PROFILE PERCEPTION AND PREFERENCE IN AUSTRALIAN GROUPS

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Dedication

This thesis is dedicated to my parents, Yongyuk and Tanormjit, for their continuing warm-hearted concern and support; to my husband, Kriengsak, for his love and understanding during my studies; and to my sons, Can and Kim, for their encouragement.

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INDEX

Page

LIST OF FIGURES

Page

LIST OF FIGURES (Cont.)

CHAPTER 3

Page

LIST OF FIGURES (Cont.)

LIST OF FIGURES (Cont.)

Page

LIST OF FIGURES (Cont.)

CHAPTER 4

CHAPTER 5

LIST OF FIGURES (Cont.)

Page

LIST OF TABLES

EXPERIMENT I

Page

LIST OF TABLES (Cont.)

LIST OF TABLES (Cont.)

Page

LIST OF TABLES (Cont.)

Page

LIST OF TABLES

APPENDIX A

Page

LIST OF TABLES (Cont.)

Page

LIST OF TABLES (Cont.)

LIST OF TABLES (Cont.)

COMPUTER PROGRAM AND STATISTICAL ANALYSIS

APPENDIX A

APPENDIX B

INTRODUCTION

Many investigators have recognized the importance of psychologic factors in orthodontic treatment. Clinical judgement of malocclusion and facial harmony have, in the past, been the major clinical factors in determining whether to treat orthodontic patients. An individual's physical appearance has implications for psychological development. The psychological benefits of orthodontic treatment carried out to improve appearance could be twofold. One benefit could be direct, where the patient who previously felt self-conscious gained in positive self image. Another indirect benefit might be where the individual in future interpersonal situations is met with a more favourable response (Klima, Joseph and Mclver, 1979).

However, parental background and family needs are also important points for determining orthodontic treatment (Baldwin and Barnes, 1966).

Furthermore, it also appeared from the previous sociological and psychological evidence that the general public does have a rather consistent, demonstrable concept of facial preference which is related to tooth position.

These factors led me to pursue an idea originated by Associate Professor K. Godfrey (1982). He suggested the study of the preference and opinion of Australian people regarding facial profile in general, as well as their own facial profile. (Also included is the study of an average proportional ideal that is recognized in the general public's esthetic concept and our own esthetics).

SECTION 1

CHAPTER 1

HISTORY OF ESTHETICS

Esthetics has been defined in Webster's Collegiate Dictionary 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".

Riedel (1957) observed that there were three primary sources from which orthodontists developed esthetic ideals:

1) The first source of esthetics was probably derived from painting, drawing and ancient sculptures.

2) The second source of esthetic concepts developed through the tremendous influence of such men as Tweed who have developed concepts of esthetics based upon accepting as pleasing or satisfactory a face in which the orthodontist visualizes a denture as stable and incisors in the upright position.

3) The third concept of esthetics has been determined by cephalometric angular and linear standards.

Another possible source of development of esthetic concepts and ideals has been investigated by the personal singular concept of proportionality, e.g. Ricketts (1981, 1982).

1.1. Old Ideas in Esthetics

As early as 35,000 years ago, Paleolithic Man discovered that his mental agility made hunting and survival less arduous. It was possibly in this period that Man found the leisure to develop his esthetic awareness and sensitivity. The sensitivity was preserved in primitive art, paintings, figurines, and representations discovered in recent times.

In 2600-2000 B.C., Egyptian culture depicted its ideal of beauty, harmony and proportion with the stature of royalty. The idealized Egyptian of the Old Kingdom exhibited a round broad face with a sloped forehead, weak brow ridge, prominent eyes, evenly contoured nose, thickened lips and a mild yet positive chin. The soft tissue contour was further stylized with ornamental headdress and, on the male's chin, a beard (Peck and Peck, 1970) (Fig. 1.1).

In the fourth and fifth centuries B.C. called "the Golden Age of Greece", Plato and Aristotle questioned the intrinsic meaning of beauty and introduced esthetics as both the study of beauty and philosophy of art.

Esthetic form embodied in classic Greek is oval, slightly tapering toward the chin. The facial profile

Figure 1.1. Egyptian King Mycerinus carved to the idealized profile of his day, Ca. 2580 B.C. (from Peck and Peck, 1970).

exhibits an anteriorly prominent forehead. The stature of Greek man and lady demonstrates a straight profile (Hambleton, 1964; Peck and Peck, 1970).

In the early sixteenth century, an Italian named Firenzuola wrote a book detailing feminine beauty. On the perfect profile he wrote:

> "When the mouth is closed, the lips must meet in such a way that the lower project no more than the upper, nor the upper than the lower and at the corner they must diminish so as to form an obtuse angle" (Bax, 1946).

In 1835, a Briton, Woolnoth, introduced the objective study of human facial esthetics. He classified the facial form and wrote:

> "The general form and outline of all faces especially as they are seen in profile, are of three orders - the straight face is considered the handsomest, and may be (detected by drawing) a straight line from the top of the forehead to the bottom of the chin without intersecting more than a portion of the nose and a very small part of the upper lip. A line in like manner drawn down a convex face, from the top of the forehead to the lower part of the chin, would intersect all the features, leaving the forehead and chin behind, and throwing the

nose forward .... A line drawn down the concave face, from the top of the forehead to the bottom of the chin, would seem to shut in the features and nearly escape them all. Convex faces ... have this ulterior advantage, that they retain a youthful appearance beyond the natural periods, and are found by observation and experience to last much longer than the concave or straight. Concave face give young persons somewhat of an old fashioned appearance, and most unfortunately bring the face too soon to its maturity" (Peck and Peck, 1970).

Angle (1907) in a chapter on facial art, used the terms balance, harmony, beauty, and ugliness. He gave us his concept of an ideal profile in a photograph of the classical Greek profile of Apollo Belvedere. In his early works, Angle regarded Apollo as the esthetics standard for all faces (Fig. 1.2).

Hatton (1907) in a book entitled "Figure Drawing", describes changes that he would make in the profile of Venus of Milo by Sir Edward Burne-Janes:

"The upper part of the nose is set back and the jaw is robbed of some of its fullness by accentuation of the bone".

Vanderpoel (1936) in his book entitled "The Human Figure", commented that the lips fall on a backward-sloping

Figure 1.2. The classic Greek profile of Apollo Belvedere (from Peck and Peck, 1970).

Figure 1.3. a) The statute of a French girl with a very good profile, a small nose and a voluptuous lower face.

b) German art shows a flat, straight profile that looks almost as if it had been over-treated orthodontically.

c) Italian girl with a semi-full profile in the lip area.

d) A painting of an American Indian with semi-full lip and a large nose.

(from Hambleton, 1964).

plane from nose to chin, the upper lip should be overhanging the lower lip and should be overhanging the chin in the beautiful face.

1.2. Modern Esthetics

The above review indicates that facial esthetics change from culture to culture, and from one age to another. They are also affected by ethnic preferences in various groups: Caucasian, Negroid and Oriental.

National average profile percepts differ from person to person, and from one racial or ethnic group to another, depending upon the visual experience of individuals or groups. The average face of the native of African Sudan is far different from the typical face of a New York urbanite. The average profile therefore must be considered a variant depending upon individual, ethnic or racial and temporal factors.

There appears to run through human civilization a thread of continuity, overriding cultural, historical and ethnic choices, which selects certain characteristic facial proportions as being esthetically pleasing and desirable.

Edmund H. Wuerpel (1937) stated:

"Beauty is the finest expression of human emotions ....

The art that was produced in the past has survived because it was expression in the highest, finest most sensitive manner possible. The beauty that survives knows no limits either of time or place".

Each man's concept of beauty is a matter of his own innermost sensibility and understanding. However, there most certainly is considerable agreement among many of us that certain faces fall well within the definition of beauty or harmony of form.

Wuerpel (1937) drew his conception of racial differences. He stated that faces can be beautiful even if they are proportioned differently. The major factor is balance. Balance is achieved when no part of the pattern is over-emphasized at the expense of the other (Fig. 1.4).

Therefore, European esthetic philosophy has been influenced by art works from the rest of the world on an unprecedented scale. The great diversity which confronted scholars influenced their thinking, and it became apparent that the standards used to judge Western art could not be applied universally. Each style of art had to be evaluated independently, the subjective response of the observer being fully considered (Powell and Rayson, 1976).

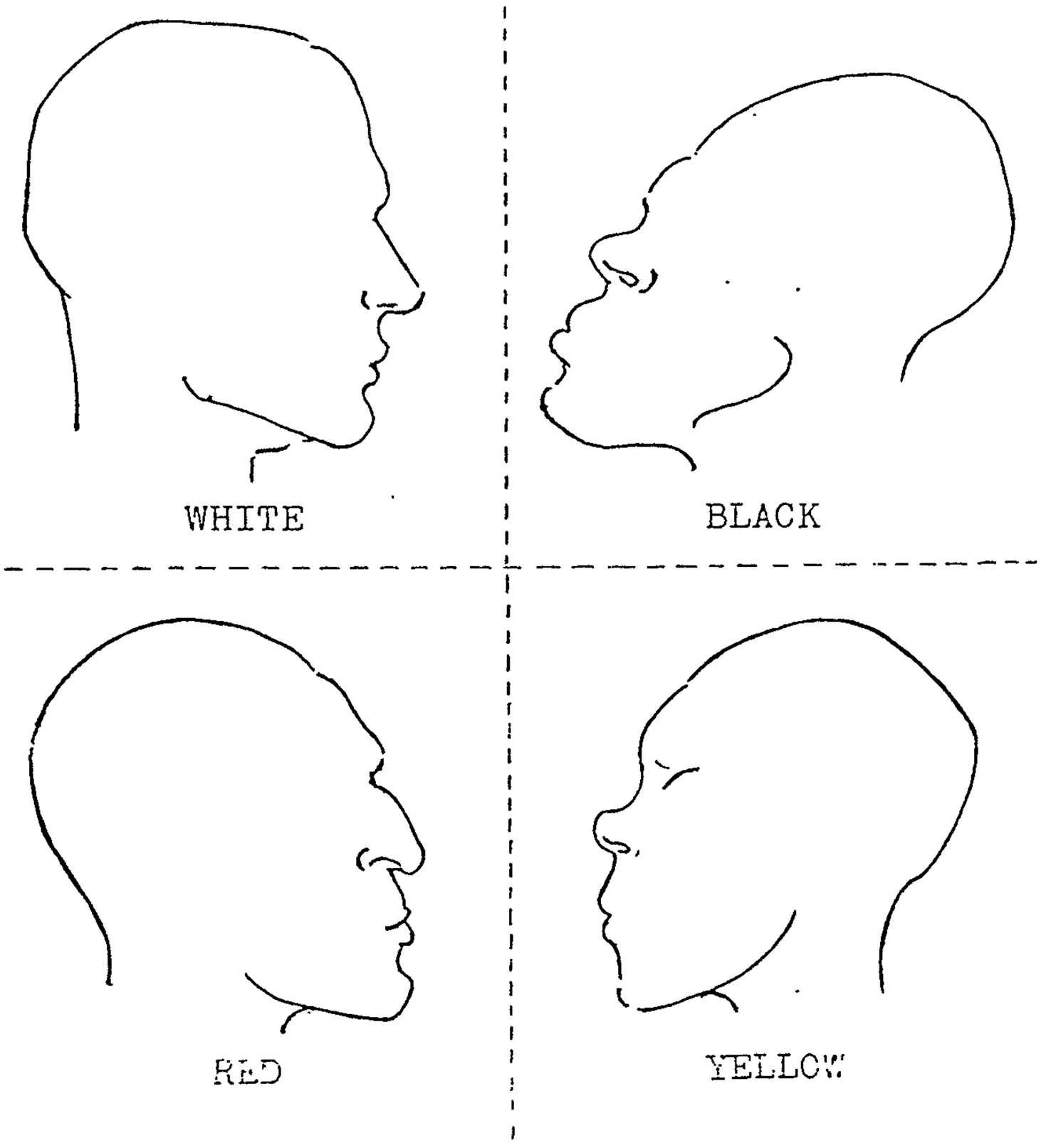


Figure 1.4. Racially different characteristics (from Wuerpel, 1937).

The source of the orthodontist's esthetic concept developed through the influence of various men. The esthetic standards have been determined as satisfactory if a mental image of a stable denture could be seen beneath the soft tissue draping.

Angle's (1907) assumptions are:

1) all faces are in balance and harmony when their dentition are in normal occlusion;

2) all faces are out of balance and harmony when their dentition are in malocclusion;

3) all faces are restored to balance and harmony when the dentition are changed by orthodontists from malocclusion to normal occlusion.

However, Angle never explained what is "the normal" in so far as the face is concerned and what is "balance and harmony in facial features" in so far as orthodontic measures are concerned. Hellman (1936) stated:

> "if an examination is made of many adult faces with dentitions in normal occlusion, it is found that not all of them correspond to one particular type".

Therefore, the designation "normal face", either because the dentition is in normal occlusion or because its features are, as Angle maintains, in balance and harmony is really no measure at all.

Tweed (1941, 1944) developed a concept of esthetics based upon accepting as pleasing or satisfactory a face in which the orthodontist visualized a denture as stable with incisors in uncrowded, upright position. He arrived at this conclusion after a very thorough study of his patients. He used sectioned plaster casts of the lower arch to arrive at the conclusion that in the patients with desirable facial esthetics the lower incisors were upright over basal bone.

Riedel (1950) attempted to evaluate orthodontic opinion concerning soft tissue profile outline. He indicated that facial balance, harmony, or proportion are related in some degree at least to the underlying skeletal and dental pattern of the individual. The relation of the maxillary and mandibular apical bases in an anteroposterior dimension, the degree of the convexity of the skeletal pattern of the face, and the relation of the anterior teeth to the face and to their respective apical bases have a marked influence on the soft tissue profile outline. The soft tissue profile outlines, which were judged by the orthodontists to be pleasing, revealed skeletal parts arranged in a straight line or flat plane with little or no dental protrusion. In contrast, those facial soft tissue profile outlines judged to be poor, revealed convex skeletal patterns and greater than average dental protrusions.

Tweed (1953, 1954) confirmed his concept of esthetics in the lower incisor relation to facial contour. He suggested the rule of compensation of the correlation of mandibular incisor position with variations in the Frankfort-mandibular plane angle. This of course is the principle of clinically relating this angle as plus or minus, such as for every degree of the Frankfort-mandibular angle (FMA) exceeding 25^{o}, the lower incisor angulation to the mandibular plane should be decreased 1^{o}. He believed that ideal facial balance is reached in a given patient, regardless of the severity of the Frankfort-mandibular plane angle if, clinically, the axis of the mandibular incisor can be made to reach a 65^{o} angle with the Frankfort plane.

Downs (1948, 1952, 1956) and Ricketts (1960, 1964) further advanced the thinking of an environmentally placed incisor when they recommended relating the incisor to AP-line. The relationship of the incisor to AP-line appears to be of definite influence on facial type.

Holdaway (1956) suggested the method of directly relating the lower incisor to chin point. Both the lower incisor and the chin were related to the NB-plane. The distance from the most labial portion of lower incisor crown to the NB-plane should be equal to the distance from point pogonion to the NB-plane in stability and esthetics.

Brouwer (1976) stated that the teeth are behind the lips, or at least are supposed to be there. Their position helps to determine the shape of the face. A face normally is harmonious if all teeth of the individual have room enough on well developed supporting bony structure.

CHAPTER 2

PERCEPTION AND ATTITUDE PREFERENCE

2.1. Definition

Perception is a single, unified awareness derived from sensory processes while a stimulus is present (Urgang, 1968).

Allport (1955) stated that it has something to do with awareness of the objects or condition about us. It is dependent to a large extent upon the impression these objects make upon our senses. But perception also involves to some degree, an understanding, awareness, a meaning or recognition of these objects. Thus, perception can include all the senses and can be interpreted as covering the awareness of complex environmental situations, as well as of single objects.

2.2. Origin of Perception

Adcock (1962), a psychologist wrote that our perception depended upon:

i) innate sensory factors: feeling, taste and smell;

ii) the achievement of perceptual meaning;

iii) the development of form concepts; and

iv) condition.

Hochberg (1968) has noted that there are 5 senses with which we can perceive anything in the world:

i) the major distance senses: seeing and hearing;

ii) the skin senses: touch, warmth, cold and pain;

iii) the chemical senses of taste and smell;

iv) the deep senses: position and motion of muscle joint; and

v) the senses of internal organs.

Hochberg (1978) suggested that the commonsense view of the perceptual process is that somehow the outside object gets inside, and then our minds can examine it. The analogy that the eye is just like a camera, and that our minds examine the upside down images of the objects in our retinas, and in the sensory projection areas of the brain, is only slightly more sophisticated.

Therefore, in order to identify the component sensation, procedures known as the psychophysical method were devised to draw out the repertoire of different sensations that we can experience, i.e. to measure our sensory thresholds.

According to Hochberg (1978), the structuralist thought that the world of perception could be analyzed into general classes of elements:

i) Sensation, which we experience when each individual receptor is stimulated.

ii) Memory images, which are the recollections of previous sensations.

With these two classes of components, sensation and memory images, we should be able to account for all the things and happenings we can perceive.

2.3. Self-perception and Interpersonal Perception

Self-perception theory

Ben (1972) noted that there are 2 postulates of self-perception theory:

1) The first postulate was derived thus: "Individuals come to know their own attitude, emotions and other internal states partially by inferring them from observation of their own overt behaviour and/or the circumstances in which this behaviour occurs".

2) The second postulate suggests a partial identity between self and interpersonal perception: to the extent that the internal cues are weak, ambiguous, or uninterpretable, the individual is functionally in the same position as an outside observer who must necessarily rely upon some external cue in order to infer the individual's inner state.

2.4. Sociology and Psychology

The perception of people is currently an important area of psychology and sociology.

In Secord and Muthard's studies (1955a), male and female judges rated photographs of women's faces according to ascribed personality trait. They also showed that individual differences among judges in the perception of women's photographs are significantly related to age and sex of the judge, and probably to the personality of the judge. Other studies by Secord and Muthard (1955b) were concerned with rating 24 photographs of young women on sets of physiognomic and personality attributes. The studies of appearance, particularly facial appearance, with behavioural factors controlled, have shown that observers attribute personal characteristics to others on the basis of facial characteristics. Apparently, persons with certain physical features commonly are thought of as having certain personality characteristics.

Peck and Peck (1970) said that the formalized studies of psychology and sociology have helped transform esthetic judgement from simply a visual "feeling" to an understandable exercise in visual perception. While the study of face as the esthetic stimulus is still important, of equal significance now is the nature of the "esthetic response" which is the observer's perception.

Some observers have noted that demand for correction of facial disharmony is often based on psychological factors. Although there is recognition of the role played by psychological factors in attitudes to facial appearance, little research has been aimed at investigating the underlying personality.

The most important variable is the interpersonal adjustment of the individual, which may have two aspects in relation to profile disharmony:

1) the effect of the patient's profile on the perception of the patient by other people;

2) the patient's reactions toward his profile and facial appearance and toward the way others behave toward him.

