

**Comparison of different Soft Tissue analyses in the
evaluation of Beauty in South Indian Adults –
A Preliminary Cephalometric study**

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CERTIFICATE

This is to certify that this dissertation titled, “**COMPARISON OF DIFFERENT SOFT TISSUE ANALYSES IN THE EVALUATION OF BEAUTY IN SOUTH INDIAN ADULTS – A PRELIMINARY CEPHALOMETRIC STUDY**”, is a bonafide record of work done by **Dr. ANUSHA V** under my guidance during her postgraduate study period between 2002-2005.

This dissertation is submitted to **THE TAMILNADU DR. M.G.R MEDICAL UNIVERSITY** in partial fulfillment for the award of the degree of Master of Dental Surgery in Branch–V Orthodontia

It has not been submitted (partially or full) for the award of any other degree or diploma

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INTRODUCTION

“Beauty is in the eye of the beholder.”

-Margaret Hungerford

The concept of facial beauty is abstract, and to make it more concrete and define it better, facial features have been evaluated with anthropometric, photometric, and cephalometric measurements.

Judgement of facial esthetics is subjective and is undoubtedly, dependent on various cultural, social, geographic and psychologic backgrounds of the person. Soft tissue profiles for what constitutes an “excellent” face have been repeated many times by representatives of several disciplines including artists, physical anthropologists, reconstructive surgeons and orthodontists. These profiles show large variations in skeletal convexity, soft tissue and lip protrusion, and position of the lower incisor. The inevitable conclusion is that great variation exists in what is considered a good to excellent face within a given culture.

“Esthetics” is the study of beauty and philosophy of art. The esthetic results of our treatment are often of greater interest to the patient than the achieved occlusal changes.

Orthodontists base their treatment planning primarily on cephalometric evaluations. Recognising that the orthodontic speciality has gone too far with its obsession with the placement of teeth at certain angulations on the basal bone and its effect on facial esthetics, it is now common to hear that the treatment goals should be geared to the achievements of an overall facial balance. The true objective from the point of view of esthetics is to treat the dentition to the face. Skeletal

norms help define treatment need and stability goals, but soft tissue appearance is only partially dependent on the underlying skeletal structure.

However, an average face is considered more esthetic than one that is atypical. By knowing the soft tissue traits and their normal range, a treatment plan can be designed to normalize the facial traits for a given individual. Allowance can then be made for variation in facial attractiveness while maintaining the familial and ethnic characteristics that make a person unique.

For a long time, orthodontists have focused on the horizontal lip position as the most important feature in determining beauty. Several lines have been introduced to assess the anteroposterior position of the upper and lower lips and the esthetic quality of the profile. The crux of the need for measuring was stated by Moroney as "It is always useful when we can measure things on a ruler instead of simply calling them 'big' or 'small.' "Better treatment goals can be set if we quantitate the soft-tissue features which contribute to or detract from that "physical attractiveness stereotype".

The purpose of this study is to

1. Examine the applicability of the norms of the soft tissue lines of Steiner, Ricketts, Burstone, Sushner, Holdaway and Merrifield in evaluation of beauty in South Indian adults
2. Analyse and compare the esthetic preferences of a panel comprising of orthodontists and the members of the general public associated with art and culture.
3. Evaluate the photographic perception of beauty by comparing the photographs and silhouettes.

REVIEW OF LITERATURE

CEPHALOMETRY

Broadbent¹¹ (1931) by means of a head holder and a standardized roentgenographic technique made it possible to make accurate determinations of changes in the living head that may be due to developmental growth or orthodontic treatment. This permitted changes in the same individual to be measured and studied. He also showed that certain areas in the cranial base showed no change between certain ages. These areas offered a more stable base for providing a very accurate method of measuring changes in the teeth, jaws and face.

CEPHALOMETRIC ANALYSIS

Riedel A Richard⁵⁴ (1950) used lateral cephalograms and posteroanterior cephalograms of two groups of patients consisting of children and adults with clinically normal occlusions and cases of orthodontically corrected malocclusions. Various angular and linear measurements were measured. The profile outlines were rated by seventy two orthodontists. Results indicated that, in the individuals with good profile the ANB did not exceed 2.5° . The upper incisor to the nasion-pogonion line did not exceed 6.5mm and the lower incisors were more upright. The angle of convexity did not measure more than 4° . He concluded that the points A, the upper incisor, the lower incisor and the points B and Pog bear harmonious relation to each other in patients with good profile. The opinion of the orthodontists concerning the soft tissue profile were found to be remarkably uniform.

