anterior divergent concave profile (fig 35).



**Fig 35**

### 5.4.6 Anterior divergent straight profile

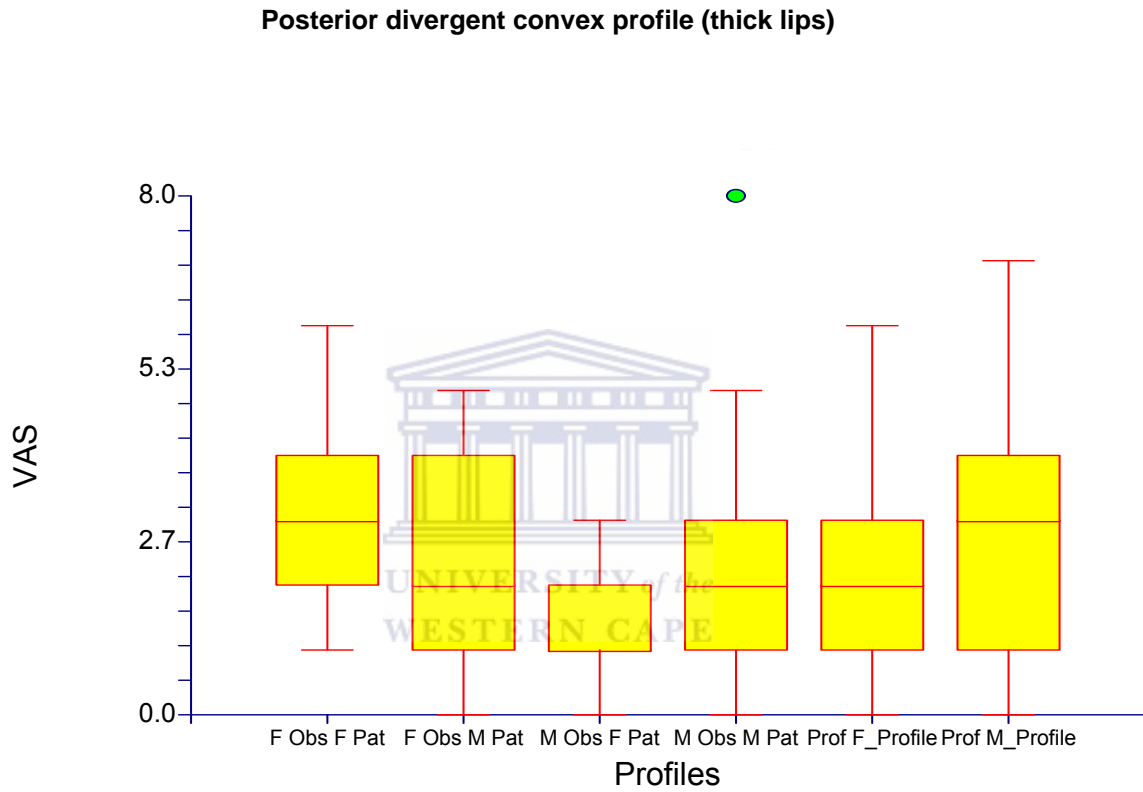
The professionals preferred the anterior divergent straight profile for males over that for females. The lay persons had no preference for the male nor female anterior divergent straight profile (fig 35).