Story (1966) pointed out that the role of the face and the mouth was special in the emotional and self-image development of the child.

Neger (1959) found that abnormal dentofacial traits can become handicapping when actual or imagined defect interfered with normal social interaction.

The motivation for orthodontic treatment has been shown to bring together the physical aspects of orthodontics with the more emotive aspects which set the stage for a further look at self concept.

Baldwin and Barnes (1967) reported that about 50% of a large group of candidates for orthodontic treatment had never been teased about their malocclusion and 10% reported that teasing was a frequent occurrence.

Baldwin and Barnes (1966) stated that parental background and family need, correlated with the child's dentofacial problem, affects demand for orthodontic treatment. In addition, status-seeking was listed, in more than half the cases reported; the children were seeking treatment because of their mothers' wishes.

Lewit and Viralainen (1968) found that motivation for orthodontic treatment among adolescents was related to several dispositional factors and social pressures. In addition to facial esthetics, motivation for orthodontic treatment emanates from the influence of parents, peers and friends.

The human face is interesting for people the world over. The anthropologist Hooton said:

> "We recognize our acquaintances by looking at their face rather than their heads. Individual variations express themselves here more plainly than in any other part of the body. Racial differences too are much more marked in the countenance than elsewhere" (Lusterman, 1963).

There was evidence that facial deformity might be seen as a greater disadvantage than some other physical disabilities (Richardson et al., 1961). It seems that in social situations facially attractive people might be at an advantage.

Secord and Backman (1959) also found that some personality characteristics may be stereotypically attributed to individuals on the basis of their facial appearance, such as sincerity, intelligence and conscientiousness.

Stricker (1970) pointed out that an individual's physical appearance had implications for his psychological development. The psychological benefits of orthodontic treatment carried out to improve appearance could be two-fold. In the first place, benefit could be direct, where a child who previously felt self-conscious gained in positive self-image. Secondly, there might be indirect benefit where the individual in future interpersonal situations is met with a more favourable response.

2.5. Perception Related to Sex, Age and Race

It was found that sex, age and race are factors in recognition or perception of facial appearance.

Goldstein and Chance (1965) reported that 9-year-old children found it easier to recognize younger faces more than those of the same age or older.

Malpass and Kravtiz (1969) had worked with black and white students. They found that white faces were recognized more frequently than black faces, but there was a significant interaction between race of subject and race of the stimulus. Subjects having more experience with the opposite race recognized faces of that race more frequently than more racially segregated subjects.

Cross, Cross and Daly (1971) found that females can recognize female faces more frequently than the male faces, while male subjects recognized the male and female face with equal facility. Whites recognized the white face more frequently than black faces, while black subjects recognized the black and white face with equal facility. The number of false identification of faces decreased as subjects increased in age.

2.6. Esthetic Perception

Much time has been spent in arguing about the nature of beauty and derivation of esthetic standards. The problem was studied in the light of modern psychological thinking. It is soluble only within the framework of a general metaphysic.

Adcock (1962) postulated that man is a behaving, experiencing agent who modified his behaviour in accord

with his experience. He was so constituted that he found certain experiences enjoyable and others painful. He attempted to prolong and intensify in the former, while the latter he reacted to inversely.

Adcock also wrote:

"The major aim of humans is to understand their own experiences and the relation of these to their volitions in such a way as to enable them to maximize affective enjoyment. This results in the building up of a perceptual reference frame, a motor reference frame and a set of values, related to these. We thus come to have a sort of perceptual alphabet in terms of which we spell out our perceptual cues, and a behavioural alphabet to enable us to spell out the appropriate behaviour which will maximize our enjoyment in relation to these perceptual cues".

The nature of our experience is such that we are forced to postulate an objective reality behind our experience. Our actual experiences are to be interpreted as the joint result of the postulated "real" environment and our own nature since we are, ourselves, a part of objective reality. It follows that, if by beauty we mean the capacity to produce esthetic enjoyment, it cannot be an absolute attribute of an object but must depend upon the experience also.

According to Huntley (1970), esthetics is the study of beauty, and together with ethics, logic, politics, and metaphysics, is a branch of basic philosophy. It has been said that beauty is in the eye of the beholder, but a thing is said not to be truly beautiful until it arouses the senses to an emotional level of pleasure. This level of perception is not in the cognitive part of the brain (neocortex) but is thought to be located within the sub-conscious or primitive portion of the brain referred to as the reptilian complex or the limbic system. The limbic system is thought to contain the instincts. It is considered capable of conditioned reflex so that, in the appreciation of beauty and art, a factor of discipline and previous exposure exists (Ricketts, 1982).

The "sense" of esthetics is a curious thing and is composed of our visual acumen, to a large extent. Concepts of selective conditioning help to explain visual perception or a single unified awareness. The more frequently that we observe a distinct facial pattern, the more likely we will perceive it as correct.

Watson (1980) said that learning affects the formation of images, and consequently the perception of depth could even be conveyed from two-dimension pictures. Visual illustrations of distortion come into play with our assessment of facial harmony. Perception, in general,

is based upon cognitive processes. A prevailing view among psychologists and sensory physiologists was that form perception could be reduced to the perception of contours and that contour perception, in turn, could be reduced to abrupt differences in light intensity.

2.7. Self-perception of Profiles

Giddon, Hershon and Lennartoson (1974) asked 21 unselected Swedish females, aged 18 to 30, to recreate their own and desired profile from three adjustable cardboard pieces representing the nose, upper lip, and lower lip/chin. Angular and linear measurements were obtained from actual soft tissue profile landmarks of cephalometric tracing. For the semantic differential self-evaluation of attractiveness, the subjects could indicate their judgements of each feature of the face. The result showed that subjects differed in their ability to recreate their own profile as a function of some combination of intervening psychologic, perceptual, or motor variables. In general, subjects underestimated the less desired profile and they were satisfied with their own appearance.

Pitt and Karabik (1977) studied the relationship between actual physical facial profile, self-perceived profile (body image) and psychologic-self-satisfaction. Two hundred and seven patients' parents were asked to choose the ideal male and female profile from groups of 5 drawings ranging from severely retrognathic to severely

prognathic, and to pick from the profile drawings the profile they felt most closely resembled their own.

The result from this study showed that 56% of the subjects were able to correctly identify their profiles. Ninety-three percent agreed with orthodontic standard of the ideal profile. Of the subjects who misperceived their profiles, those in the high self-esteem group judged their profile to be significantly more ideal than they actually were and, conversely, those in the low self-esteem group judged their profile to be significantly less ideal than others judged them. In most cases, it seems that a person's perception of his facial profile is determined by his psychological self-satisfaction rather than by his objective appearance.

Deloach (1978) used 10 representative profiles of 150 North American blacks randomly arranged, plus a questionnaire which was presented to 224 North American black women of various educational and social backgrounds. The subjects were asked to choose the most pleasing and the least pleasing to them, and the profile which resembled themselves, and indicate their attitude toward their own profile.

A significant majority of subjects preferred the straighter facial profiles; this preference was consistent among all age groups. The respondents generally

could not recognize their own profile type among the 10 pictured profiles, and a substantial number of respondents did not desire to change their profiles, regardless of their own profile type.

Graber (1982) reported on a study concerned with psycho-social implication of dentofacial appearance. He investigated the relationship between specific facial characteristics and judgements of facial appearance and indicated that variations in profile were probably more significant in judgement of facial appearance than were frontal variations. In the second section, he evaluated the relationship between specific facial characteristics and self-perception. The major finding was that excessive dental protrusion was seen as being a negative factor in self-descriptions of one's own facial appearance. In the last section he reported on the relationship between self-concept and facial form. His data indicated a definite relationship between dentofacial malocclusion and self-concept.

2.8. Esthetic Preference in the General Public

In 1947, Riedel had attempted an investigation of profile photographs of "Hollywood stars". The profile photographs were projected to normal size in an enlarger and a tracing line of the soft tissue profile was made.

Tracing of several "Hollywood stars" and a group of profiles of persons having excellent occlusion were submitted for the opinion of the U.S. Midwest orthodontists.

The result was that none of the tracings of female Hollywood stars were judged to be anything more pleasing than "fair" in the opinions of orthodontists, because most of the stars' profiles were regarded as too protrusive (Riedel, 1957).

In 1950, Riedel sent a series of profile outlines to practicing orthodontists for assessment of their esthetic value. Subsequently, an analysis was made of the underlying skeletal and dental pattern of profile outlines. He had concluded from this study that:

i) the profession agrees on what constitutes a good profile, but lacks objective criteria by which it may be determined;

ii) the soft tissue profile closely follows the skeletal profile;

iii) generally speaking the more convex the profile, the more upright must be the incisor to produce harmonious facial balance.

Conversely, if the skeletal profile is straight the incisors may be allowed greater procumbency in proportion (Riedel, 1950).

Riedel (1957) had undertaken a further study in which he set out to determine the concept of facial esthetics held by the general public. He studied dento-facial relationships of Seattle Seafair Princesses (i.e. 30 girls chosen as the Seattle Seafair Princesses and their Queen). He found that the public's concept of acceptable esthetics is apparently in agreement with standards established by orthodontists on the basis of normal occlusion.

Burstone (1958) considered that the face has influenced the social acceptance and psychological well-being of the individual. He used an integumental grid, prepared from profiles chosen by artists, with which to compare the soft tissue profile outlines of his patients. He found that integumental analysis may be a misconception, as the patient and parent could have a different concept of facial balance from the artists, and that appearance is not only a function of morphology, but may be influenced by the subtle factors of personality.

According to Wylie's note:

"Orthodontists have tried for 20 years to make a scientific proposition out of what can only be a matter of personal taste. Esthetic preferences should be frankly presented as such and not put on a par with physiologic consideration which the parent cannot adequately judge".

He also remarked that the layman's opinion of the human profile is every bit as good as the orthodontist's and perhaps even better since it is not conditioned by orthodontic propaganda (Wylie, 1959).

So it has been demonstrated that the general public express remarkable agreement in its judgement of facial profile.

Iliffe (1960), a British psychologist, conducted an interesting study of preferences in feminine beauty. He arranged with a major London newspaper to publish 12 female photographs taken under uniform conditions. Their ages were between 20-25 years and were selected to represent various facial types. The photographs were judged by 4,355 Britons in order to rank the 12 faces according to their pleasing facial esthetics or prettiness. It was found that the positive correlations were significantly high to suggest that a common basis for judging facial beauty indeed existed, and it was shared by men and women of all ages, in all parts of England, in most occupations.

In 1965, Udry, a sociologist, had studied the same 12 facial photographs in the United States. The study drew over 100,000 responses from Americans. Udry found that there was a significant agreement among the replies as to who were the prettiest, and that there was agreement with Iliffe's British study. Three of the best choices in

the American study were identical with the British result. In the group of the first three girls, the esthetic selection order in both studies differed only slightly (Udry, 1965).

In part of Martin's work (1964), he was concerned about the relationship between racial group membership and judgement of female beauty by males. A panel of judges was asked to rank 10 facial photographs of black females from the least Negroid type to the most Negroid type. The least Negroid type was understood to have the most Caucasian appearance.

After the judges ranked the photographs, 3 groups of men; 50 American whites, 50 American blacks, and 50 African (Nigerian) blacks were asked to rank the photographs according to esthetics.

He found that American whites and American blacks share a common esthetic standard. Furthermore, Caucasian features are considered more attractive than Negroid features in American society today. The judgements of the African (Nigerians) were, surprisingly, in closer agreement with American whites than with American blacks.

However, similar international and transcultural esthetic agreement has been reported by several authors

using works of art instead of faces as their testing medium. They appear to substantiate the observation that people share a common basis for esthetic judgement regardless of nationality, age, sex or occupation.

Peck and Peck (1970) devised a system of photographic profilometric analysis in order to provide a meaningful concept of facial esthetics and an additional source of clinical data. Their study used 52 young adult subjects, each acclaimed previously in some manner by a segment of the general population as possessing those qualities of facial esthetics which are the most pleasing. The sample included professional models, beauty contest winners, and performing stars noted for their facial attractiveness. The result of the study found that the general public admires a fuller more protrusive dentofacial pattern than customary cephalometric standards would like to permit.

Cox and Linden (1971) used silhouette photographs as the selection base to differentiate between good and poor facial esthetics in young male and female adults. Four groups of 18 persons were formed, representing males and females of the two categories. These silhouette photographs were evaluated by 10 orthodontists and by 10 laymen. The result was that two professionally different groups of evaluators showed no significant differences in their rating.

From the view of an analysis, the soft tissue and skeletal measurements of the lateral head film showed that in both sexes, persons with poor facial balance have more convex faces.

Foster (1973) had studied 6 diversified groups of 30 people. Each was asked to judge 7 silhouette facial profiles. Each silhouette drawing was unchanged with the exception of the lips which were advanced in 2 mm stages so that the "full face" had a 12 mm lip protrusive to the "straight face". Number 7 profile to the far right is 12 mm fuller in lip than number 1 to the far left. The series of profiles were sent to the following groups: general dentists, art students, orthodontists, a black lay group, a Chinese lay group, and a white lay group.

Each group was asked to choose the profile most pleasing for male and female at ages: 8, 12, 16 and adult.

The result of this study indicated that the diversified group in this study did seem to share a common esthetic standard for posture of the lip within 1 to 2 mm in most cases.

All groups were consistent in assigning fuller lips for younger ages.

Sex differences were clearly defined in the adult. A straighter adult male preference over female by 3 mm was indicated by most groups.

Anderson et al. (1979) studied the differences between the 3 groups: general practitioners of dentistry, orthodontists, and parents of children, in their judgement of typical morphological features and their assessment of the need for orthodontic treatment.

The 3 groups were requested to rate, independently, 11 line drawings of facial profile and 11 intraoral colour photographs. A predetermined 3-point scale was used to evaluate the picture. The parents could choose between - normal, as it should be; slightly deviating, but not disturbing; and abnormal, requiring treatment. The dentists and orthodontists were asked to indicate the assessment most appropriate to each picture: profile or dentition was normal; profile and dentition was deviating from normal, but did not require orthodontic treatment; or, abnormal and require orthodontic treatment.

The general finding was that the parents considered more of the examples acceptable and not requiring orthodontic treatment than did the professional group.

The layman's opinion of facial esthetics was most important, since it was not preconditioned through

specialized training. Individuals do share a common basis for esthetic judgement, regardless of nationality, age, sex or occupation. In elective corrective procedures, such as those involving facial esthetics, the patient and the parent certainly should be consulted concerning the mutually desired esthetic outcome.

The general American public of the present time favours a more protrusive dentofacial pattern than most cephalometric standards suggest as normal. Also, convex faces exhibit a youthful appearance as opposed to concave profile.

Generally the term "normal", as used by the orthodontist, often means an average of ideals. Consequently, we must recognize the general public's esthetic as well as our own esthetic prejudices (Watson, 1980).

Therefore, perception and attitude preference of the facial profile are based on experiences of the observers which relate to age, sex and race (ethnicity). The study of the face as the esthetic stimulus is important. Of equal significance now is the nature of the esthetic response.

CHAPTER 3

DIAGNOSIS AND ASSESSMENT OF FACIAL PROFILE

It is apparent that, in endeavouring to establish facial esthetic preference, the orthodontist will make his observation over a wide field.

H.A. Young (1956) summarized these "Facial Factors" as:

1) the relative over-all size of the face;

2) the proportions of the face and the ratio of the facial divisions;

3) the profile of the face;

4) the mouth size, the curvature length and form, and the form and shape of the angles of the mouth;

5) the thickness, form, curvature, prominence and tenseness of the lips;

6) the creases and folds of the facial tissues;

7) the squinting of the eyes;

8) the breadth of the nostrils;

9) the spatial position of component elements of the face; nose, eyes, mouth and chin;

10) facial impress.

3.1. Line and Angle in Profile Assessment

A significant early point of study about the facial profile was the work of the Dutch anatomist, Camper, who contrived a means for comparing the profile of mammals in the latter part of the last century (Neger, 1959).

Camper suggested a line that was drawn from the center of external auditory meatus to the wing of the nose. This line is called Camper's plane. This line intersected another line drawn from the glabella to the alveolar crest of the upper jaw to form Camper's angle. This angle can be used to demonstrate racial difference as well as various evolutionary changes in human faces.

At the Anthropological Congress in 1884, a horizontal line introduced by Von Ihering in 1872 was selected in order to compare the craniometric findings. This plane is named the Frankfort horizontal plane. It is drawn from the upper margins of the ear holes to the lower infraorbital margin (Neger, 1959).

In the early twentieth century, Angle (1907) had written:

> "We know that while all human faces are greatly alike, yet they all differ. Lines and rules for their measurement have been sought by artists and many have been the plans for determining some basic lines or principles from which to detect

variation from the normal, but no line no measurement admits of anything nearly like universal application. The beautiful face of Apollo Belvedere has been very largely used as a guide toward the ideal and form which to judge variation but this is impracticable and misleading, for notwithstanding the beautiful harmony of proportions of that face, with its straight line touching the frontal and mental eminences and the middle of the wing of the nose, its range of application has been found to be very limited in gauging the harmony or inharmony of other faces" (Fig. 3.1).

Figure 3.1. shows the face of the Apollo. The face was a study of symmetry and beauty of proportion in the fully developed nose and nostril, the full rounded, finely curved, lip, squarely chiselled chin (from Angle, 1907).

A section entitled "Dentofacial Malocclusions" written by Case (1921) concerned facial analysis and described zones of movement. An interesting observation which he makes is that slight changes in the profile will produce considerable improvement of the facial appearance. He does not employ the method of measurements, and like Angle relies more upon training one's power of observation to determine facial changes.

In 1922, Dreyfus suggested the line be drawn a vertical plane through nasion perpendicular to the Frankfort plane for measuring profile changes (Neger, 1959).

According to Hinds and Kent (1972), Izard and Simon divided the face in three planes of space: the orbital, the median sagittal, and the Frankfort horizontal planes. The orbital plane passes through the two infra-orbital foramina perpendicular to the Frankfort plane and to the median sagittal plane, and passes through the incisal tip of each maxillary cuspid. Simon could measure soft tissue growth and other changes. Dentofacial deviation from Frankfort and Orbital Planes illustrate protrusion or retrusion of maxillary or mandibular parts. In part, anterior and posterior frontal planes illustrate the position of the chin in prognathism and retrognathism (Fig. 3.2).