Charles Burstone¹² (1959) established the integumental extension standards by using adolescent group (37 in number) with a mean age of 14.7 years and 40 young adults who were selected by artists

as having good facial profiles. A method of measuring the integumental (vertical and horizontal) extension was presented. Areas inferior to the nose in the males had a greater horizontal extension of the soft tissue and increased maturational changes with the significant differences present in the lower facial, mandibular, interlabial, superior labial, inferior labial and supramental inclinations. The total facial contour tended to flatten with age. Thus stressing that the soft tissue should become an integral part of orthodontic case analysis.

Ricketts⁵⁵ (1960) suggested three planes of reference for clinical use, namely the facial plane, the point A-pogonion plane, and the E line to evaluate the profile in terms of skeletal size, facial form, denture position and soft tissue relations. According to him in Caucasian adults, lips should be contained within this line with the lower lip falling slightly ahead of the upper lip (1-2mm).

Merrifield⁴⁶ (1966) introduced a Z line by drawing a line tangent to the soft tissue chin and to the most anterior point of the upper lip or the lower lip to the Frankfort horizontal plane as he felt that the Frankfort plane can be visualized in the patients, in the photographs and in the lateral cephalograms. The material consisted of lateral cephalograms of forty nonorthodontic normals, forty orthodontic normals (post treatment) collected by Tweed and another forty from the author's post treatment cephalograms. Results showed that in the adults with normal FMA, IMPA, FMIA and ANB, a Z angle of $80^{\circ} \pm 5^{\circ}$ was normal and at 11-15 years the Z angle is 78° . For an ideal profile, the total chin thickness should be equal to or slightly greater than the upper lip thickness. Further he stated that the upper lip should be tangent to the line and the lower lip should be tangent or slightly behind the profile line.

Ricketts⁵⁶ (1981) found that the lip convexity decreased from the deciduous dentition to adult dentition with the lips progressively retracted. The changes with the retraction were that the upper lip thickened 1mm for each 3mm retraction of upper incisors. The lower lip did not thicken but curled backward as a result of upper anterior retraction with an increase in the soft tissue chin because of the loss of lip strain and loss of chin elevation by mentalis muscle.

Legan and Charles Burstone³⁹ (1980) evaluated horizontal lip posture and introduced a reference line extending from soft tissue subnasale to pogonion. The perpendicular linear distance from this line to the most protruded point on the upper or lower lip was measured as prominence. This line was selected as it was considered as line of minimum variation in the area of the face as he considered that nose length used in Rickett's E line as having twice as great a standard deviation as that of lip protrusion. The standards developed for young Caucasian adults were upper lip 3 ± 1 mm anterior to the line and lower lip 2 ± 1 mm anterior to the line. Difference in males and females were insignificant.

Holdaway³² (1983) was of the opinion that fundamentals associated with facial beauty included a H angle that is within 1 or 2 degrees of average ($8-9^0$), a range of 4 to 6 mm. in depth of the superior sulcus to the H line as well as 2.5 to 4 mm to a perpendicular line drawn from Frankfort. Further, he suggested that the lower lip should be either on the H line or within 1 mm. of it and no unusual large or small measurements of either nose prominence or soft tissue chin thickness. He stressed that there is a natural draping of the soft tissue profile which harmonizes with the basic skeletal type of the individual .

Holdaway³² (1984) stated that both the lips and the chin should line up near the H line. He further summarized that the H angle increases as the basic skeletal convexity increases, and as the convexity increases, the lower incisors will need to be left farther forward than in a straight or concave skeletal profile. Thus standardizing the position of the lower incisor as measured in the Frankfort mandibular incisor angle fails to recognize and the upper incisors can be retracted too far, leaving a "streamlined" upper lip which is not esthetically pleasing. He cautions against "dishing" of those cases having good facial balance with quite normal skeletal convexity and only 5 mm or 6 mm of lower arch length discrepancy.

Park and Burstone¹³ (1986) selected thirty adolescent patients who had lower incisors positioned approximately 1.5 mm anterior to the A-pogonion plane at the end of treatment and used normal sample as a control. Profile measurements of hard and soft tissues were made. They observed that there was a large variation in the facial profiles even in cases successfully treated to a cephalometric dentoskeletal standard. Large variation was found in the amount of lip protrusion even though the goal of incisor positioning was achieved. Thus concluding that facial esthetics requires consideration of soft tissue factors in addition to hard tissue structures.