**Fig 36**

### 5.4.7 Posterior divergent convex profile (thick lips)

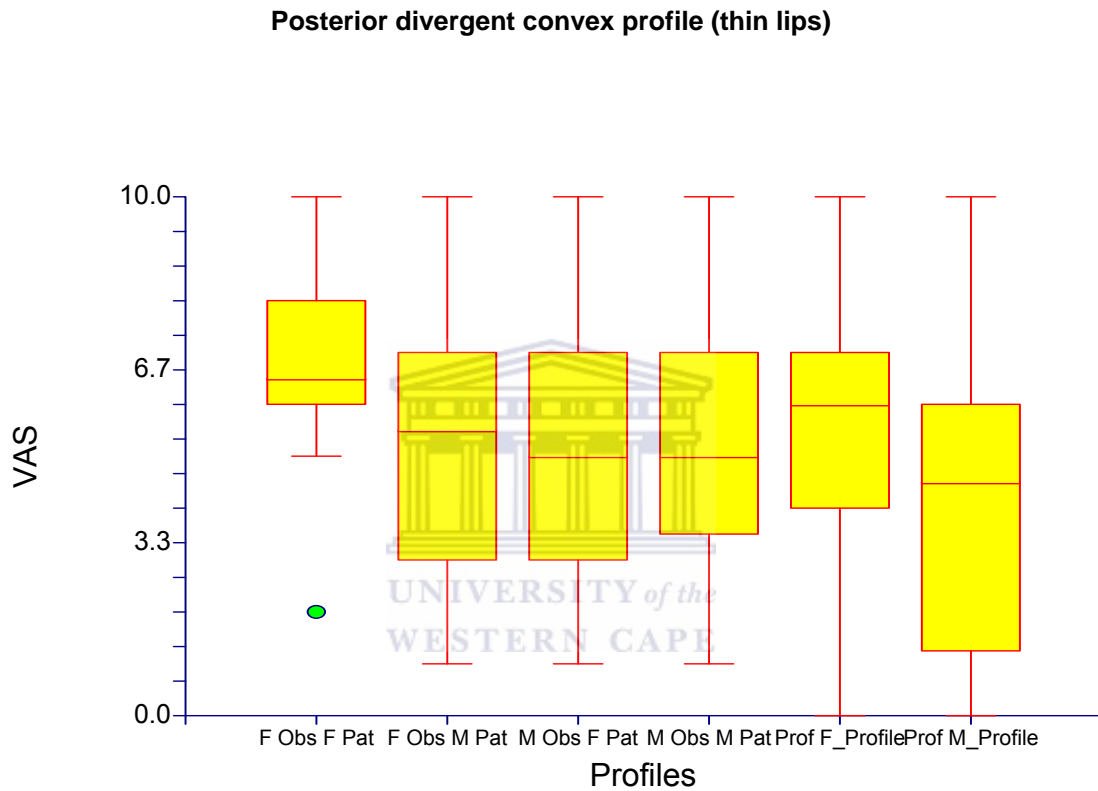
The graph (fig 37) indicates that both the professionals and the lay persons expressed no preference for male nor female posterior divergent convex profiles (thick lips).



**Fig 37**

### 5.4.8 Posterior divergent convex profile (thin lips)

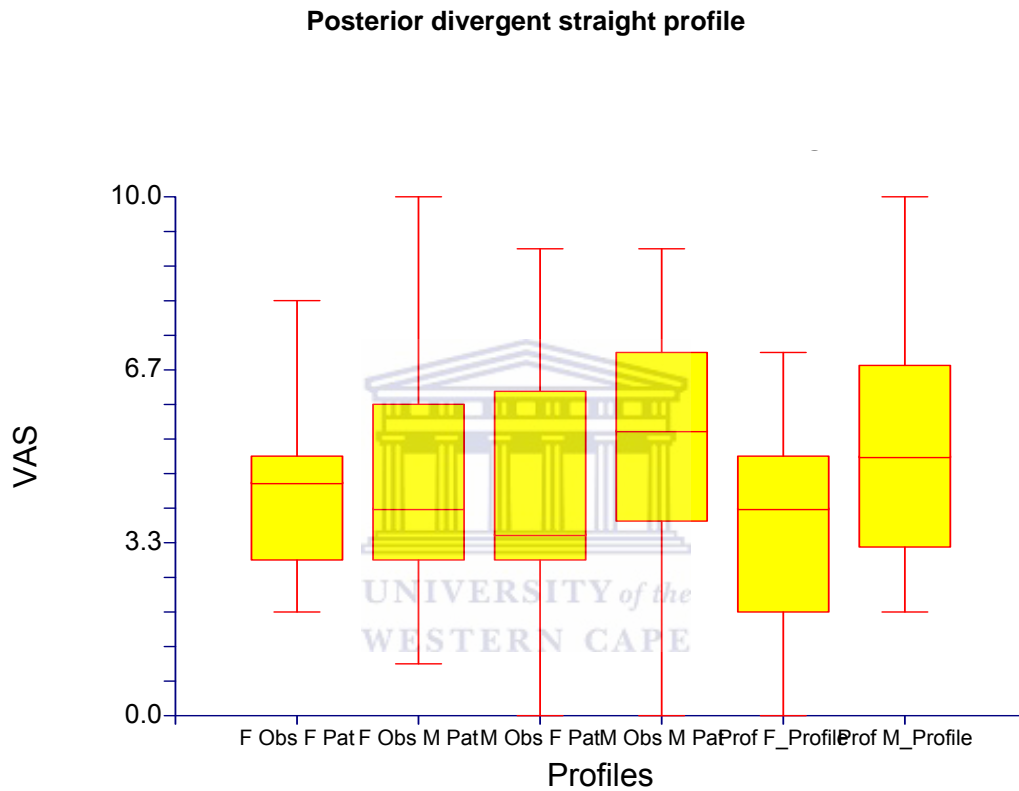
Both the professionals and the lay persons considered females with posterior divergent convex profile (thin lips) to be more attractive compared with males with this profile (fig 38).