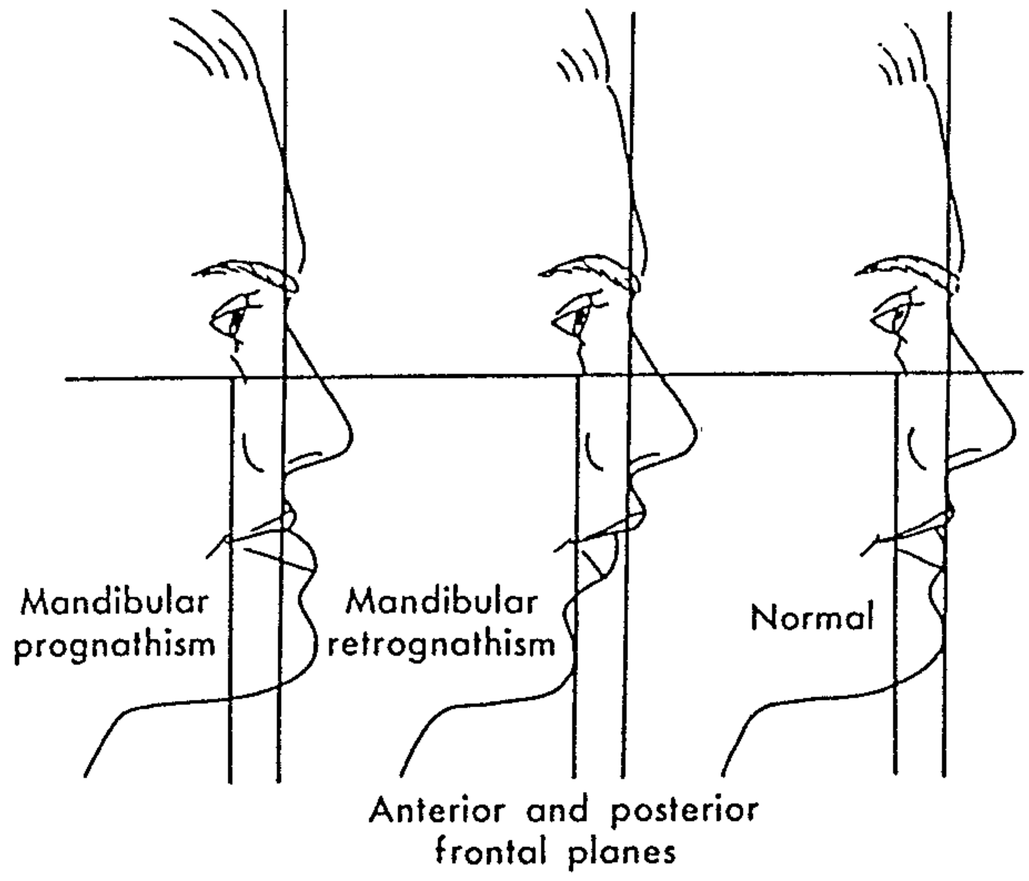


Figure 3.2. Orbital and Frontal planes (from Hinds and Kent, 1972).

A simplified method of determining facial balance and chin position is the profileplasty lines described by Gonzales-Ulloa (1968). He considered most faces beautiful if the chin is tangent to a vertical line, a true meridian 0 degrees to the face. This vertical line was drawn from nasion perpendicular to the Frankfort plane. If soft tissue chin button fell on the line, the facial balance was considered fairly normal.

In 1927, Hellman had adapted physical anthropology to orthodontic research. He used several devices to portray his measurements graphically; he used what he called a "profilogram", a diagrammatic polygon representing the face in midsagittal section, which incorporated

measurement of depth and height. Gosman (1950) followed Dr. Milo Hellman. He tried to bring the anthropometric method of facial analysis into orthodontic research and practice.

3.2. TOTAL FACIAL PROFILE ASSESSMENT

3.2.1. Anteroposterior Relationship of Facial Profile

a) *Assessment from X-ray*

The most elaborate and promising set up for study of the face by means of roentgenography had been developed by B. Holly Broadbent at the Western Reserve University Medical School, under the sponsorship of the Balton Foundation (Broadbent, 1931).

Downs (1948, 1952, 1956) used X-ray cephalometrics for analysis of the dentofacial profile. He said that from the orthodontic viewpoint, a person's facial type is best described by the relative anteroposterior relationship of the forehead, middle face and lower face. The facial angle tells the relative prognathism of the mandible. The terminology used to describe facial type is mesognathic for the average 87.5° (81° to 89° in range), retrognathic for the receding mandible and prognathic for the prominent mandible. The other characteristics of the profile were expressed by the angle of convexity

nasion (N), subspinale (A), and pogonion (Po). When N, A and Po fall in a straight line, there is a zero angle of convexity; A is read as a deviation from 180 degrees and, given a positive value, the angle of convexity denotes convexity. Likewise, when A is posterior to N and Po, the reading is given a minus value denoting concavity of the profile.

Wylie (1955) showed how to measure quantitatively the straightening of the soft tissue profile. He calls the measurements, the "soft tissue angle of convexity" established between three points which are the approximate soft tissue equivalents of the bony landmarks which define Downs' angle of convexity. The angle involves the prominence of the forehead, the most prominent point on the upper lip and the most prominent point on the fleshy chin. The acceptable range should be 6.5 to 16 degrees.

Subtelny (1959) studied the longitudinal characteristics of soft tissue profile. The growth and development of the soft tissue in a number of subjects possessing satisfactory skeletal profile were observed. Equally divided as to sex, these individuals ranged from 6 months to 18 years of age. Serial cephalometric roentgenographs were

used. He applied the facial angle as projected by Downs in the investigation to objectify the relative degree of protrusion or retrusion of the skeletal chin. The relative anteroposterior position of the skeletal chin was evaluated with reference to the cranial base line, which was defined by a line connecting the skeletal landmarks basion and nasion. The position of the skeletal chin was determined by reading the angle formed by the cranial base line and a line drawn from nasion to pogonion (Fig. 3.3).

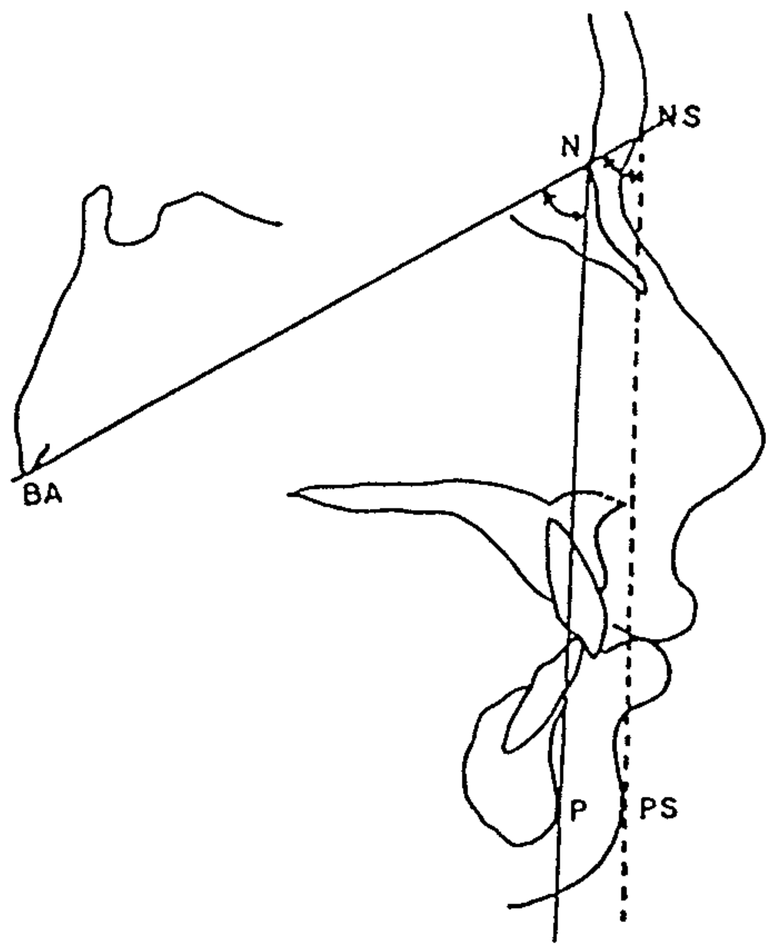


Figure 3.3. Angular method of determining the relative anteroposterior position of the skeletal chin and the integumental chin (from Subtelny, 1959).

From the continuation of the cranial base line anteriorly, the intersect of the soft tissue profile was designated as Ns (soft tissue nasion). From this point, a line was drawn to a point comparable to pogonion (Ps). The angle formed by this line and the cranial base line indicated the relative anteroposterior position of the integumental chin (Fig. 3.3).

Furthermore, he divided facial convexity into three categories:

1) Convexity of the skeletal profile. Subtelny used the angle of convexity to specify observation on the skeletal profile. The angle of convexity is determined by measuring the angle nasion - point A - pogonion. If the angle approaches 180 degrees, it indicates a straighter skeletal profile. Similarly, a decrease in this angle indicates an increased degree of convexity.

2) Convexity of the soft tissue profile. Subtelny employed two methods to evaluate change in the convexity of the soft tissue profile (Fig. 3.4):

2.1) The first measurement was designed to focus upon soft tissue structures which were closely analogous to the degree of convexity of the skeletal profile (Ns - subnasion - Ps).

2.2) The second method of measuring the soft tissue profile was devised so that the nose could be included in the measurements of facial convexity (Ns-No-Ps).

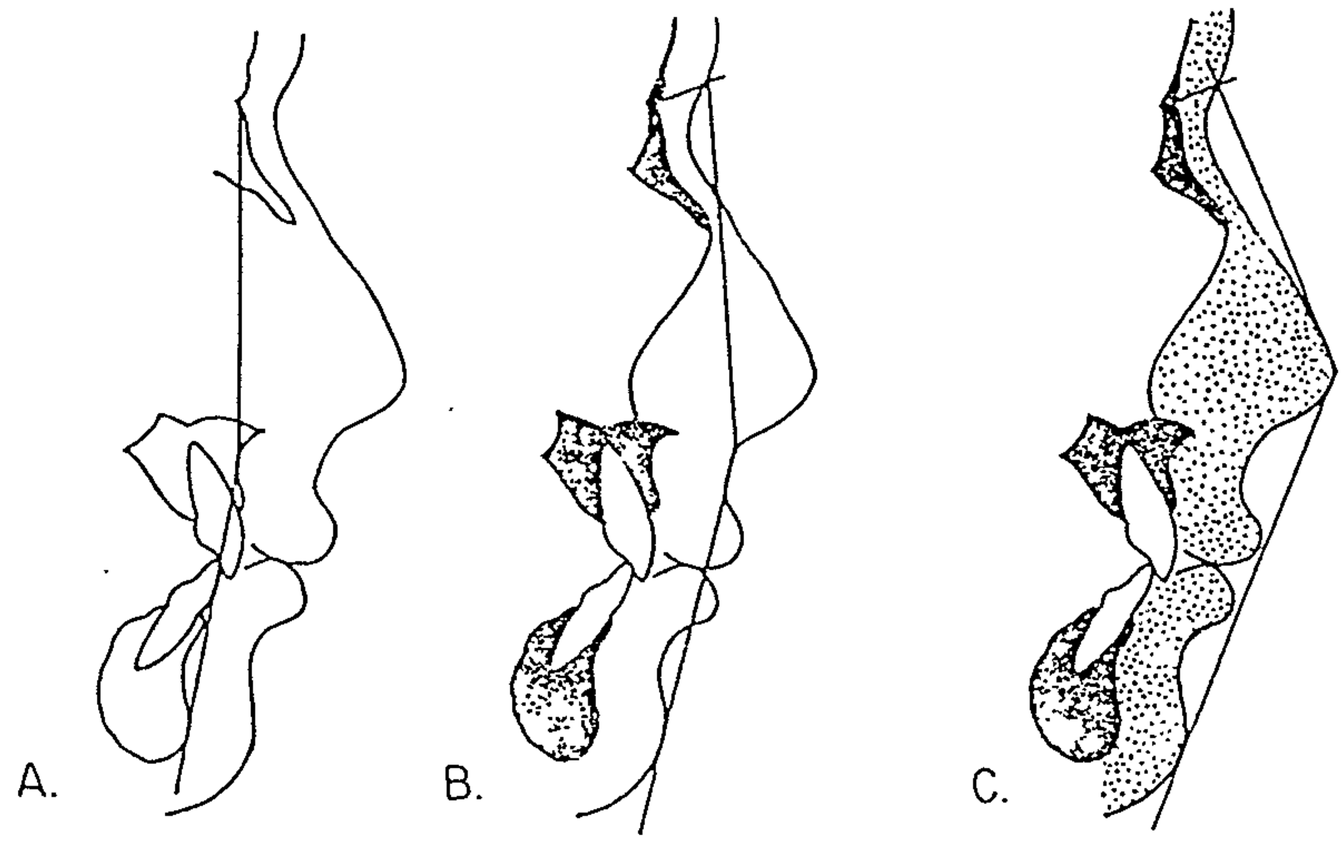


Figure 3.4. Method of evaluating facial convexity:

a) convexity of the skeletal profile (N - point A - pogonion);

b) soft tissue profile convexity (soft tissue nasion - subnasale - chin);

c) total soft tissue profile convexity, including nose.

(From Subtelny, 1959).

Burstone (1967) and Legan and Burstone (1980) described the overall horizontal tissue profile of the patient, by using the angle of facial convexity, or facial contour angle G-Sn-Pg'. This angle was formed by the line glabella (G) to subnasale (Sn) and the line Sn to soft tissue

pogonion (Pg'). The average measurement of -11 ± 4 degrees from a straight line was suggested the ideal facial contour (Fig. 3.5).

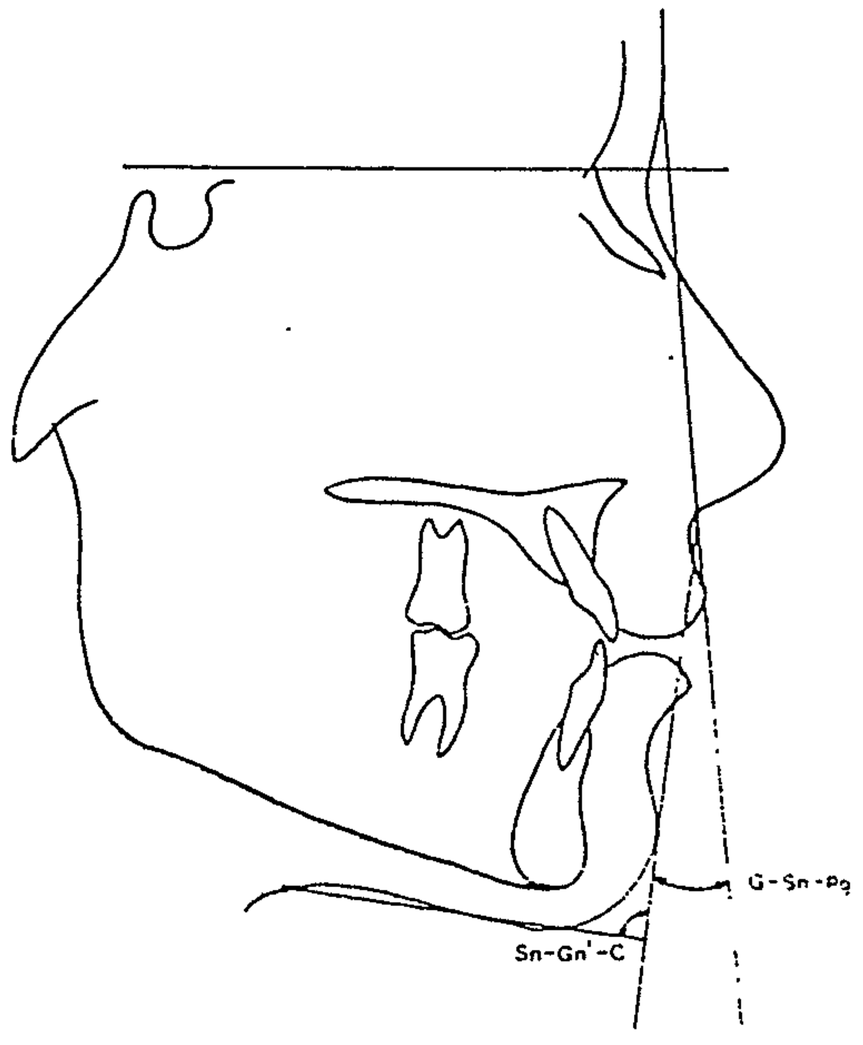


Figure 3.5. Measurement of facial form,. and angle of facial convexity (from Burstone, 1967; Legan and Burstone, 1980).

b) *An investigation profile from photograph*

Over fifty years ago, Simon (1926) and Hellman (1939) advocated systematic measurement and analysis of the face. They constructed the line, angle and relationships directly from the patient and photographs for use in orthodontic diagnosis and classification. After the clinical introduction of X-ray cephalometrics, the profile photograph became a rather passive facial record.

However, a soft tissue profile analysis can provide valuable information in the development of a concept of facial esthetics, and as a supplement to other diagnostic records.

In 1952, Herzberg described the profiles of three subjects which he had considered to be "in balance" by using photographs. He stated that in such a face, the chin, upper lip and lower lip are not in protrusion. These tissues should fall on a vertical line through subnasion or subnasale (Herberg, 1952).

Stoner (1955) reported a method for evaluating facial contour around the mouth and the area affected by orthodontic treatment in order to determine the facial changes, that all fit into the the range of measurements found in excellent faces. The acceptable faces were selected as being well balanced and in excellent proportion, representing an individual concept of beauty (Fig. 3.6).

In the evaluation of an excellent profile, he found that:

1) the facial angle was 87.7 ± 2.9 degrees;

2) the protrusion of the lower lip as related to the chin (Nc-Lc) was 7.3 ± 3.3 degrees;

3) the relationship of upper lip to lower lip recorded by the intersection of UL and CL was 5.3 ± 3.9 degrees;

4) the relationship of the lip plane UL to the facial plane NC was 12.5 ± 3.6 degrees.