G. William Arnett, Robert Bergman² (1993) presented a new soft tissue cephalometric analysis tool and summarized that natural head position, seated condyles, and relaxed lip positions are essential. Absolute projection values for important soft tissue structures were measured to the true vertical reference line passing through subnasale. The true vertical reference line was moved forward from subnasale when maxillary retrusion is present. Treatment guidelines for incisor and

occlusal plane angulations that influence facial outcome were defined with values suggested for male and female patients.

Hsu³³ (1993) analyzed using five analytic reference lines: Rickett's E line, Holdaway's H line, Steiner's S1 line, Burstone's B line, and Sushner's S2 line in one-hundred ten lateral facial profiles judged to be attractive by a panel of four men and three women from different educational backgrounds. Their results indicated that the B line was found to be both consistent and sensitive. The anterior location of E and H lines are convenient for the clinician to use chairside. This study found that those analytic reference lines that do not transverse an anatomic landmark of the nose were most likely to have poor consistency and sensitivity. Thus the nose should be taken into consideration as a reference for beauty.

Hwang, Kim WS and McNamara JA Jr³⁴ (2000) studied the values obtained by 2 drawing methods (tangent line and anatomic points) of constructing angles, and assessed the reproducibility. Their results indicated that both methods showed statistically significant correlations between repeated measurements with the anatomic point method, showing greater reproducibility. Thus indicating that the anatomic point method is more reproducible than the tangent line method.

Erbay and Caniklioglu²¹ (2002) investigated cephalometrically the horizontal lip position of 21 females and 23 males with normal skeletal and dental relationships. Ten linear and 6 angular measurements were analyzed using the soft tissue analyses of Steiner, Rickett, Burstone, Sushner, Holdaway, and Merrifield. The results indicated that in Anatolian Turkish adults, the upper and lower lips were retrusive according to the norms of Steiner and Ricketts but both the upper and

lower lip values were within the normal range according to Burstone's B line. The upper lip was protrusive and the lower lip was retrusive compared with the norms developed by Sushner and 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. The Z angle was smaller than the norm established by Merrifield.

Erbay and Caniklioglu²² (2002) In part II they evaluated orthodontist's perceptions of Anatolian Turkish adult's beauty using forty-four subjects with Angle Class I occlusal relationship and normal skeletal relationships. The material consisted of lateral cephalometric radiographs and facial-profile slides of these subjects. Ten linear and 6 angular measurements were analyzed on each radiograph, and the facial profiles were judged as poor, fair, good, or excellent by 6 raters. The results demonstrated that persons having a high mandibular plane angle, a small nose, protrusive lips, and a retrusive profile were selected as attractive. Among the 7 esthetic lines used to evaluate the soft tissue profile, only Rickett's norms for upper and lower lips corresponded to the values they found for attractive profiles.

NATURAL HEAD POSITION

Cooke and Wei¹⁶ (1988) studied the effects of ear posts, an external source of eye reference (a wall mirror), sex and time in relation to the reproducibility of recording lateral cephalometric radiographs in natural head posture. Findings showed that boys looked up more when changing from the self-balance position to the mirror eye reference position, NHP reproducibility was better with a mirror and without ear posts the radiographs tended to be of poor quality. The reproducibility of

same-day repeat radiographs recorded with ear posts and with a mirror was 1.9 degrees.

Lundstrom and Lundstrom⁴⁰ (1992) demonstrated a photographically recorded natural head position (NHP) in which the vertical axis was recorded with a plumb line and transferred to the lateral head radiographs of the patients. His findings showed that the reproducibility of NHP, was close to 2 degrees. Thus supporting the use of NHP as a basis for cephalometric analysis of dentofacial anomalies.

Ferrario, Sforza and Tartaglia²⁴ (1993) quantitatively described the depicted craniofacial soft tissue structure, the relationships among facial structures, and head posture relative to the ground with the frontal and lateral profile photographs. He found that the male faces were wider and longer than the female faces especially in the mouth and chin regions. Both sexes were generally symmetrical. In the standing position, the Frankfurt plane was directed upward and forward, with a mean angle of 13 degrees relative to the ground. In seated subjects, it was more nearly horizontal (5 degrees in the men, 8 degrees in the women). Thus showing that a careful reevaluation of standard cephalometric and photographic protocol is necessary.