**Fig 38**

### 5.4.9 Posterior divergent straight profile

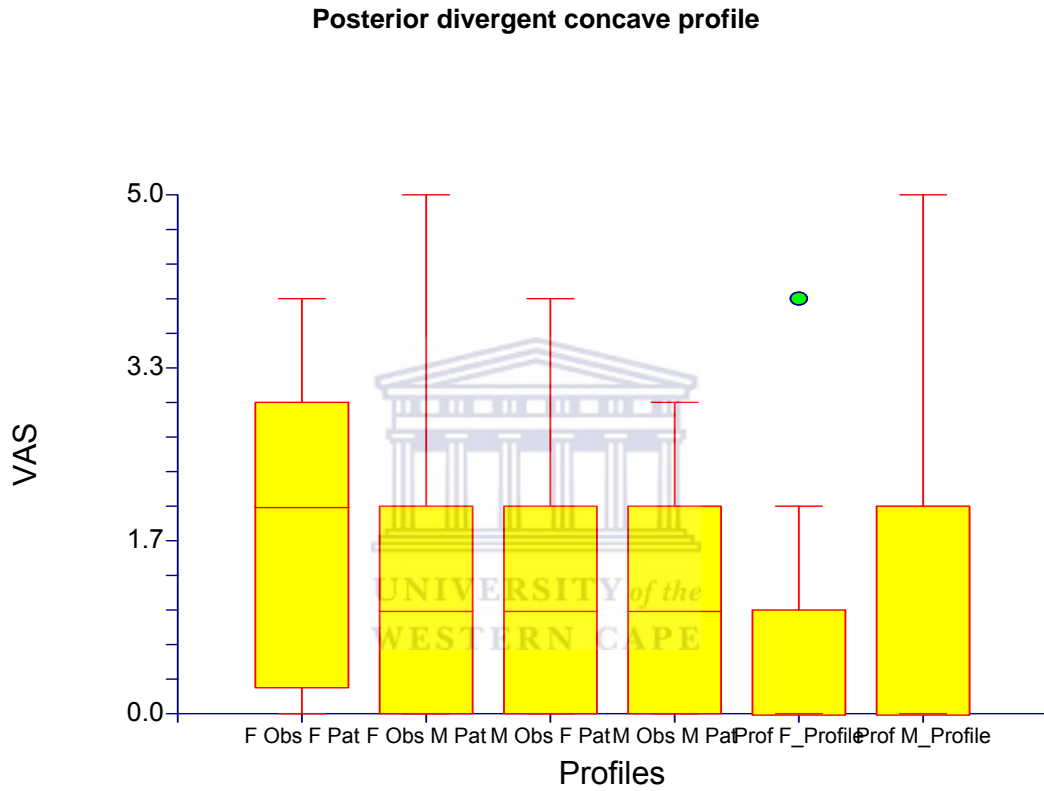
Both the professionals and the lay persons regarded males with posterior divergent straight profile to be more attractive compared with females with this profile (fig 39).