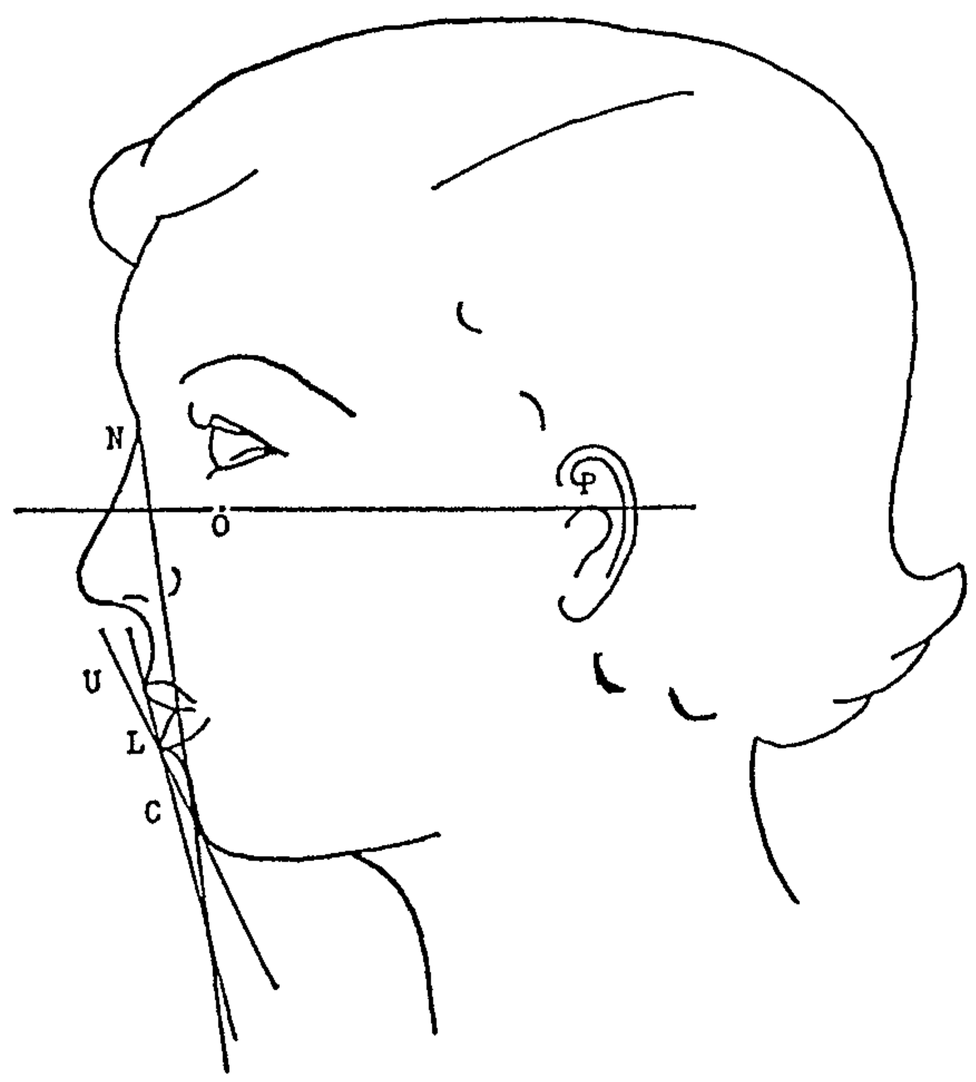


Figure 3.6. Drawing of face with all points and planes of reference. P, porion; N, nasion; O, orbitale; U, tangent to upper lip; L, tangent to the lower lip; C, tangent to chin (from Stoner, 1955).

Neger (1959) examined a group of persons with normal excellent occlusions and acceptable facial form and other groups with malocclusions by establishing a method of assessing the facial soft tissue and lips in a quantitative manner from photographs. The facial contour had been recorded by using such points as may be influenced by orthodontic treatment (Fig. 3.7).

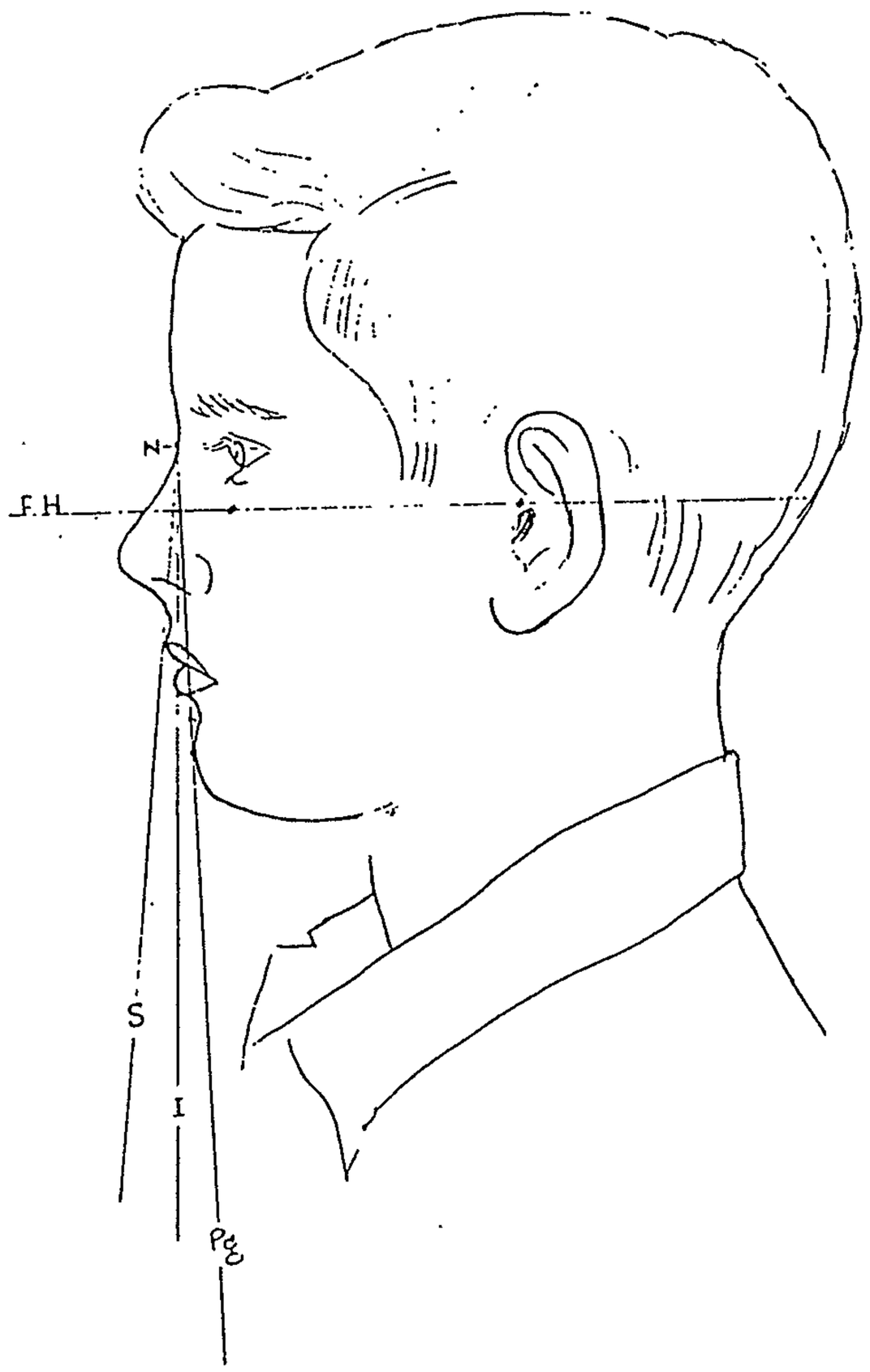


Figure 3.7. Soft tissue reference points. N, nasion; O, orbitale; T, tragion; S, labrale superius; I, labrale inferius; Pg, pogonion (from Neger, 1959).

His findings for angles in acceptable profiles were:

Superior labial angle (S) has mean 96.8 degrees.

Inferior labial angle (I) has mean 92.8 degrees.

Pogonial angle (Pg) has mean 88.1 degrees.

Labrale superius to Labrale inferius (SNI) has mean +3.9 degrees.

Labrale inferius to Pogonion (INPg) has mean 4.8 degrees.

Labrale superius to Pogonion (SNPg) has mean 8.7 degrees.

Peck and Peck (1970) used the profilometric analysis in their study. They found that the facial angle (F) was formed by the intersection of the orientation plane with the facial line at point P (Fig. 3.8). The mean facial angle of esthetically pleasing faces is 102.5 ± 2.7 degrees.

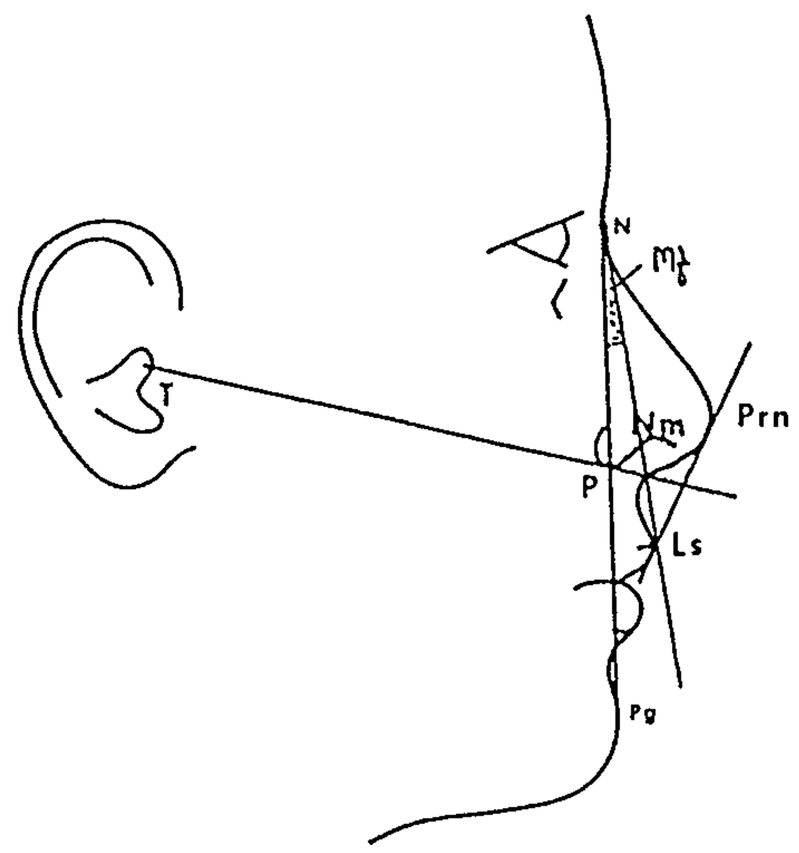


Figure 3.8. Profilometric analysis (from Peck and Peck, 1970).

In the relationship of the upper lip to the chin, horizontally, the maxillofacial angle (Mf) should be 5.9 ± 1.7 degrees in the pleasing faces (Fig. 3.8).

They also related the upper lip to the nasal apex by drawing a line through labrale superius and pronasale. The intersection of this line with the orientation plane, the inside superior angle called the nasomaxillary angle (Nm), had mean 106.1 ± 3.9 degrees in the pleasing face.

Peck and Peck (1970) attempted to clarify some of the misunderstanding commonly associated with the catchall phrases: "facial harmony", "facial proportion", and "facial orientation".

Facial harmony was defined as the orderly and pleasing arrangement of the facial parts in profile.

Facial proportion was defined as the comparative relation of the facial elements in profile.

Facial orientation is the relation of the facial element to the head.

In a descriptive analysis of facial harmony, Peck and Peck showed a diagrammatic profile landmark

that could be broken down into 11 component points (Fig. 3.9).

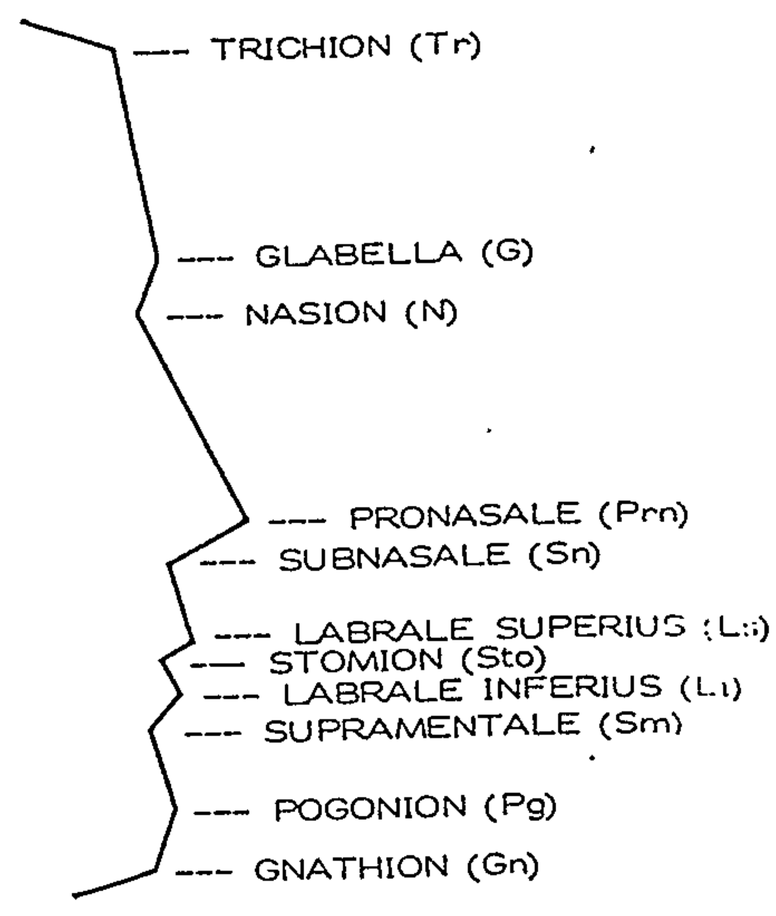


Figure 3.9. Diagrammatic profile landmarks (from Peck and Peck, 1970).

Ultimate appreciation of the profile depends upon the manner in which these points are connected. Harmonious profile flow might be visualized as a series of waves or reversed "S's" on the right profile (Fig. 3.10); and three dimension or concavities are in the harmonious soft tissue profile. There is one at nasion (N), another at subnasale (Sn) and the last at supramentale (Sm) (Fig. 3.11).

Figure 3.10. Harmonious profile flow (from Peck and Peck, 1970).

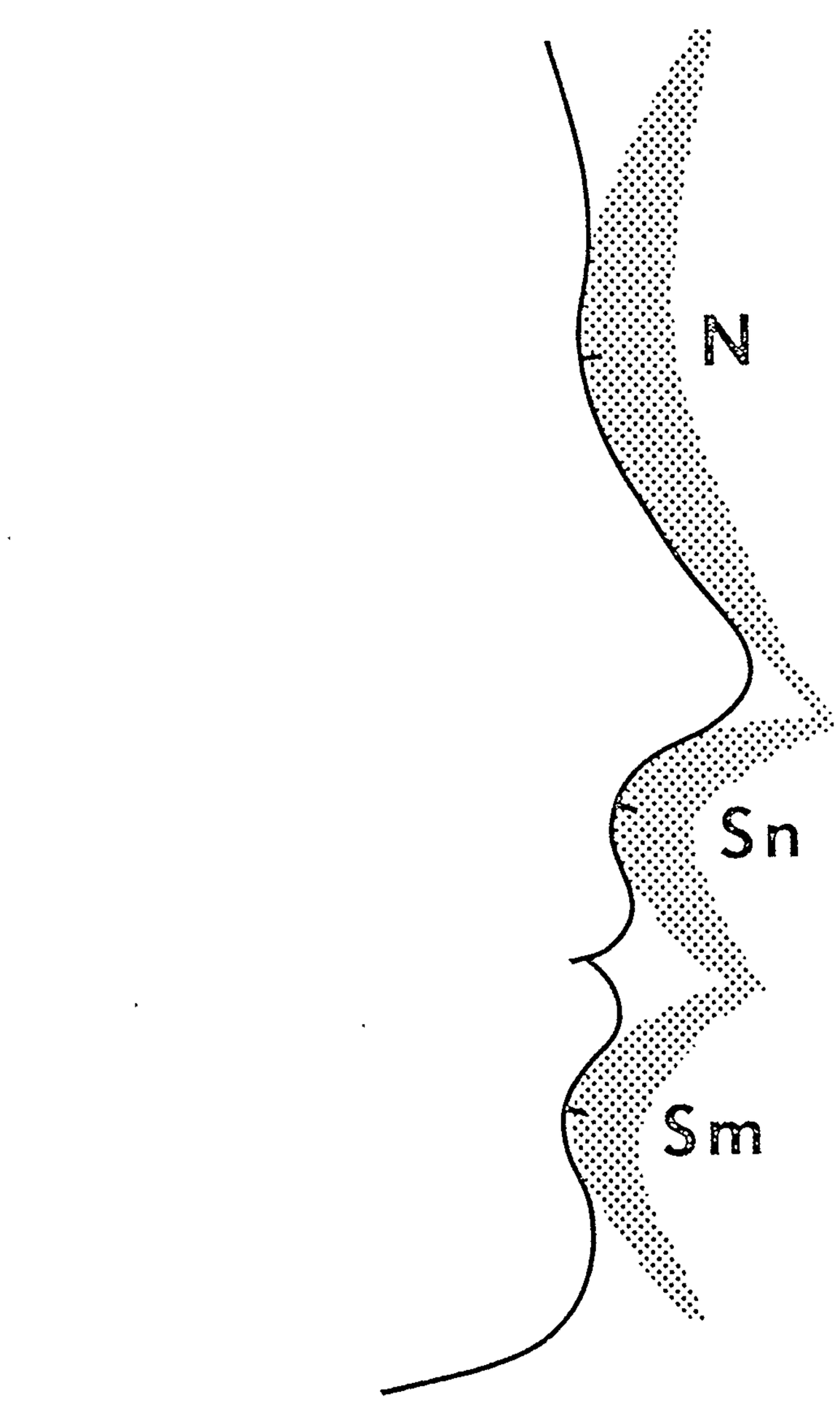


Figure 3.11. Facial harmony: the relative profile concavity observation at Nasion (N), Subnasale (Sn) and Supramentale (Sm) affects total profile harmony (from Peck and Peck, 1970).

3.2.2. Vertical Relationship of Facial Profile

The Apollo Belvedere has been widely accepted as ideal in form with features which are in harmony and balance. In addition to this form, its proportions could be readily analysed, the combination inspiring an almost mathematical concept of beauty.

The mathematical assessment of beauty is based on the assumption that an object conforming to an accepted formula of proportion will be beautiful. However, it does not follow that a beautiful object necessarily conforms to any established formula. Thus, the significance of proportion in the beauty of form cannot be totally dismissed. According to Powell and Rayson 1976, Osborne stated that

> "it is accepted that an intuitive sense of proportion - in some meaning of the term - is one of an artist's most important assets"

Burstone (1967) believed that from an esthetic point of view, the relative length of the upper lip to stomion - gnathion (Fig. 3.12) should be a ratio of 1 to 2. Some facial disharmonies were vertical in nature and were associated with a disproportion in the ratio between the upper lip and the area comprising the lower lip and chin.

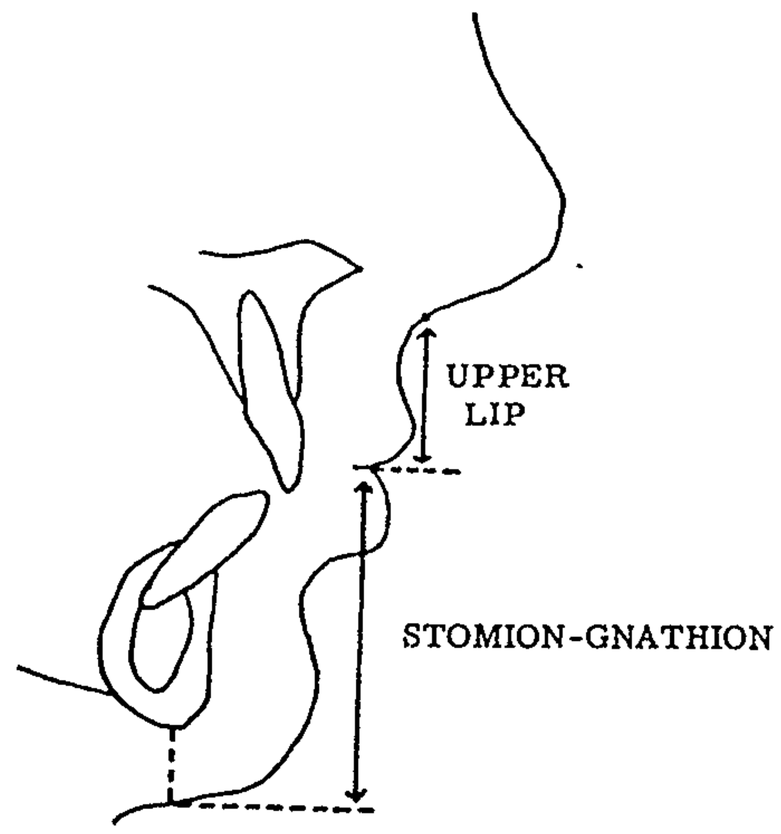


Figure 3.12. Vertical measurements of lip. Upper lip length and lower lip length (from Burstone, 1967).