Bister and Edler¹⁰ (2002) investigated the reproducibility of natural head posture using radiographs and photographs. They found that reproducibility of cephalograms after 1 year with NHP was found to be less favorable. The reproducibility of the two photographs were poor and method agreement between the cephalograms and photographs taken at the same time was good. Thus concluding that replacement of the radiographic method with the photographic method for assessing NHP reproducibility appeared justified.

Halazonetis²⁸ (2002) tested whether the natural head orientation or the natural head position used by the orthodontists was influenced by the facial form or not. Lateral photographs of 14 patients was warped to produce 2 new images, with the chin positioned backwards or forwards relative to the original. All 42 images were placed in circular frames and shown to 7 experienced orthodontists, who were asked to orient them to NHO. The results showed that NHO depended on chin position as the images with protrusive chins were positioned in a flexed posture and the images with retrusive chins were placed in a more extended posture. The difference in NHO was half of the difference in chin position. Thus he questioned the validity of NHO for diagnosis because it depended on the same factor it aims to assess and concludes that the use of NHO would result in underestimating the true skeletal relationships.

ASSESSMENT OF PROFILE

Satravaha and Schlegel⁵⁸ (1987) performed profile analysis on 180 Thai female subjects of 16 to 21 years. The determination of the profile analysis was based on the methods of Subtelny, Ricketts, Burstone, and Schwartz. For the profile forms, the investigated groups showed mainly prognathic faces. Their soft-tissue profile results showed less convexity. The results showed that proper blending of the integumentary profile produces an esthetically pleasing face and this varies in different ethnic groups.

Skinazi, Lindauer, and Isaacson⁶⁰ (1994) did a study on profiles of 66 young adults whose upper/lower lips fell within the sandwich formed by E-line and Juanita lines. The surface area of each of the component parts of the soft tissue profile was measured by superimposing a transparent millimeter grid sheet. Results showed that the mean female nose contributed significantly more to the total mean

female profile than the mean male nose did to the mean male total profile. The contribution of the mean male chin to the total mean male soft tissue profile was significantly larger than in females. When compared by percent contributions, both the upper and lower lips of the men and women contributed nearly equally. The overall female profile was more convex and the mean male profile, relatively straighter.

Miyajima⁴⁷ (1996) compared 54 Japanese and 125 adults of European-American ancestry adults with normal occlusions and well-balanced faces. They found that there is a fundamental variation in the craniofacial structure of Japanese in whom the anteroposterior facial dimensions was smaller but proportionately larger vertical facial dimensions was present. Dentally, subjects in the Japanese sample were more protrusive in these groups thus indicating that a single standard of facial esthetics is not appropriate for application to diverse racial and ethnic groups.

Johannsdottir, Thordarson and Magnusson³⁶ (2004) described the craniofacial characteristics of Icelandic adults on lateral skull cephalograms of 155 males and 169 females. They found that the mandibular prognathism was significantly greater in males, but the inclination of both the upper and lower jaws was greater in females. Linear measurements were larger for males. The lips were less protrusive in males but the thickness was greater when compared to females and the nose was significantly more protrusive in males.

STANDARDISED PHOTOGRAPHY

Claman, Patton and Rashid¹⁴ (1990) presented major considerations for frontal and profile facial photographs. Lens selection, camera position, subject distance, and position are all variables to be understood and controlled if accurate reproduction is desired. They have

found that the best way to standardize was to keep the focal length of the lens the same(100 or 105mm) and have consistent subject to camera distance with photographs taken in natural head position. Thus the dental photographers can standardize frontal and lateral portraits for more consistent comparison.

Bishara, Cummins and Jakobsen⁸ (1995) used standardized facial photographs to compare the soft tissue profile changes in persons with Class II, Division 1 malocclusions who were treated with either an extraction or a nonextraction treatment modality. The photographs were digitized. 29 angular and linear dimensions (8 frontal and 21 lateral) were constructed. The findings indicated that certain landmarks tended to be less reliable than others, e.g., subnasale, gnathion and measurements from frontal photographs were more reliable than those obtained from lateral photographs. Facial structures that lie closer to the camera appeared to be relatively larger than structures located farther from the camera and the overall process of evaluating facial changes from photographs is both technique and operator sensitive.