**Fig 39**

### 5.4.10 Posterior divergent concave profile

Both the professionals and the lay persons females recorded no preference for the male nor female posterior divergent concave profile (fig 40).



**Fig 40**

**5.5 Similarities and differences in the assessors perceptions (professionals) of various profiles.**

The results of this analysis revealed significant relationships amongst the variables:

**Male Profiles:**

Variable	p-value	% Variation explained	Perception
Posterior divergent convex profile (thin lips) vs Posterior divergent concave profile	0.00545	23.04	Similar
Posterior divergent convex profile (thin lips) vs Anterior divergent concave profile	0.00995	20.16	Similar
Posterior divergent concave profile vs Straight concave profile	0.00562	22.84	Similar
Posterior divergent concave profile vs Posterior divergent straight profile	0.00430	24.15	Similar
Posterior divergent concave profile vs Straight convex profile	0.00528	23.17	Similar



Variable	p-value	% Variation explained	Perception
Posterior divergent concave profile vs Anterior divergent concave profile	0.00375	25	Similar
Straight concave profile vs Anterior divergent convex profile	0.00070	32	Similar
Straight concave profile vs Posterior divergent straight profile	0.00001	50	Similar
Straight concave profile vs Straight convex profile	0.00290	26	Similar
Straight concave profile vs Anterior divergent straight profile	0.00001	49	Similar
Straight concave profile vs Straight profile	0.00003	45	Similar
Straight concave profile vs Anterior divergent concave profile	0.00063	33	Similar

Variable	p-value	% Variation explained	Perception
Posterior divergent convex profile (thick lips) vs Anterior divergent convex profile	0.00189	28	Similar
Posterior divergent convex profile (thick lips) vs Posterior divergent straight profile	0.00886	21	Similar
Posterior divergent convex profile (thick lips) vs Posterior divergent straight profile	0.00840	21	Similar
Anterior divergent convex profile vs Straight convex profile	0.00002	47	Similar
Posterior divergent straight profile vs Straight convex profile	0.00154	28	Similar
Posterior divergent straight profile vs Anterior divergent straight profile	0.00212	27	Similar
Posterior divergent straight profile vs Anterior divergent concave profile	0.00516	23	Similar

Variable	p-value	% Variation explained	Perception
Anterior divergent straight profile vs Straight profile	0.00003	46	Similar
Anterior divergent straight profile vs Anterior divergent concave profile	0.000003	52	Similar
Straight profile vs Anterior divergent concave profile	0.00106	30	Similar

The straight concave profile and the posterior divergent straight profile revealed a significant relationship ( $p$ -value = 0.00001). Fifty percent of the variation in the straight concave profile is explained by the posterior divergent straight profile. This means that the perceptions of these profiles were similar.

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The anterior divergent straight and the anterior divergent concave revealed a significant relationship since the  $p$ -value = 0.000003 which is less than  $\alpha$  = 5%. Fifty two percent of the variation in the anterior divergent concave profile is explained by the anterior divergent straight profile. This meant that the perceptions of these profiles were similar.

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### 5.5.2 Female Profiles:

Variable	p-value	% Variation explained	Perception
Straight concave profile vs Anterior divergent convex profile	0.00179	28	Similar
Straight concave profile vs Straight convex profile	0.00000	52	Similar
Posterior divergent convex profile (thick lips) vs Anterior divergent convex profile	0.00001	50	Similar
Posterior divergent convex profile (thick lips) vs Anterior divergent straight profile	0.00204	28	Similar
Posterior divergent convex profile (thick lips) vs Straight profile	0.00459	52	Similar
Anterior divergent convex profile vs Posterior divergent straight profile	0.00796	21	Similar

Variable	p-value	% Variation explained	Perception
Anterior divergent convex profile vs Straight convex profile	0.00340	25	Similar
Anterior divergent convex profile vs Anterior divergent straight profile	0.00135	29	Similar
Anterior divergent convex profile vs Straight profile	0.00092	31	Similar
Anterior divergent convex profile vs Anterior divergent concave profile	0.01217	19	Similar
Posterior divergent straight profile vs Straight convex profile	0.000003	64	Similar
Posterior divergent straight profile vs Anterior divergent straight profile	0.00003	45	Similar
Posterior divergent straight profile vs Straight profile	0.000001	57	Similar