Samson (1974) agreed that for the best profiles, the lip-line should be at one-third the way down between nose and chin.

Peck and Peck (1970) used the nasal angle (Na), the maxillary angle (Mx), and the mandibular angle (Mn), in the determination of a well-proportioned face (Fig. 3.13). They found that the nasal angle was 23.3 degrees with a range 20-27 degrees; the mean maxillary angle was 14.1 degrees with a range of 12-17 degrees; the mean mandibular angle was 17.1 degrees ranging from 14 to 20 degrees. They also found that the total vertical

(TV) dimension from nasion to pogonion had a mean value of 54.5 degrees with a range of 47 to 62 degrees.

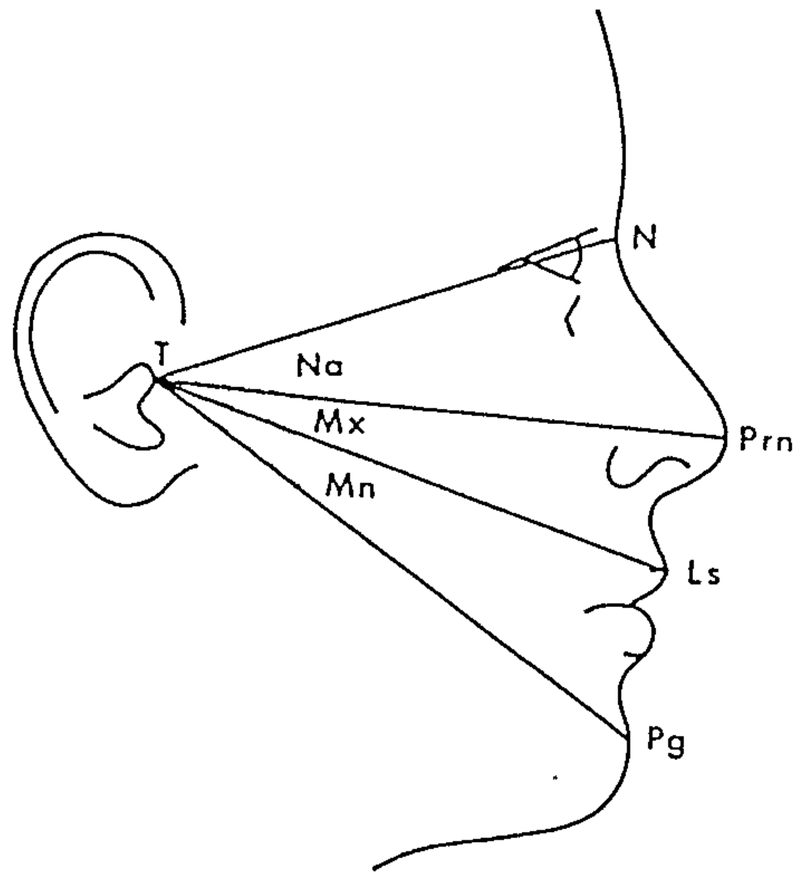
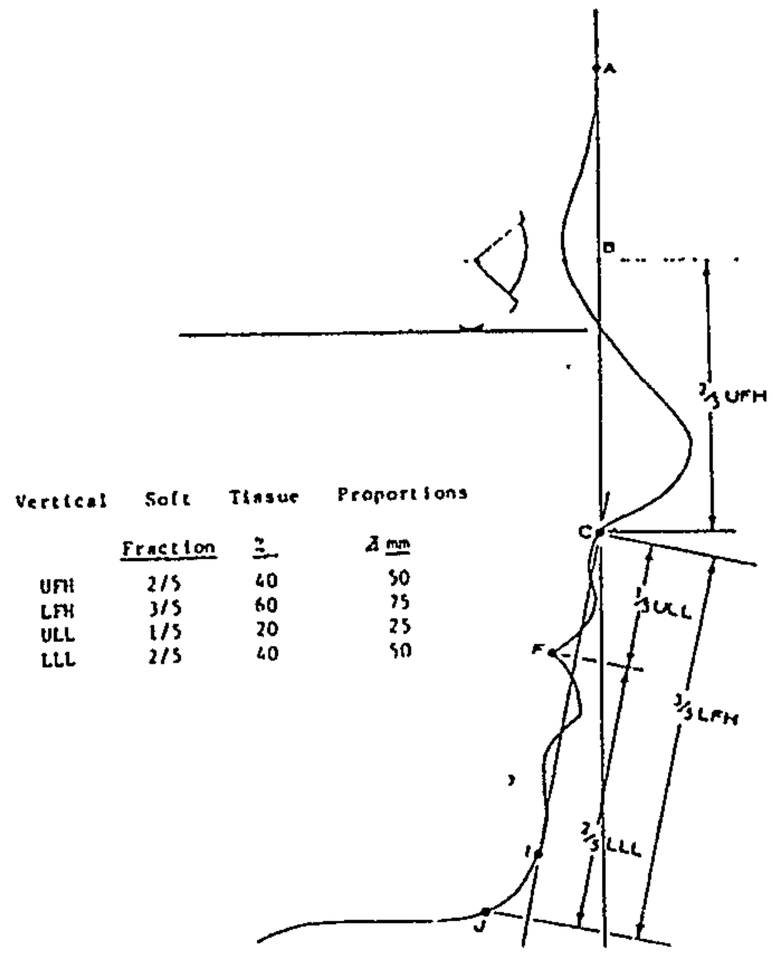


Figure 3.13. Nasal angle (Na) measures nasal height from nasion to pronasale; the maxillary angle (Mx) measures maxillary height from pronasale to labrale superius; and the mandibular angle (Mn) record mandibular height from labrale superius to pogonion. The vertex of all these angles is at tragion (from Peck and Peck, 1970).

Cuteliffe (Worms et al., 1976) suggested a general rule of thumb of the soft tissue vertical proportions: the total facial height between eye and soft tissue menton can be divided into fifths. The upper facial height (eye - subnasale) is 2/5, the upper lip length (subnasale - stomion) is 1/5, and the lower lip length the remaining 2/5. Another

proportionality that is helpful in assessing the lower facial height (subnasale - menton) is that the upper lip length is one half of the lower lip length (Fig. 3.14).



Vertical	Soft Tissue Proportions		
	Fraction	%	Δ mm
UFH	2/5	40	50
LFH	3/5	60	75
ULL	1/5	20	25
LLL	2/5	40	50

Figure 3.14. Vertical soft tissue proportion. UFH, upper facial height; LFH, lower facial height; ULL, upper lip length; LLL, lower lip length (from Worms et al., 1976).

Legan and Burstone (1980) assessed the soft tissue anterior facial proportionality in the vertical dimension by taking the ratio of middle-third facial height to lower-third facial height measured perpendicular to the horizontal plane. They suggested that the ratio of the distances G-Sn and Sn-Me' should be

approximately one-to-one in the acceptable normal people (Fig. 3.15).

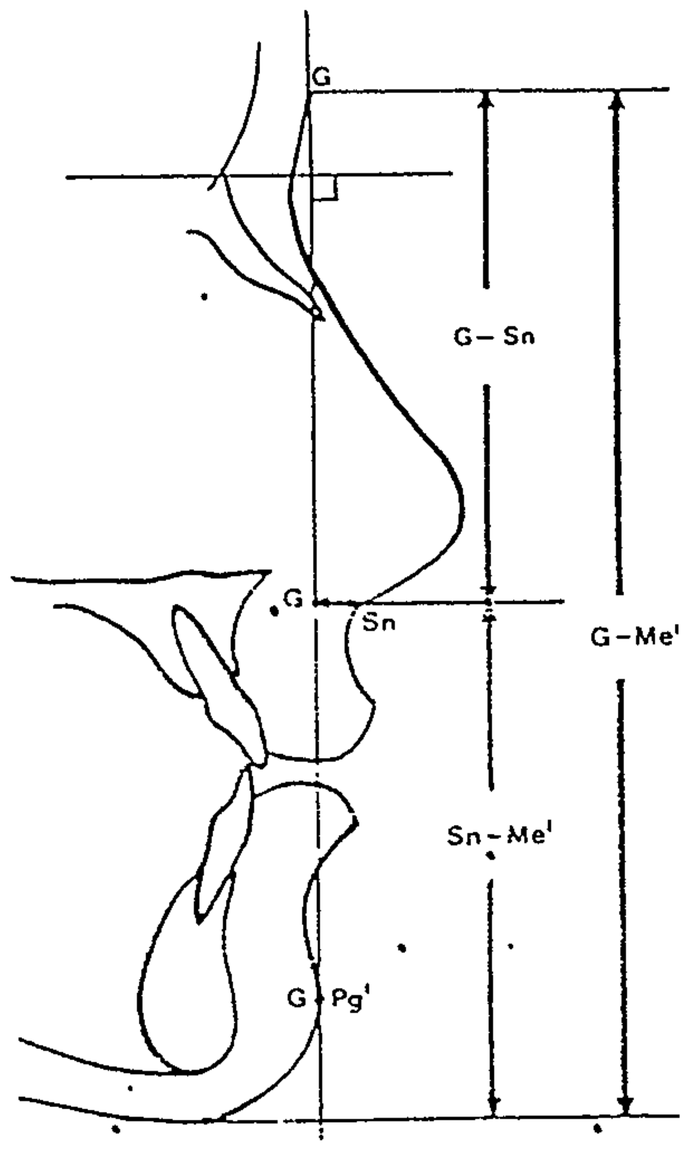


Figure 3.15. Vertical facial height proportionality (G-Sn/Sn-Me') should be one-to-one in adult people (from Legan and Burstone, 1980).

Ricketts (1981, 1982) applied the "golden mean", 1:1.618 proportional ratio in the profile aspect. It was based on the "Golden section", also called the "Divine Proportion". Upon widening the divider, the longer side is 1.618 times the shorter side, and the

shorter side is 0.618 the length of the longer. From Fig. 3.16, Ricketts applied the golden divider to the eye - nose - chin for facial height. Recording the chin to nose rim as 1.0, the eye to the chin is 1.618 in beautiful facial profile. In Fig. 3.17, the golden divider shows the proportion of ala of the nose - lip embrasure - chin to determine denture height in lip position. The distance from nose rim to lip embrasure is .618, the distance from lip embrasure should be 1. Inversely the bottom of chin to mouth is 1, the bottom of chin to nose rim should be 1.618 in the good proportion denture height and lip position.

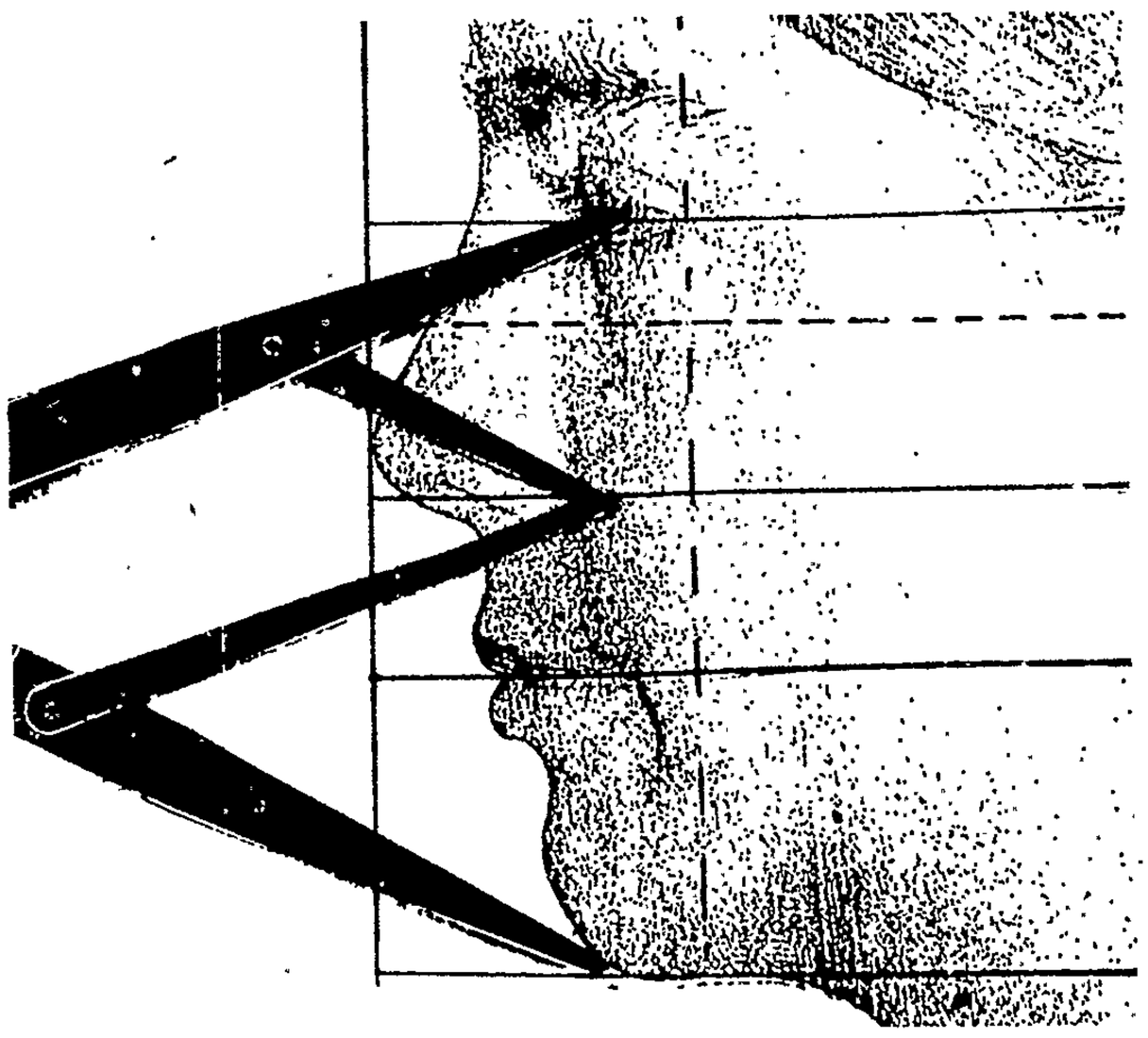


Figure 3.16. Golden proportion from eye - nose - chin (from Ricketts, 1981).

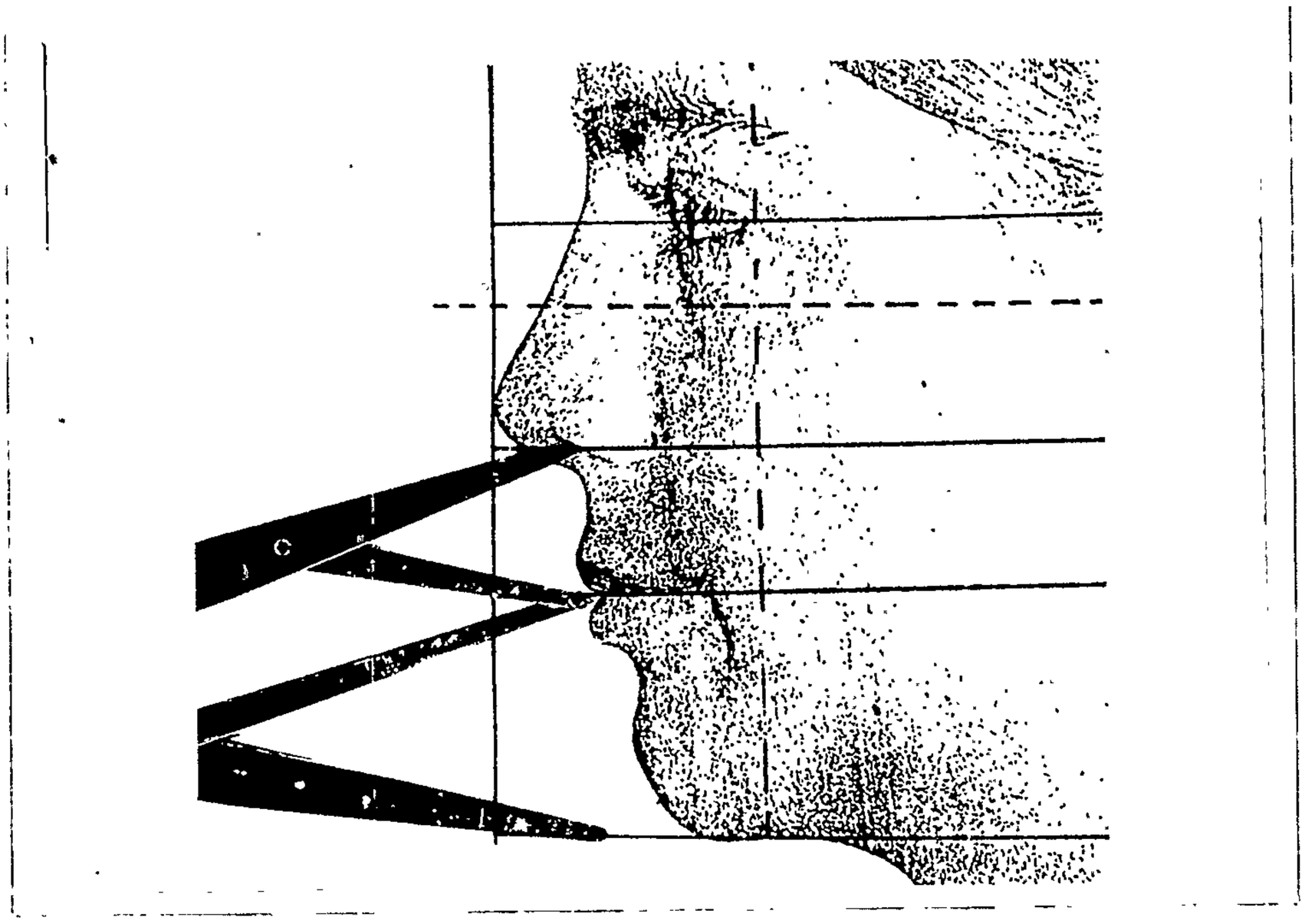


Figure 3.17. Golden proportion from nose - mouth - chin (from Ricketts, 1981).

3.3. Lower Facial Profile Assessment

Other aspects of the soft tissue analysis should be given attention, such as, the regions of the soft tissue on the lower face. These regions have been measured in a variety of ways.