Benson and Richmond⁶ (1997) investigated the validity and reproducibility of using a photograph, a video image and a radiograph, for the measurement of the soft tissue profile of the face. The method involved comparing direct measurement of the radiographic phantom head (a dry bone skull encased in a soft tissue substitute) in a Reflex Metrograph with the results of computerized digitizing of a cephalometric radiograph, a digitized video image from a computer screen and measurement of a photograph. It was found that digitizing the soft tissue outline from a video image was neither a valid nor a reproducible method of replacing cephalometric radiographs in the measurement of the soft tissue profile of the face. A photograph may be

a clinically acceptable alternative but errors from this method are likely to be larger than those due to digitization of a radiograph.

EVALUATION OF PROFILE USING PHOTOGRAPHS

Weurpel⁶³ (1931) felt that there can be no universality of treatment and the final objective apart from the restoration of normal occlusion should be to restore the face to its best appearance. According to him, “there is no most beautiful person”. Roman faces had just as much as beauty as there was in the most refined type of Greeks. He felt that each era creates its types and emphasized that the orthodontist must clearly understand what type of face he is dealing with, whether Greek, Roman, Mongoloid etc. He stated that the orthodontic deformity must be corrected but the distortion of the facial type should be avoided.

Peck and Peck⁵⁰ (1970) attempted to identify the present day concept of facial esthetics, and also develop a historical perspective of the subject. Each great era of the esthetic heritage was examined to reflect the esthetic tastes of that period. Prehistory period was studied from primitive art, paintings, figurines and representations discovered. The idealized Egyptians (2600-2000BC) exhibited a round broad face with a sloped forehead , prominent eyes, evenly contoured nose, thickened lips and mild yet positive chin. Then was the Golden Age of Greece where the basic facial features was an anteriorly prominent forehead and a well-proportioned orthognathic lower face. Later was the period of Renaissance in which Michelangelo`s sculpture of David was of strong influence. An objective study of human facial esthetics was done by Woolnoth in 1865 where he wrote that the straight face is considered the handsomest with the convex faces retaining a youthful appearance and concave faces giving a mature look. Peck and Peck used fifty-two young white adult subjects who were professional models,

beauty contest winners, and stars noted for their facial attractiveness. They found that the general public admired a fuller, more protrusive dentofacial pattern than customary cephalometric standards .

Romani, Farrah Agahi and Ravindra Nanda³⁸ (1993) evaluated the changes in the facial profile mimicking the effects of various orthognathic surgical techniques using video image processing technique. Incremental changes were introduced in images simulating the effects of mandibular advancement or set-back, maxillary advancement or set-back, and maxillary impaction. Twenty-two clinicians and 22 lay people completed questionnaires evaluating their level of sensitivity to changes in the facial profiles. The results indicated that both orthodontists and lay people are sensitive to relatively small horizontal changes in the facial profile. In contrast, orthodontists were less sensitive to relatively large vertical changes but more sensitive to horizontal mandibular changes.

Farrow, Zarrinnia, and Azizi²³ (1993) attempted to discover the attractiveness of black American profile with fifteen black patients. Lateral photographs were was used to alter the profiles to depict four different levels of bimaxillary protrusion according to specific numerical guidelines. The four profile types were classified as S (straight) BM1, (bimax one), BM2 (bimax two) and BM3 (bimax three). The S profile was considered a straight or white facial profile, and the BM3 was an extreme example of bimaxillary protrusion. The photographs were surveyed among black and white laypersons, general dentists and orthodontists. The results found the BM1 profile to be the most attractive. This was consistent with all groups surveyed. The BM1 profile would be considered a slightly convex profile and is more protrusive than white orthodontic norms.

Theo Mantzikos⁴³ (1998) studied the the facial profile preferences in a sample of 2651 randomly selected panelists (mean age, 29 years) from Japanese cultural and educational backgrounds. Five facial profile types were computer-generated by an orthodontist to represent distinct facial types. Subjects were asked to rank the profiles in descending order of attractiveness. The ranking was as follows: orthognathic profile, bimaxillary retrusive profile, bimaxillary protrusive profile, mandibular retrognathic profile, and mandibular prognathic profile.

Douglas Nguyen, and Turley⁴⁸ (1998) analysed 5,116 profile photographs of male models collected from leading fashion magazines of the last 65 years and the images were scanned and projected onto a computer monitor. Six linear, nine angular, and three proportional parameters were measured after the soft tissue landmarks were digitized. The results showed that the male profile depicted in fashion magazines has changed significantly with time and there was a trend of increasing lip protrusion, lip curl and vermilion display.