Variable	p-value	% Variation explained	Perception
Straight convex profile vs Anterior divergent straight profile	0.000003	52	Similar
Straight convex profile vs Straight profile	0	60	Similar
Straight convex profile vs Anterior divergent concave profile	0.000002	53	Similar
Anterior divergent straight profile vs Straight profile	0	76	Similar
Anterior divergent straight profile vs Anterior divergent concave profile	0	78	Similar
Straight profile vs Anterior divergent concave profile	0	72	Similar

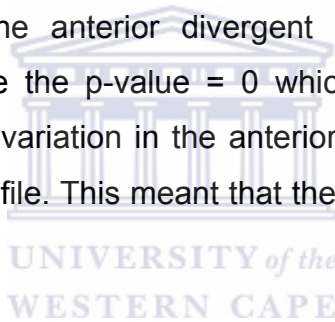
The posterior divergent straight profile and the straight convex profile revealed a significant relationship since the p-value = 0 which is less than alpha = 5%. Sixty four percent of the variation in the posterior divergent straight profile is explained by the straight convex profile. This meant that the perceptions of these profiles were similar.

The straight convex profile and the straight profile revealed a significant relationship since the p-value = 0 which is less than alpha = 5%. Sixty percent of the variation in the straight convex profile is explained by the straight profile. This meant that the perceptions of these profiles were similar.

The anterior divergent straight profile and the straight profile revealed a significant relationship since the  $p$ -value = 0 which is less than  $\alpha$  = 5%. Seventy six percent of the variation in the straight profile is explained by the anterior divergent straight profile. This meant that the perceptions of these profiles were similar.

The anterior divergent straight profile and anterior divergent concave profile revealed a significant relationship since the  $p$ -value = 0 which is less than  $\alpha$  = 5%. Seventy eight percent of the variation in the anterior divergent concave profile is explained by the anterior divergent straight profile. This meant that the perceptions of these profiles were similar.

The straight profile and the anterior divergent concave profile revealed a significant relationship since the  $p$ -value = 0 which is less than  $\alpha$  = 5%. Seventy two percent of the variation in the anterior divergent concave profile is explained by the straight profile. This meant that the perceptions of these profiles were similar.



# DISCUSSION



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Early studies on profile preferences up until the 1960's would seem to indicate a public bias toward the typical "Hollywood" profile, which was relatively straight or flat (Riedel, 1950, 1957; Goldsman, 1959; Neger, 1959; Hambleton, 1964). However, in an analysis of art form from the time of the Egyptians to the present (Hambleton, 1964), suggested that there was a "constantly changing concept of profile beauty". Orthodontists notably concurred with the public in their appreciation of facial aesthetics (Riedel, 1957; Burstone, 1959).

The present study tested whether this trend towards a fuller profile was shared by the study population and tested for similarities and differences in the assessors (laypersons/professionals) perceptions of various profiles. Numerous authors (Riedel, 1950; Peck and Peck, 1970; De Smit and Dermaut, 1984; Czarnecki et al, 1993; Soh et al, 2005) have evaluated the opinions of professionals as well as those of lay persons (Peck and Peck, 1970; Iliffe, 1960; Martin, 1964; Linn, 1976; Foster, 1973; Turkkahraman et al, 2004; Beukes et al, 2007). With regard to a comparison of the perceptions of lay people to those of professionals', there are many studies with varying results (Cox and Van der Linden, 1971; Foster, 1973; Lines et al, 1978; Kerr and O'Donnell, 1990; Farrow et al, 1993; Hall et al, 2000).