Holdaway (1956) suggested as a reference line for profile assessment, the straight line that was drawn from the point of the soft tissue chin tangent to the upper lip to create an angle with the line NB. This angle can be measured and used for soft tissue diagnosis.

Holdaway believed that if the ANB angle is 1 to 3 degrees, his "H" angle should be 7 to 9 degrees, to produce the pleasing profile. If the ANB angle is greater or smaller than 1 to 3 degrees, the same amount is added or subtracted from the "H" angle (Fig. 3.18).

Ricketts (1957, 1960) had suggested a line which was drawn from the chin to the tip of the nose (Fig. 3.19) which he had termed the "Esthetic plane". It was employed for the purpose of establishing the relationship of the mouth to the other profile structures.

Ricketts (1968) also noted that most people object to lips that protrude beyond the E-plane. Lip prominence seemed to be an undesirable trait and an unacceptable situation, particularly in the adult. Fullness of the lips and mouth prominence are characteristics of the young. In Caucasians, by adulthood, the lips should be contained within Esthetic plane. The mouth should be closed without strain, and the contour of the lips should be smooth. The lower lip should fall slightly (2 mm) ahead of the upper when related to this line.

Steiner (1960) had suggested "S" plane (Fig. 3.20) that was drawn from the chin to the middle of the "S" formed by the lower border of nose and the upper lip. He believed that the lips often fall on this line, and that

lips ahead of it would on average be too full, whereas those falling behind it would give too flat an appearance as related to other parts of the profile.

These analyses, in which the lip position is more defined, would take into consideration a large or small nose and a large or small chin and would harmonize them with the lips.

Nevertheless, Hambleton (1964) examined the relative values of Rickett's esthetic plane, Steiner's "S" plane and Holdaway's "H" line used for soft tissue diagnosis. He found the "H" line to be the most practical approach to soft tissue appraisal.

This result was supported by Anderson et al. (1973), who studied serial cephalometric of the changes in soft tissue occurring during and following orthodontic treatment of severe skeletal discrepancy cases.

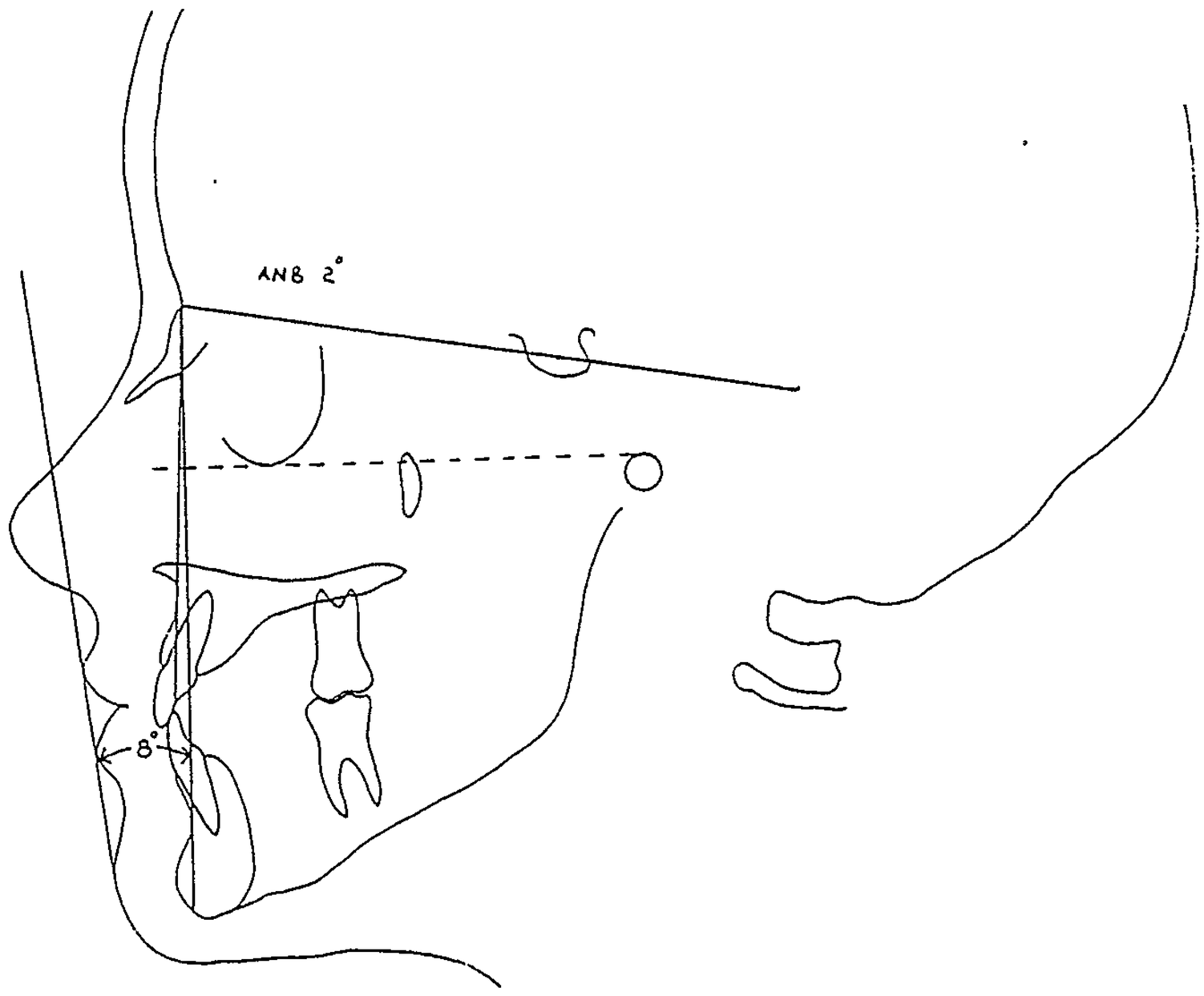


Figure 3.18. Holdaway's "H" line (from Hambleton, 1964).

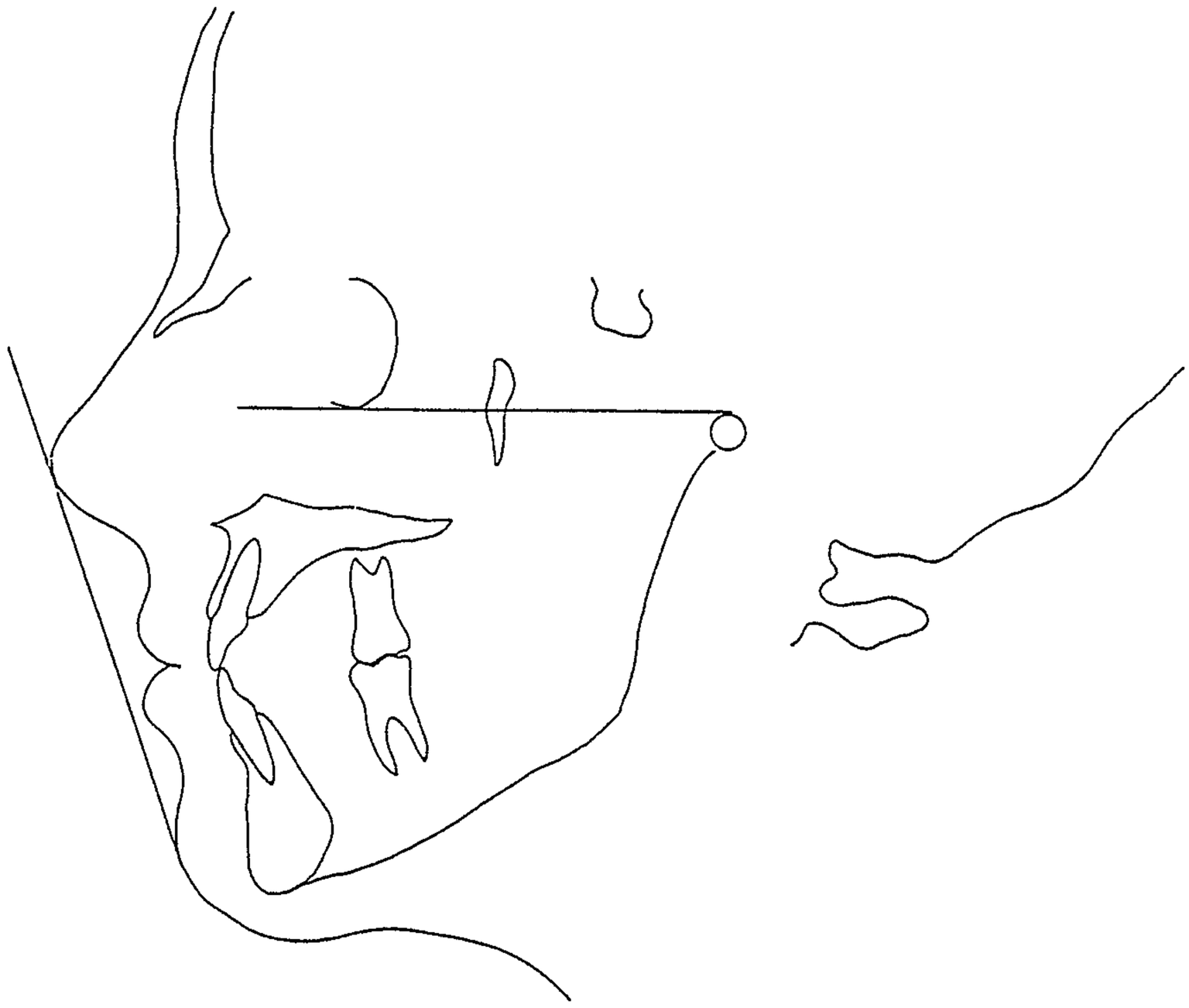


Figure 3.19. Rickett's law of lip relationship (from Hambleton, 1964).

Figure 3.20. Steiner's plane or "S" line (from Hambleton, 1964).

In 1966, Merrifield suggested the line that was drawn tangent to soft tissue pogonion and to the most procumbent lip (upper or lower lip, whichever protruded the most anteriorly) and extended superiorly until it intersected the Frankfort horizontal plane was designated "the profile line". An angular measurement used was the inferior angle formed by the intersection of the Frankfort plane and the profile line. He has termed this angle as the "Z" angle. Merrifield believed that the "Z" angle and profile line gave a critical description of the lower face relationship and eliminated the vagueness of "eye judgement". The lip position can be judged accurately by relating it to the profile line. The upper lip should be tangent to the line. The lower lip should be tangent or slightly behind the profile line. The "Z" angle should be 81.4 degrees in normal mean profile (Fig. 3.21).

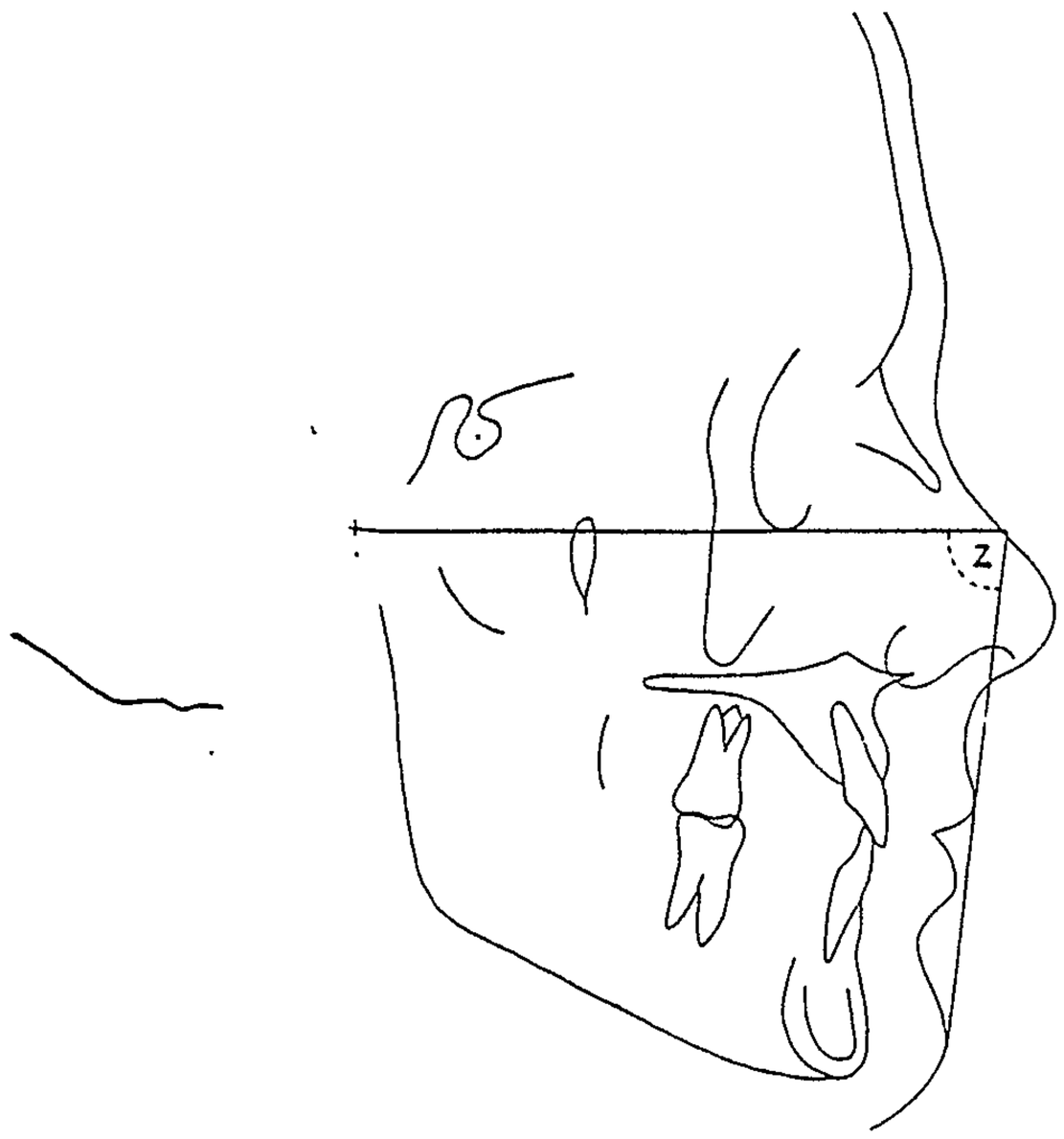


Figure 3.21. Measurement used for the "Z" angle value (from Merrifield, 1966).

According to Burstone (1967) in any discussion of the anteroposterior posture of the lip, a plane that can be used for evaluating the relative protrusion or retrusion of the lip is a line connecting subnasale and soft tissue pogonion (Fig. 3.22). In a normal adolescent sample, the upper and lower lip fall forward of the subnasale - pogonion plane, the upper lip on the average is 3.5 mm anterior to the line and the lower lip lies 2.2 mm anteriorly.

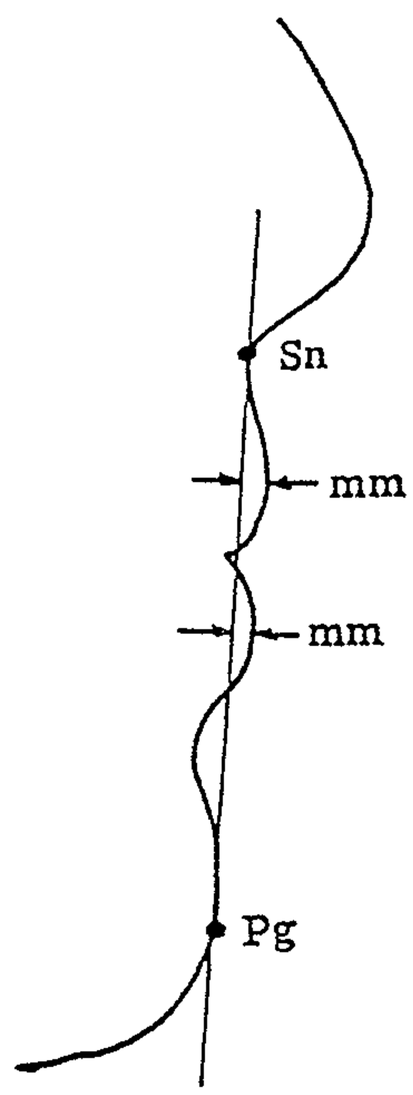


Figure 3.22. Horizontal lip posture. Lip protrusion is measured perpendicular to subnasale - pogonion plane (from Burstone, 1967).

Planes of reference other than subnasale - pogonion had been suggested by Burstone to evaluate the protrusion or retrusion of the upper lip. For instance, an angular

reading could be employed to measure the upper lip protrusion, by measuring the intersection of the line subnasale - labrale superius with the palatal plane (Fig. 3.23). Normally the lip is slightly flared, forming an angle of 97.5 degrees with the palatal plane.

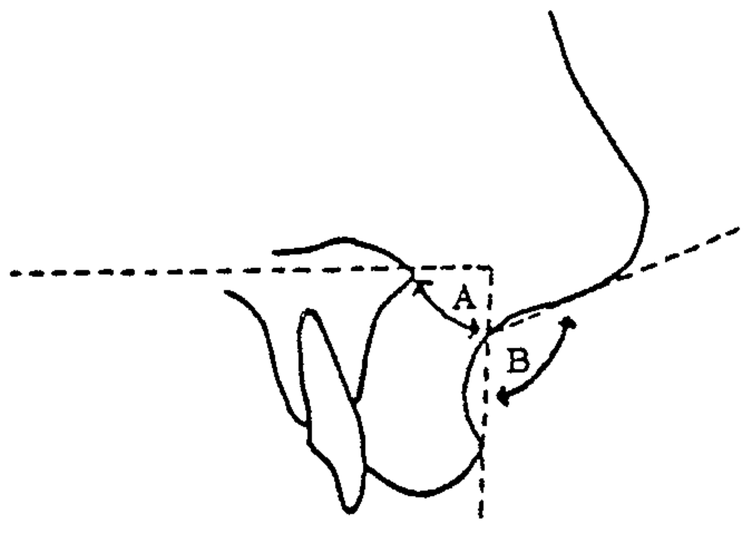


Figure 3.23. Angular reading of upper lip protrusion. A, upper lip inclination angle; B, naso-labial angle (from Burstone, 1967).

From an esthetic viewpoint, Burstone also indicated that the measurement of the protrusion of the upper lip to the inferior border of the nose was provided by the nasolabial angle. It was formed by the intersection of a line, originating at subnasale, tangent to the mean of the lower border of the nose and a line from subnasale to labrale superius. A typical nasolabial angle is approximately 106 degrees.

Holdaway in 1977 stated that the sulcus or the curvature of the upper lip is one of the most important

factors in the evaluation of the integumental profile. He concluded that the sulcus should be about 5 mm in depth, when measured in relation to the "H" or Harmony line (Galvao and Madeira, 1981). Galvao and Madeira also showed that the depth of the sulcus of the upper lip in a person with harmonious facial profile was close to the Holdaway ideal 5.9 ± 1.8 mm (Fig. 3.24).