Sutter and Turley⁶² (1998) compared the profiles of female Caucasian and African American models and their nonmodel counterparts (30 subjects each). The models' profiles were photographed, scanned from current fashion magazines and landmarks were digitized. Each profile was standardized for size and oriented along the N'-Sn' line. Results indicated that the African American models and controls had profiles that were more similar to each other than were those of the Caucasian models and controls. The Caucasians had straighter profile while the African Americans had fuller, more prominent lips. The Caucasian models displayed a profile that was fuller

than their controls, but not as full as the profiles of either African American group.

Cochrane, Cunningham and Hunt¹⁵ (1999) investigated whether the preferred facial profile chosen by orthodontists, maxillofacial surgeons, dental students, and members of the general public conformed to a Class I profile. Photographs were taken of 2 male and 2 female adult subjects with Class I profiles, and by means of a computer program the images were manipulated to produce Class II, Class III, and long face profiles. Results showed that orthodontists and maxillofacial surgeons were more likely to choose a Class I skeletal relationship as the most attractive profile. A significant difference was found between orthodontists and dental students and between orthodontists and the general public. Similar results were noted for maxillofacial surgeons. The sex of the assessor was also a significant factor, where female assessors were more likely to rank the Class I profile as most attractive.

Hier, Evans and Giddon³⁰ (1999) examined the esthetic preferences of lip position in both the sexes, and compared with a common orthodontic standard using a custom computer animation program in 53 young adult subjects divided into orthodontically treated and untreated subjects. The results indicated a sex-effect, with females preferring fuller lips than males. Significant differences were also found between orthodontically treated subjects and untreated subjects, with untreated subjects preferring fuller lips. Furthermore, both males and females preferred lip fullness greater than the Rickett's values.

Auger and Turley³ (1999) conducted a study to evaluate the changes in the preference for white female facial profiles, with time. They measured 14 soft tissue variables on profile photographs presented

in the fashion magazine during the 1900`s. Five time frames were studied with a sample of 25 photographs from each period, correcting the size and orientation. Significant differences were found for anteroposterior lip position, amount of visible lip tissue and interlabial angle, with more recent groups displaying fuller and more anteriorly positioned lips. No significant differences were found for measurements calculated to subnasale or relation of the chin to the upper face. The results indicated that the standards for the esthetic white female facial profile are static and show a trend in this century towards a fuller and more anteriorly positioned lips.

Maganzini, Tseng and Epstein⁴¹ (2000) utilized a manipulated digital video imaging model to elicit profile facial esthetics preferences in a lay population of native Chinese participants. A series of 4 distinct digitized distortions were constructed from an initial lateral cephalogram and video morphed to create soft tissue profiles. The native Chinese participants found that the profile distortions most acceptable were the "flatter", or bimaxillary retrusive distortion, in the male stimulus face and the "anterior divergent", or maxillary deficiency, in the female stimulus face.

Spyropoulos and Halazonetis⁶¹ (2001) assessed the relative contribution of the shape of the soft tissue profile outline on the attractiveness of the face using pretreatment color profile facial photographs of 20 female patients. The average outline of the 20 original photographs was used as a template resulting in 20 warped photographs, all with the same soft tissue outline. Three additional photographs were constructed with 1 face-the composite average of the 20 original photographs and 3 hairstyles from 3 of the original pictures. The photographs were printed and presented to 10 laypersons and 10

orthodontists for scoring. The orthodontists tended to be more influenced by the profile outline than did the laypersons. The 3 averaged composite photographs were consistently given the highest scores. The modified photographs were given higher scores than their original counterparts but the score was not to the level of the composite images. This shows that factors other than profile outline shape may be more influential in facial esthetics.

Paula Fernandez Riveiro and David Suarez Quintanilla⁵⁷ (2002) analysed the soft tissue facial profile of European population of young adults by means of linear measurements made on standardized photographic records taken in natural head position. Results showed sexual dimorphism in most parameters of labial, nasal and chin areas with males having greater heights and lengths as well as greater prominence of these 3 areas. They also had greater nasal and facial depths at the level of tragus points.

Hakan Turkkahraman and Hatice Gokalp²⁶ (2003) performed a study to determine the general esthetic preference of a Turkish population and to find out whether this preference was affected by sex, age, education, social status, geographic location, or personal profile. Eight profile estimates for each sex were morphed by a video imaging technique and then scored by 400 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.