The Likert and VAS scales were used in this study to enable observers to rate the profiles. However, only the VAS scale results were used as it was deemed sufficient for the scope of this research project (Kerr et al, 1990; Hall, 2000). When the various judges were asked to rate the aesthetic appeal of the profiles, it was not always possible to determine which characteristics of the different profiles influenced their preferences. The silhouettes employed in the present study offer the advantage of eliminating extraneous distracters such as hair texture, complexion, facial hair and facial features (Scott, 1999). However, there remains a possibility that judges might have been influenced simply by how artistically the profiles were drawn, or whether the patients held their lips together or apart when the photograph was taken (Scott, 1999). Of course, the judges

were left to evaluate the profiles on their own terms, and then to characterise the strength of those preferences on the VAS.

This investigation concurred in part with many studies reporting that orthodontists and laypersons have similar aesthetic preferences. Cox and van der Linden (1971), Dunlevy and associates (1978), Farrow et al (1993), and Oynick (1988) all indicated that orthodontists and laypersons appear to have a common sense of facial aesthetics. Each study gave judges from different backgrounds the opportunity to choose between different photographs or drawings that represented different treatment effects; in each instance, orthodontists and laypersons chose similarly.

The most preferred profile in the present study for the male is the straight profile followed by the posterior divergent straight profile according to both the laypersons and the professional groups. This finding is similar to that of Czarnecki et al (1993), who found that professionals preferred a straighter male profile. However, this is not in agreement with Foster's (1973) study, which indicated that orthodontists preferred a fuller male face in comparison with the choice of the lay person who preferred a straighter male adult profile.

The most preferred profile in the present study for the female is the posterior divergent convex profile (thin lips), according to both laypersons and the professionals. This finding is similar to that of Czarnecki et al 1993, who found that professionals preferred a slightly convex profile. However, this is in contrast to Peck and Peck's (1970) work. They found that the general public preferred a fuller and more protrusive dentofacial pattern than the cephalometric standards that Margolis (1947), Downs (1948) and Steiner (1953) had prescribed. However, as previously mentioned this sample consisted of forty-nine females and only three males; a possible shortcoming of this study (Peck and Peck, 1970).

The results of this study supported the findings of Riedel's (1950) observations, which can be echoed here. He found that there was greater overall agreement on poor profiles than those that were considered good. It was also shown in this study, as it was by Beukes et al (2007), that the most unattractive profile was not as clearly identified as the **most** attractive profile, thus highlighting the difficulty the evaluators experienced in choosing the least attractive profile. The profiles selected as unattractive were the anterior divergent convex profile, the posterior divergent convex profile (thick lips), the posterior divergent concave profile and the anterior divergent concave profile. This indicates that beauty is a perspective most people can identify but when it comes to unattractiveness, people become less sure of their aesthetic criteria (Beukes et al, 2007).

In this study more of the convex profiles were chosen as being unattractive, which concurred with the findings by Cox and van der Linden (1971), who found no significant difference between the concepts of the orthodontists and laypersons (ten orthodontists and ten laypersons). Using silhouette photography as the assessment instrument they concluded that persons with poor facial balance generally had a more convex face.

Another objective included testing for similarities and differences in perceptions of the professional assessors of various profiles. There was no literature available on this particular objective. According to Horowitz and Hixon (1996), a correlation coefficient may be statistically significant at the 0.001 level of confidence but is still of no clinical significance for prediction. As a rule they suggested an  $r$  value of 0.8 to be the dividing line for use in clinical prediction because the coefficient of determination or  $r^2$ , is 0.64 which means that 64% of the variation can be accounted for in the variable that is being predicted (Horowitz and Hixon, 1996). It is with these facts in mind that the available data was interpreted. There was a similarity in the perception of the anterior divergent concave profile and the straight profile, the straight profile and the anterior divergent straight profile, and the anterior divergent concave profile and the

anterior divergent straight profile. Thus, for the female profiles the number of profiles can actually be decreased as there was a high percentage of perceived similarity between these profiles. For the male profiles none were interpreted by the participants as being similar. Therefore, according to the definition by Horowitz and Hixon (1996) these results are of no clinical significance.