The relationship between depth of this concavity co-ordinated with the pattern of the facial profiles is important for the clinician to eliminate the vagueness of "eye judgement". Understanding, before treatment, the soft tissue facial profile status allows a determination whether the treatment procedures will maintain or alter it by the moving of the dentoskeletal structures.

Lines et al. (1978) studied profilemetrics and facial profile silhouettes which were observed by each of the various groups of subjects at unlimited time intervals. Each series was preceded by an explanatory drawing demonstrating the specific angle with which that series of profile choices was concerned. Each subject was asked to mark a ballot to indicate the profile he thought best exemplified the ideal angulation for the series. They indicated that the female's chin was in the same plane as one would construct from a point bisecting the columellar length and touching labrale superius and inferius, or the chin was slightly ahead of the nasolabial plane in the range of 0 to ± 4 degrees. They also indicated that the

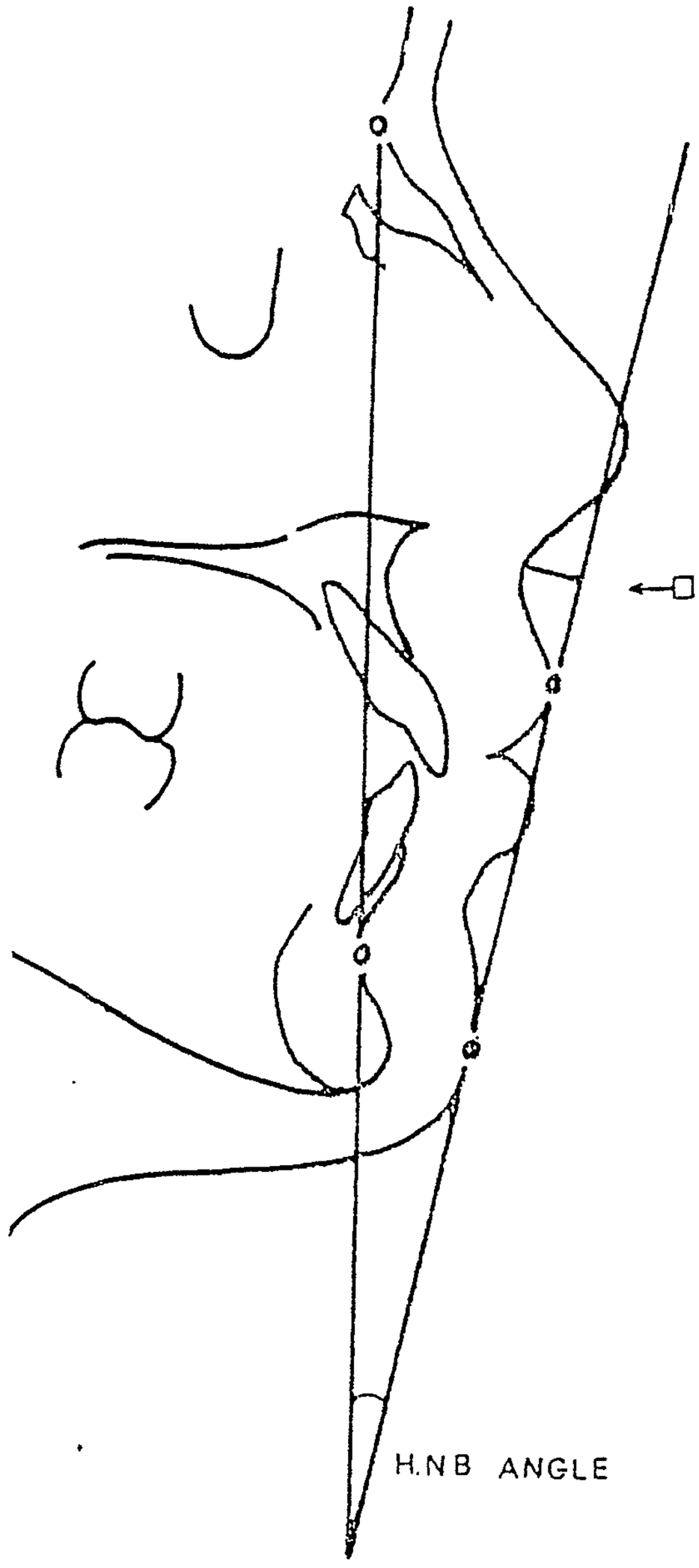


Figure 3.24. Cephalometric drawing showing the H.NB angle and the depth of the upper lip sulcus (arrow) (from Galvao and Madeira, 1981).

nasolabial angle and inferior labial angle in the female ideal profile are in the range of 90 to 110 degrees, and 110 to 134 degrees respectively.

3.4. Age, Sex, and Growth Related to Profile Characteristics

Hellman (1932) showed sex differences in the profile of the patient; the female patient was more prognathic than the male patient of the same age in the soft tissue profile. He also demonstrated that there are three factors which contribute to the changing of the face from infancy to adulthood: increase in size, change in proportion, and adjustment in position. These changes continued in boys after they had ceased in girls (Hellman, 1935).

Bjork (1947) used cephalometric study on the 12 and 20 year olds. He had summarized that the characteristic of bony profile change with age can increase prognathism of maxilla and mandible, but the increase is greater in the mandible than in the maxilla. Thus, the boy's profile becomes straighter with age.

Alfred and Baum (1951) studied and compared the dento-facial pattern of 31 boys and 31 girls with a group of the young adults appraised by Downs (1948). It was found that the face of a child 11-14 years old with good occlusion did not present the same proportions as the face of a

young adult. It was shown that during this age span the female facial pattern was less convex than the male facial pattern. The female 11-14 years of age was more similar to an adult dentofacial relationship than the boys.

Baum (1961) indicated that there are structural and proportional differences between young and mature faces, and the timing of the change depends on the sex of the individual. The developmental facial pattern begins and ends earlier in girls than in boys, and still progresses further in boys. The adult dentofacial relationship differs from the child in that the adult has a less convex face, a less protrusive denture with more upright incisors and more prognathic mandible.

Subtelny (1959) pointed out that the convexity of the skeletal profile tends to decrease with age, while the convexity of the total soft tissue including nasal structures tend to increase with age. The convexity of the soft tissue profile excluding nasal structure tend to remain relatively stable, showing changes of minimal magnitude with increments in age.

Burstone (1959) found that protrusion of the upper lip from sulcus increases with age, but the curl of the lower lip shows significant decrease with age, and the total face becomes less convex.

He also noted that the soft tissue mass of the face demonstrates sex differences. In the young adult there is no apparent difference between the sexes in the thickness of soft tissue covering the forehead. In the lower face where the development of the orbicularis oris complex exerts its influence, significant differences are to be found. The soft tissue mass of all areas from subnasale to menton are thicker in the male. In particular, the horizontal value of the lower lip averages 3 to 4 millimeters greater in the male than in the female.

Vertical differences in the upper lip can be observed with respect to the skeletal points, subspinale and incision. In the male, the superior labial sulcus and stomion are found to be in a more inferior position.

Anderson et al. (1973) found that soft tissue thickness over pogonion increases with age, and that nose length when measured to the facial plane increases 4.8 mm in males and 1.8 mm in females in the 13 to 28 year age group. They also found that the soft tissue profile is dependent upon, and closely related to, the dentoskeletal profile.

Lines et al. (1978) found that the inferior labial sulcus angle preferred deeper mentolabial groove in men than women. In males greater chin prominence was noted than in females.

Sarnas and Solow (1980) studied longitudinally early adult change in the facial profile from 21-26 years of age in a Swedish Caucasian sample of 50 females and 101 males by using lateral cephalometric radiographs.

They demonstrated that the magnitude of linear dimensional change of skeletal and soft tissue profile was similar in the two sexes.

The largest changes were found in the vertical dimensions. Total anterior facial height increased by about 1.5 mm in the 5-year period, suggesting that the major part of the increase in vertical facial dimensions during the third decade of life takes place in the first half of this decade. Sagittal jaw relationship increased by about 0.5 degrees in both sexes. Soft tissue changes reflected those of the vertical skeletal dimensions.

Spradley, Jacobs and Crowe (1981) had studied the anteroposterior position of soft tissue profile landmark inferior to the nose in young adults exhibiting pleasing facial profile, and normal sagittal and vertical skeletal relationships. They found that the subnasale vertical constructed from the true horizontal may be a good tool for assessing the anteroposterior contour of soft tissue profiles. Their study tended to support the view that the male chin was not actually more prominent than the female, but only appeared to be more prominent because the lips

are not as full and the labial sulci are more pronounced.

Therefore, in general, females have slightly fuller lip regions and shallower labial sulci than males, and chins that are at least as relatively prominent as the males.

3.5. Relationship of Hard Tissue and Soft Tissue

According to Angle (1907) the important point of esthetic objectives in orthodontic treatment was that the upper incisor position is more important than the lower in establishing facial balance. He also stated that it was the upper teeth, not the lower, that established the curve of the lower lip.

Stoner (1955) established a method of evaluating the facial profile. The result of his study indicated that the chin position did not greatly affect the over-all facial balance, and the soft tissue profile was not related to the underlying skeletal structure.

Burstone (1958) showed that the soft tissue profile did not closely relate to the hard tissue profile due to varying thickness. He suggested that "Increasing or decreasing vertical dimension would obviously have an influence on soft tissue structure".

Sassouni and Nanda (1964) stated:

"Facial balance is of cardinal concern to health specialist, not only because many vital organs are concentrated in a circumscribed area but also because of the social value of the face".

In the two dimensions of space in which the human profile is examined from a lateral aspect, the evidence accumulated indicates that facial balance, harmony or proportion are related in some degree at least to the underlying skeletal and dental pattern of the individual. The relation of the maxillary and mandibular apical bases in an anteroposterior dimension, the degree of the convexity of the skeletal pattern of the face, and the relation of the anterior teeth to the face and to their respective apical bases have a marked influence on the soft profile outline (Riedel, 1950).

Burstone (1967) felt that lip protrusion in Class II, Division 1 malocclusion was the result of the combined effects of axial inclination of upper incisors, the adaptation of the upper lip to the incisor, and the thickness of soft tissue.

Bloom (1961), in a study of adolescent boys and girls reported a high correlation of the relationship of maxillary central incisor changes to the superior sulcus and upper

and lower lips. He also found strong relationship of the lower incisor to the inferior sulcus and the lower lip. Bloom noted that it was possible to predict the perioral soft tissue profile change in relation to the expected amount of the anterior tooth movement.

Anderson et al. (1973) studied a serial cephalometric of the changes in the soft tissue profile occurring during and following orthodontic treatment on severely affected persons.

They found that soft tissues of the facial profile were closely related and dependent on the underlying dento-skeletal framework. Orthodontic treatment resulted in a reduction of dentofacial protrusion with both upper and lower lips becoming less procumbent during treatment. This alteration in position was related to the lingual movement of maxillary and mandibular incisors.

They also found that males showed significantly more growth than females in soft tissues of the nose, base of the upper lip and chin.

Koch et al. (1979) demonstrated that in treatment with fixed appliance following premolar extraction, the soft tissue profile did not directly reflect the change in the underlying skeletal profile. There was great variability in response of the soft tissue to the

retraction of the upper incisor and, in general, retraction of the upper incisors was greater than the corresponding retraction of the upper lip.

Waldman (1982) studied the cephalometric analysis of the influence of hard tissue changes on lip contour. He found that the nasolabial angle was increased with uprighting (lingual tipping) of the incisors.

Rains and Nanda (1982) studied the response of upper and lower lips to maxillary and mandibular movement in 30 late adolescent and early adult female patients. They found that the lower lip was more variable than the upper lip to differences in the upper incisor movement. The upper lip at labrale superius was found to be more variable with increased retraction of the upper incisors. From their prediction equation, change of sulcus superius had more direct relationship with retraction of labrale superius and labrale inferius than with dental movement. The upper lip response was related to both upper and lower incisor movement, mandibular rotation and the lower lip. The upper incisor point position related a moderately high correlation for the prediction equation for change in labrale superius.

Thus the diagnosis and assessment of facial profile do not only relate the profile component factors to standard lines and angles but also to age, sex and growth.

CHAPTER 4

SYSTEM FOR PROFILE PHOTOGRAPHY

Lateral profile views, especially the soft tissue profile that can be obtained from a lateral cephalogram, have been used extensively in orthodontics (Merrifield, 1966; and Tweed, 1944).

Investigators have used a variety of approaches with this basic technique. Downs (1956), Ricketts (1964), and Subtelny (1961) had made serial tracing from the collection of radiographs.

Margolis (1947), studying basic facial pattern, demonstrated a method of relating the anatomic and soft tissue structures to the facial profile by superimposing profile photographs over lateral cephalometric radiographs.

Stoner (1955), Peck and Peck (1970) had also used superimposing cephalometric on profile photographs. They indicated that utilizing standardized photographs for a profilometric analysis can be used to focus attention on the important structural characteristics of the esthetically pleasing profile.

However, many investigators had used only a single profile for study. In the study by Poulton (1957), he used lateral facial photographs of 28 boys and 37 girls with single side for rating facial esthetics.

Tweed (1944) used only left side profile in his study. In the opposite way, Peck and Peck (1970) preferred to record profile that was placed in a Margolis cephalostat in both the frontal and right profile position.

On the other hand, Schwartz (Haupl et al., 1952) recommended that one side of the face is rarely symmetrical with the other, and he also stressed the need for orthodontists to obtain both left and right profile views. Schwartz developed a fixed mirror system with mirrors at right angles to each other on a wall so that he could take profile and anterior views together in a single exposure.

Brodbelt (1978) developed the mirror system that consisted of two plain mirrors, supported in a hinged holder. The bracket arm limited the opening to 95 degrees, thereby preventing reflections from an electronic flash. There was a horizontal black line across the mirror surface that could be used to standardize and calibrate the orientation of the mirrors by alignment to the Frankfurt plane. When the mirrors are used, the patient has to hold the mirrors on his shoulders (as shown in Fig. 4.1).

The experiment now being reported has used a modified Brodbelt mirror system, using a mirror system that consists of two plain mirrors, supported in a hinged holder. The hinged holder is attached on a supported track and it can slide up and down for adjusting

position. The bracket arm limits the opening to 90 degrees in order that the profile image is equal in size to the frontal view image. Two electronic flashes are used on the right and left side of the camera to prevent reflections which would result with use of one flash (Fig. 5.3). The horizontal black line was drawn across the mirror surface to calibrate the orientation of the mirror by alignment to the Frankfurt Horizontal plane (Fig. 4.2).

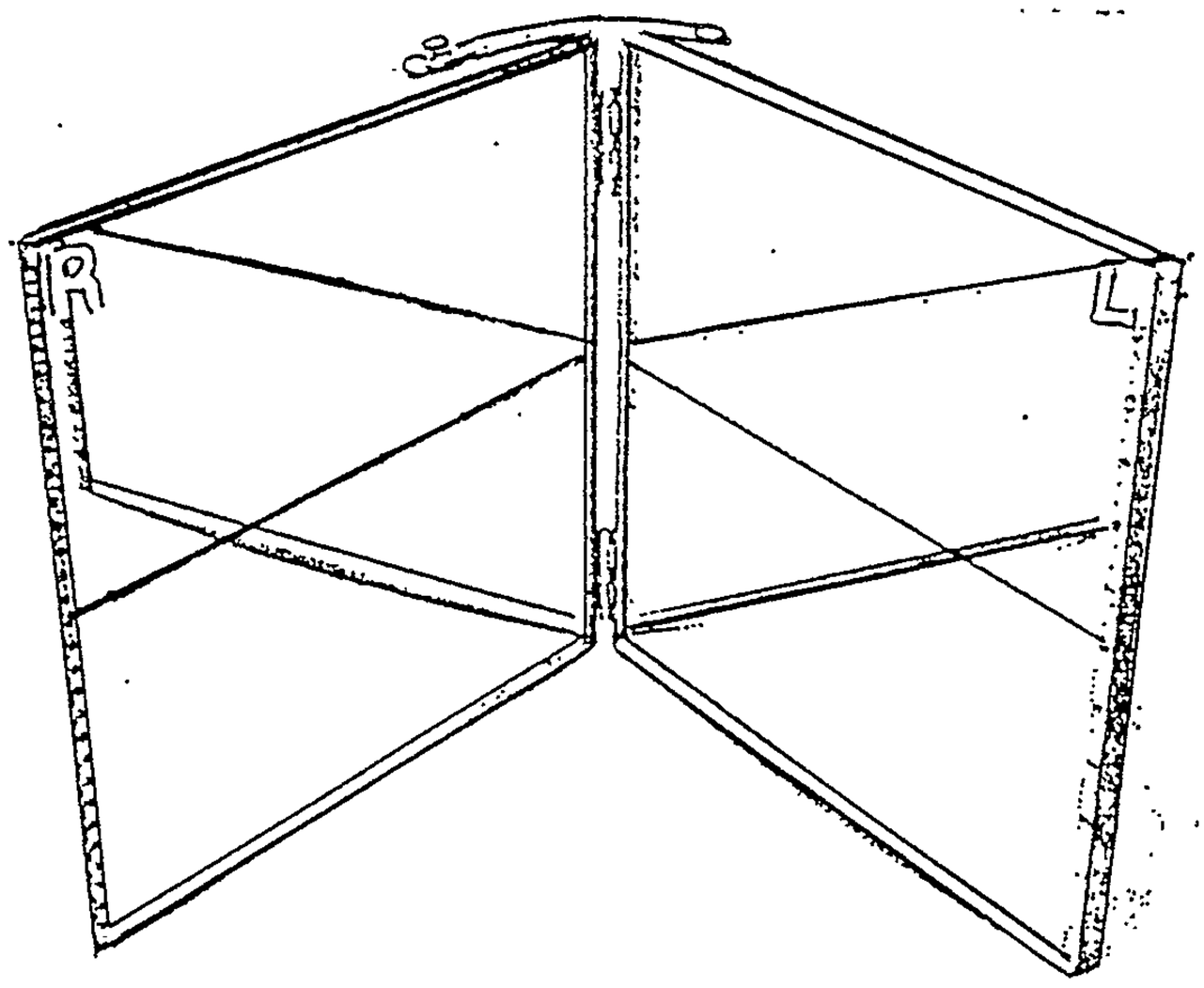


Figure 4.1. Brodbelt's mirror system (from Brodbelt, 1978).