Yehezkel and Turley⁶⁴ (2004) evaluated changes in the profiles of African American women presented in fashion magazines during the 20th century. Twenty-six variables were measured on a total of 119 profile photographs collected from various fashion magazines published in the 1940s through the 1990s which were divided into 6 groups corresponding to the decade in which they were published. Significant differences were found for anteroposterior lip position, nasolabial angle, and interlabial angle, with increased fullness and more anteriorly positioned lips in the more recent decades with no significant differences for the frontonasal angle, the nasal tip angle, and the relationship of the chin to the upper face (total facial angle). Thus concluding that the esthetic standards for the African-American female profile similar to the standards for the white profile, showed a trend toward fuller and more anteriorly positioned lips.

Hershon and Giddon²⁹ (1980) devised a psychophysical method in which each subject was requested to simulate his actual and desired or idealized profiles for comparison with an objective measure from a Polaroid profile photographic portrait. Results indicated that consistent with other studies of the self-perception of body parts, patients in both orthodontic and nonorthodontic groups underestimated the protrusiveness of their lips. They found that the actual and perceived magnitude of the protrusiveness correlated significantly with anxiety and dissatisfaction with their profiles. Subjects with flatter profiles desired a more protrusive profile, while the subjects with protrusive features desired a straighter profile.

EVALUATION OF PROFILE USING SILHOUTTE

Foster²⁵ (1973) studied the profile preferences among general dentists, art students, orthodontists, a black lay group, a Chinese lay

group and a white lay group using seven silhouette facial profiles developed from a single outline profile in which the lips were advanced in 2mm stages so that the full face had lips that were 12 mm protrusive to the straight face. Each judge was asked to choose the profile most pleasing for the males and females at ages of eight, twelve, sixteen and adult. Although the results showed that there is a highly significant difference in opinion, the diversified groups shared a common esthetic standard for a posture of lips within 1-2mm in most cases. All the groups were consistent in assigning fuller lips for younger ages and sex differences were clearly defined only in the adults.

De Smit and Dermaut¹⁹ (1984) performed a study on the relative influence of anteroposterior maxillomandibular relation, the lower facial height, and the form of the dorsum of the nose on profile preference using shadow profile photographs. Results showed that the difference in orthodontic knowledge and gender had no significant effect on esthetic preference. Nose dorsum changes induced significant differences only in Class II normal profiles with convex noses less appreciated. Class I normal profile types were the favored ones, followed by Class I deep profiles with open profile types the least appreciated. Thus indicating that vertical profile characteristics could be more important than anteroposterior features.

Barrer and Ghafari⁴ (1985) used pretreatment and post treatment silhouette profiles of forty-eight white patients with Class II, Division 1 malocclusions and mandibular retrognathism who were treated, without tooth extraction, with the Frankel appliance and by the Begg light-wire, the straight-wire edgewise, and the Tweed edgewise methods. One hundred first-year dental students selected the profile which they estimated had the best facial esthetics. As more

posttreatment than pretreatment profiles were preferred for each of the four treatment groups, there was no clear trend in preference among the treatment modalities assessed. The major drawbacks of silhouettes were its subjectivity and its simplification of facial esthetics, discarding many extrinsic (hair style, make-up) and intrinsic (skin complexion, emotional expression) factors that influence the individual concept of beauty but it is found to be suitable for comparison of changes within the same profile. They concluded that since the silhouettes are a simplified representation of profile, it is a complement to other methods of profile evaluation and not a substitute.

Bhatia⁷ (1989) conducted a study to evaluate the facial profile acceptance of 55 girls from silhouette photographs judged by 3 orthodontists, 3 artists, 3 common men. It was found that common bases for judging the profile do exist amongst the professionally different groups, however the public was found to be a more astute analyst of the face. Two profiles, which got all acceptable votes, were associated with malocclusion. It was concluded that the lip outline and the chin are chiefly responsible for profile acceptance while the nose alone of its own does not play an important role. The only way by which the nose affected the facial profile, was its relative position as compared to the chin. Thus if the lip posture and the chin position can be corrected, a poor facial profile can be converted into a good one.

Czarnecki, Nanda and Currier¹⁷ (1993) in a research dealing with the assessment of the role of the nose, lips, and chin performed a survey of constructed androgynous facial silhouettes which was evaluated by 545 professionals. The silhouettes had varied nose, lips, and chin relationships, as well as changes in facial angle and angle of convexity and were graded on the basis of most preferred to least

preferred. 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. More lip protrusion was found acceptable for both male and female faces when either a large nose or a large chin was present.