# **CRITIQUE OF THE STUDY**



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## Limitations of this study

Generalisations based upon findings of this study are limited in a number of ways:

1. This study was conducted only at one institution among patients enrolled in its routine evaluation treatment program. A replicating study at other institutions would be more meaningful.
2. The VAS used in this study is a long ordinal scale which has advantages in that it provides the opportunity for observers to describe their opinion precisely on a 9, 10 or 11-point scale. Also long ordinal scales improve the theoretical environment in which to calculate and estimate Spearman Rank Correlations. However, long ordinal scales do have some drawbacks. It is extremely difficult to describe the ordinal classes (long scales) in terms of words. Also some readers find it difficult to utilise the full scale. For example they cluster the reading around the middle class(es) or to the upper end of the scale (the halo effect; everything is fine or everything goes).
3. The Likert Scale is a short ordinal scale and was not used. In future studies one could use the Likert Scale and compare the data to the Visual Analogue Scale (VAS) to see how the results of the two scales compare. Advantages of short ordinal scales are firstly, that the classes are usually described in terms of words such as: 'very bad'; 'bad'; 'good'; 'very good'. These classes are usually well accepted and understandable to observers. Secondly, a four point ordinal scale. Even lay observers adapt easily to such a scale described by means of words it would be a disadvantage of short ordinal scales to have an uneven number of classes such as three or five; it creates a problem in that the observers easily select the middle category. Some observers however may feel that there is not enough scope to express their opinion.

# CONCLUSION



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The professionals (orthodontists) and lay persons (patients) found the straight profile followed by the posterior divergent straight profile, to be the most pleasing profile for the males, whereas for the females the posterior divergent convex (thin lips) profile was selected as the most attractive.

The most unattractive profile was not as clear as that of the most attractive profile, thus indicating the difficulty the evaluators experienced in evaluating less attractive appearances. The profiles chosen as unattractive included: anterior divergent convex profile, posterior divergent convex profile (thick lips), posterior divergent concave profile and the anterior divergent concave profile.

None of the male profiles were interpreted by the participants as being similar.

For the female profiles there was a similarity in the perception of the anterior divergent concave profile and the straight profile, the straight profile and the anterior divergent straight profile, and the anterior divergent concave profile and the anterior divergent straight profile. Thus, for the female profiles the number of profiles can actually be decreased as there was a high percentage of similarity between these profiles.



# REFERENCES



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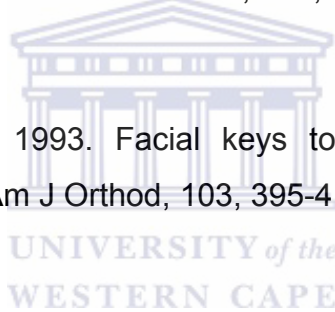
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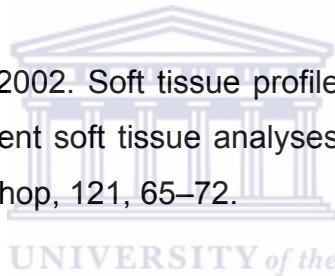
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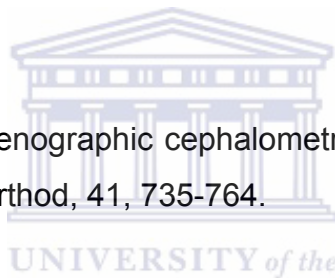
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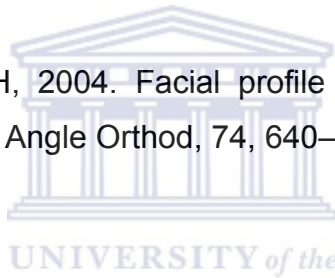
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# APPENDICES



UNIVERSITY *of the*  
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**APPENDIX 1**



Name:  
Age:  
Gender:  
Date:  
Profile:



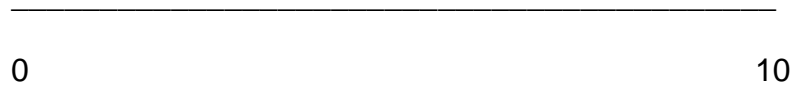
**On a scale from 0 to 10 choose the number which best describes the male profile.  
0 being the least attractive and 10 most attractive.**

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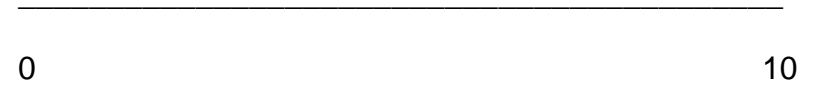
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**On a scale from 0 to 10 choose the number which best describes the male profile.  
0 being the least attractive and 10 most attractive.**



**On a scale from 0 to 10 choose the number which best describes the male profile.  
0 being the least attractive and 10 most attractive.**





UNIVERSITY of the  
WESTERN OCEAN



**On a scale from 0 to 10 choose the number which best describes the male profile above.  
0 being the least attractive and 10 most attractive.**

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**On a scale from 0 to 10 choose the number which best describes the male profile above.  
0 being the least attractive and 10 most attractive.**

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UNIVERSITY of the  
WESTERN OCEAN



**On a scale from 0 to 10 choose the number which best describes the male profile above. 0 being the least attractive and 10 most attractive.**

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**On a scale from 0 to 10 choose the number which best describes the male profile above.  
0 being the least attractive and 10 most attractive.**

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**On a scale from 0 to 10 choose the number which best describes the male profile above.  
0 being the least attractive and 10 most attractive.**

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Name:  
Age:  
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**On a scale from 0 to 10 choose the number which best describes the male profile above.  
0 being the least attractive and 10 most attractive.**

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UNIVERSITY of the  
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**Tick the box that best describes the male profile above.**

Unattractive	Mildly attractive	Attractive	Very attractive
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**Tick the box that best describes the male profile above.**

Unattractive	Mildly attractive	Attractive	Very attractive
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UNIVERSITY of the  
WESTERN ISLANDS



**Tick the box that best describes the male profile above.**

**Tick the box that best describes the male profile above.**

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UNIVERSITY of the  
WESTERN ISLANDS



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Name:  
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**On a scale from 0 to 10 choose the number which best describes the female profile.  
0 being the least attractive and 10 most attractive.**

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**On a scale from 0 to 10 choose the number which best describes the female profile.  
0 being the least attractive and 10 most attractive.**

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**On a scale from 0 to 10 choose the number which best describes the female profile.  
0 being the least attractive and 10 most attractive.**

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**On a scale from 0 to 10 choose the number which best describes the female profile.  
0 being the least attractive and 10 most attractive.**



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**On a scale from 0 to 10 choose the number which best describes the female profile.  
0 being the least attractive and 10 most attractive.**





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**On a scale from 0 to 10 choose the number which best describes the female profile. 0 being the least attractive and 10 most attractive.**

**On a scale from 0 to 10 choose the number which best describes the female profile. 0 being the least attractive and 10 most attractive.**

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**On a scale from 0 to 10 choose the number which best describes the female profile.  
0 being the least attractive and 10 most attractive.**

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**On a scale from 0 to 10 choose the number which best describes the female profile.  
0 being the least attractive and 10 most attractive.**

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Name:  
Age:  
Gender:  
Date:  
Profile:



**On a scale from 0 to 10 choose the number which best describes the female profile.  
0 being the least attractive and 10 most attractive.**

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0 10



**Tick the box that best describes the profile of each female patient.**

Unacceptable	Mildly acceptable	Attractive	Very attractive
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**Tick the box that best describes the profile of each female patient.**

Unacceptable	Mildly acceptable	Attractive	Very attractive
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**Tick the box that best describes the profile of each female patient.**

Unacceptable	Mildly acceptable	Attractive	Very attractive
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**Tick the box that best describes the profile of each female patient.**

Unacceptable	Mildly acceptable	Attractive	Very attractive
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UNIVERSITY OF WESTERN AUSTRALIA

**Tick the box that best describes the profile of each female patient.**

**Tick the box that best describes the profile of each female patient.**

Unacceptable	Mildly acceptable	Attractive	Very attractive
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Unacceptable	Mildly acceptable	Attractive	Very attractive
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**Tick the box that best describes the profile of each female patient.**

Unacceptable	Mildly acceptable	Attractive	Very attractive
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Unacceptable	Mildly acceptable	Attractive	Very attractive
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