Melvin Polk and Allan Farman⁵¹ (1995) designed a study with 85 males and 65 females of varying ages with diverse social and educational backgrounds, who were asked to evaluate their personal soft tissue profile preference. Results indicated that African-American male and female subjects prefer relatively flat profiles, with varied fullness of the lips with the African-American subjects preferring the male subjects to have more protrusive profiles than the female subjects and more than a third of the respondents desire a change in their own profile usually involving the lips, chin, or nose. This investigation revealed that African-Americans did prefer the flatter profiles but also liked more fullness of the lips than is typical for the white profile.

Hall, Taylor, Jacobson and Sadowsky²⁷ (2000) assessed the perceived optimal profiles of African Americans versus white Americans using profile silhouettes of 30 African American and 30 white patients. 20 white orthodontists, 18 African American orthodontists, 20 white laypersons, and 20 African American laypersons evaluated the profiles. Their results showed that all raters preferred the African American sample to have a greater profile convexity than they preferred for the white sample. The raters preferred the African American sample with upper and lower lips that were more prominent compared with the white sample. But only the choice of the African American orthodontists for the African American sample was

significantly different for this parameter. The white orthodontists gave the highest mean scores for the profile chosen, whereas the African American laypersons gave the lowest scores.

Andrew Shelly, Thomas Southard and Jakobsen⁵⁹ (2000) investigated the impact of mandibular advancement surgery on profile esthetics in 34 patients. Pretreatment and posttreatment cephalometric radiographs of each patient were used to produce silhouette images. The images were displayed randomly to lay persons and orthodontic residents for scoring the profile. It was concluded that if improved profile esthetics are a desired outcome, an initial ANB angle of at least 6° is recommended. The less attractive the initial profile, the greater the potential improvement with orthodontics and mandibular advancement surgery. No statistical difference existed between esthetic scores of lay persons and orthodontic residents of orthodontic and surgical-orthodontic treatment.

Kieran O'Neill, Michael Harkness and Robert Knight³⁷ (2000) determined the change in profile attractiveness in children with Class II Division 1 malocclusion after 18 months' treatment with functional appliances. The changes in profile attractiveness were assessed by panels of art students, dental students, and parents of orthodontic patients. The raters decided whether the initial or 18-month profile silhouette was more attractive. Results indicated that there were no significant differences between the male and female raters or among panels in their assessments. Neither were there significant differences between the change in profile attractiveness of the untreated subjects and the subjects treated with either Fränkel function regulators or Harvold activators. Thus concluding that treatment with functional appliances does not lead to more attractive profiles than nontreatment.

SUMMARY AND CONCLUSION

This study was designed to investigate the relevance of the norms of the various soft tissue lines of Steiner, Rickett, Burstone, Sushner, Holdaway and Merrifield in the evaluation of beauty. Further, profile photographs and silhouettes of standardized size were created for sixty South Indian subjects and the opinion of the orthodontists and the general public concerning the attractiveness of the photographs and the silhouettes were studied.

The results showed

1. The lip values of Rickett's E line and Sushner's S2 line, Burstone's upper lip value, Steiner's lower lip value and the H angle of the attractive subjects selected by the orthodontists were closer to the norms.
2. Rickett's E line was reliable in assessing the lip position and the B line appeared to be a better representation of the lip thickness and lip prominence in adults.
3. The lip values indicative of protrusive or retrusive values resulted either due to comparatively shorter nose length and a weak chin or a long nose and a strong chin. Thus the relative importance of the nose and chin should be weighed with greater emphasis in the assessment of profile.
4. Differences were present in the esthetic preferences of the orthodontists and the general public.
5. General public preferred more protrusive lips in females than males.
6. Assessment of the soft tissue profile using photographs had an edge over the silhouette series when the public judged,

as their esthetic preference was primarily based on facial features than the profile itself.

7. The rating of the photographs and the silhouettes by the orthodontists were similar due to their prior acquaintance in the subject of facial profile.
8. External factors such as colour, texture, complexion, age, gender and internal factors such as emotions played a significant role in the evaluation of attractiveness by the general public. They were unable to rate the photographs and the silhouettes similarly.
9. Individuals with a relatively smaller nose, protrusive lips and a retrusive profile were preferred by the general public unlike the orthodontist who preferred a flatter profile.

Though the orthodontists preferred straight profiles on the photographs and silhouettes, the lay public differed. Therefore, this leads to the concept of treating profiles according to the patient's preferences rather than orthodontic norms.

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