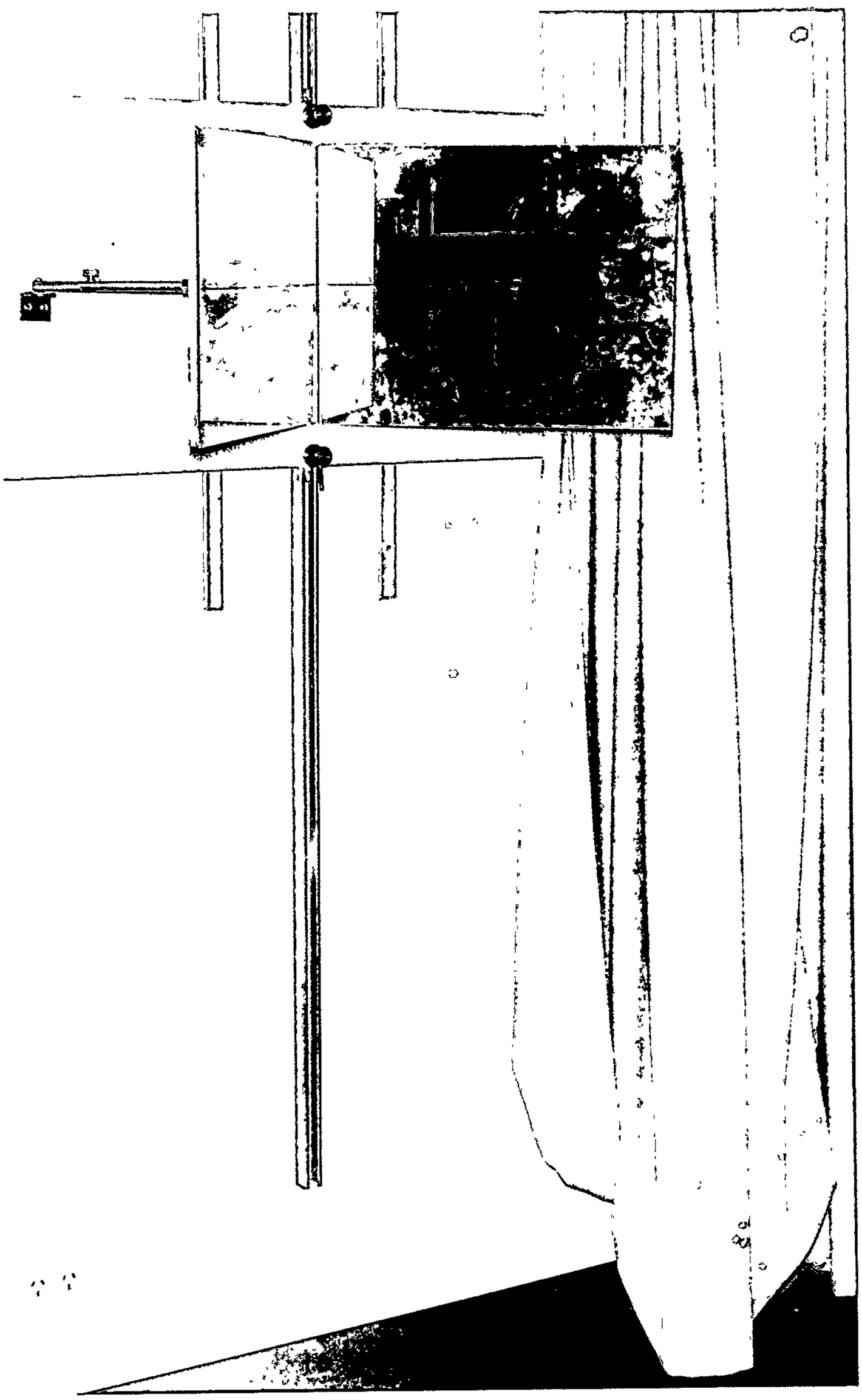


Figure 4.2. A modified mirror system in the present experiment.

SECTION 2

ORIGINAL WORK

Plato and Aristotle examined the meaning of beauty and developed the concept of esthetics as a study of beauty and philosophy in art. The qualities of measurement and proportion or harmony of structures were considered the essence of study (Peck and Peck, 1970).

The sense of beauty relies upon our visual acumen to a large extent. Classic Greek sculpture of facial esthetics appealed to many early orthodontists, but not in the sense of applying Apollo's attributes to every individual. The sculpture's importance was evident because of the balance and symmetry.

Wylie (1959) remarked that the layman's opinion of facial esthetics is most important, since it is not pre-conditioned through specialized training. He also demonstrated that general public express remarkable agreement in its judgement of facial profile.

The general American public of today appears to favour a more protrusive dentofacial pattern than most cephalometric analyses suggest as normal. It could be that the mass media may be significant in unifying the public's impression of facial esthetics. Therefore, while generalizations based on average add to our

information, such as those involving facial esthetics, the patients and the parents certainly should be consulted concerning the mutually desired esthetic outcome.

From another point of view, many investigators have recognized the importance of psychological factors in orthodontic treatment. Lewit and Viralainen (1968) found that motivation for orthodontic treatment among adolescents was related to several dispositional factors and social pressures. In addition to facial esthetics, motivation of orthodontic treatment emanates from the influence of the parents, peers and friends.

Therefore, this study can be divided as follows:

1) Experiment I(a);

2) Experiment I(b); and

3) Experiment II.

CHAPTER 5

EXPERIMENT I(a)

Many researchers have attempted to study the soft tissue qualities and quantities in esthetically-pleasing faces. It has been concluded that facial profile outlines are related to various factors. Peck and Peck (1970) wrote about harmonious profile flow, proportion and orientation. Maliniae (Lusterman, 1963) noted that the frontonasal angle at root of nose should be about 130-140 degrees in the ideal profile. The nasolabial angle, the inferior labial sulcus angle, the columellar length angle and chin prominence to upper lip - lower lip plane angle had been studied on an explanatory drawing, demonstrating the specific angle with which that series of profile choices was concerned by Line et al. (1978). E line of Ricketts is very commonly used for the consideration of the lip position (Ricketts, 1964). The vertical and horizontal proportion of the face are important factors for considering the profile too (Burstone, 1958, 1959).

The above values have been used by professional people in particular fields (e.g. orthodontist, plastic surgeon, oral surgeon ...). Many investigators attempted to correlate the standard values of orthodontic work for the general public's concept esthetics (Riedel, 1957).

However, the results of orthodontic treatment should be appreciated by the patients and their parents. Therefore, the aims of this experiment are:

1) to observe whether or not there is agreement among the patients, parents and orthodontist in profile preferences;

2) to observe the results of evaluation of pleasing profile by each group to determine whether or not they are close to the standard values.

5.1. Material

Material used in this experiment consists of two parts:

a) Experimental groups which can be divided into 3 groups:

i) Patient group: 120 female patients, 12-18 years old. All (of them) have received orthodontic treatment at the Dental Hospital (Sydney).

ii) Parent (Mothers) group: 104 female patients' parents, 33-50 years old, whose children have received orthodontic treatment at the Dental Hospital.

iii) Orthodontist group: 13 orthodontists and orthodontists-in-training who have treated orthodontic patients at the Dental Hospital.

b) A questionnaire sheet used by the different groups of judges as mentioned in the experimental group. Apart from identification of the subjects, the questionnaire consisted of two other parts. In the first of these other parts, the judges were asked to rank the silhouette profiles. Copies of 12 silhouette profiles were printed and supplied with the questionnaire. The remainder of the questionnaire provided an opportunity for the subjects or evaluators to record their own comments about the profiles which were shown to them (Figs. 5.1 and 5.2).

5.2. Example of Questionnaire Sheet in Experiment I(a)

PROFILE PREFERENCE

The following questionnaire is part of our survey to study the profile preference in various groups of Australians in Sydney (1982).

Please fill in the following spaces before answering the questions:

Situation.....(patient, parent or orthodontist)

Race.....Age.....Years.....Months

Sex.....(male or female)

Please rank the female profiles as shown on the following page from the most pleasing to the least pleasing perception, by recording the profile number of the profile pictures in the following boxes:

The most pleasing

☐
☐
☐
☐
☐
☐
☐
☐
☐
☐
☐
☐

The least pleasing

Please record any special comment you woula like to make about any of the profiles shown.

1. .....

2. .....

3. .....

4. .....

5. .....

Figure 5.1. Questionnaire sheet.

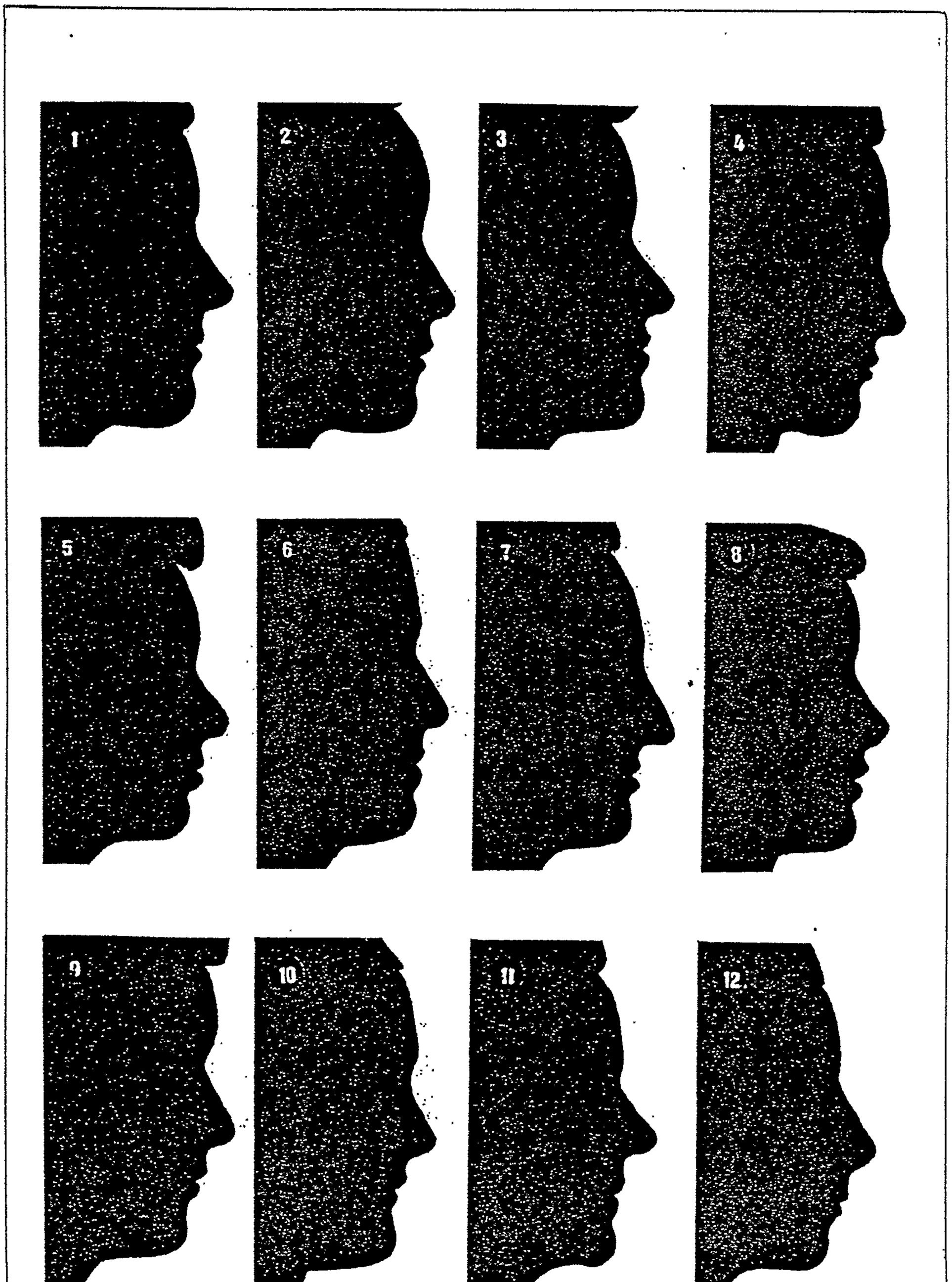


Figure 5.2. Twelve silhouette profiles of the samples.

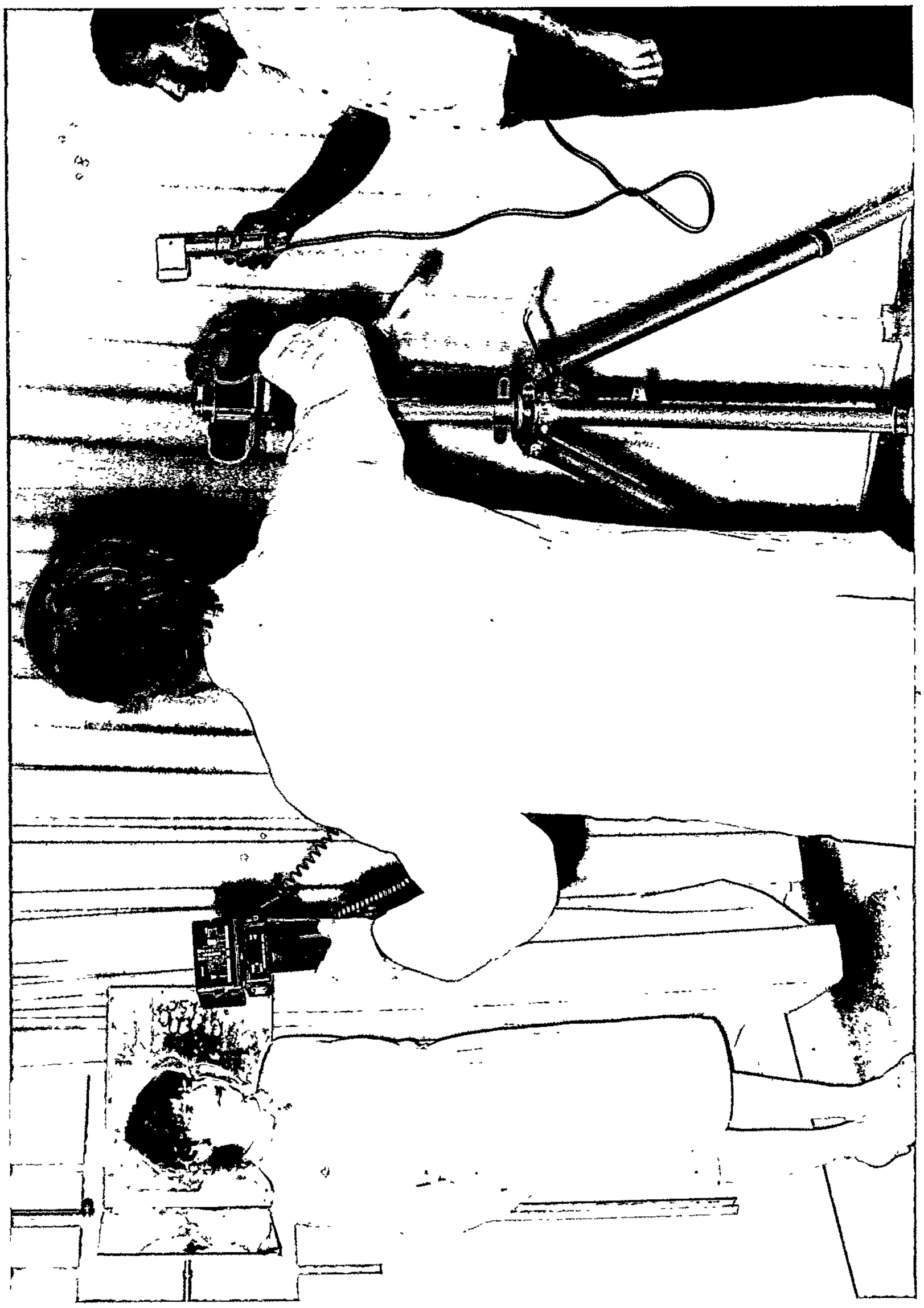


Figure 5.3. A standardized photographic instrument.

Figure 5.4. The picture of the sample profile is duplicated from the standardized photographic slide.

5.3. Criteria in Selecting Samples for Silhouette Profiles

a) Twelve female samples were selected from the patients, nurses, and staff of the Dental Hospital. These 12 female samples had total facial profile contours varying from slight facial convexity to slight facial concavity. They were chosen to provide as great a range as possible of the facial profile component factors (i.e. position of lip, sulcus of the upper lip depth, nasolabial sulcus angle, inferior labial sulcus angle, nose, etc....). Total facial profile contour can be considered by using Burstone's (1958, 1959), Glabella-subnasale-chin angle which should be -11±4 degrees for the range of the acceptable profiles.

b) In order to cover the range of the various types, the subjects were checked by measuring the traced profiles. The traced profiles were obtained by projecting photographic slides to paper on the wall to approximately life-size. Two profile samples for which the facial profile components are very close to the range of standard of the various angles in the ideal profile (references in (e)) in the 12 silhouette samples were used. The reasons for this were to test whether or not the most pleasing profile in each group (experimental group: patients, parents and orthodontists)

related to the approximately standard profile outline in the silhouette sample.

c) All samples were female, 15-27 years old. None was a "professional beauty".

d) Twelve silhouette profiles for ranking were selected in order to provide a wide range of profile outlines and so test the effective ranking of the judges.

e) The facial profile component factors that are considered to relate to the pleasing ideal profile are:

i) the nasolabial angle; this angle is attractive in the female as it approaches 90 to 110 degrees (Hind and Kent, 1972);

ii) lower lip to E-line by Ricketts (1964) is about -2±3 mm;

iii) upper lip sulcus depth to Holdaway line (Galvao and Medeira, 1981) should be 5 mm;

iv) inferior labial sulcus angle; this angle was measured at 122 degrees on the Greek sculpture and at 59.7 degrees, measuring the inside angle of living persons (Burstone, 1958). (One angle is the supplement of the other).

v) the relative chin prominence preference for general profile; this can be determined

according to the method of Burstone (1958, 1959) who established a mean for the angle between the intersection of chin-labrale superious and nasal columellar-labrale inferiorus of 0.5 degree. Lines et al. (1978) indicated the range of 0 to +4 degrees;

vi) vertical proportion (upper face height to lower face height) was indicated by Burstone (1958, 1959);

vii) columellar length angle should be 21 to 24.5 degrees as suggested by Lines et al. (1978). The Greek profile averaged 22.3 degrees.

viii) frontonasal angle should be 130 to 140 degrees, as proposed by Lusterman (1963);

ix) total facial profile contour should be -11±4 degrees as indicated by Burstone (1958, 1959).

(See Table 5.14 for analysis of the 12 sample silhouettes according to the above recorded standards).

5.4. Method of Silhouette Preparation

Method of a standardized photography

The colour slides were taken for 12 people by using the modified standardized mirror system of photography (from Chapter 4).

Each subject was arranged to stand in front of fixed right angle mirrors. The head was in the middle between the two mirrors. The subject was asked to look straight forward in a relaxed position. The fixed mirror assembly was moved up or down to position the horizontal line on the two mirrors to the approximate level of the right eye; and then the mirror bracket was fixed to the supporting vertical track. The subject was allowed to move out in order to adjust the level of the camera. A single-lens reflex camera was fixed on the tripod legs and set at approximately 2.3 metres from the mirrors. It was adjusted by fixing the level of the lens at the same level as the horizontal line on the mirrors and adjusted to provide symmetry on both the sides. The subject was told to come back and stand in the original position. The subject was asked to look at the camera and bite in centric occlusion. The lips were relaxed and lightly touched together during the standardized photographic procedure.

The method of drawing the profile from slides

a) Each slide was projected on the screen by a slide projector. The slide projector had been standardized by placing on table with the projection axis horizontal using a levelling gauge. The size of the projected slide image had to be adjusted to approximately the same size as the real profile by comparing measurement from the mirror assembly with measurement on the projected image. This means that the sample profile is reproduced life size.

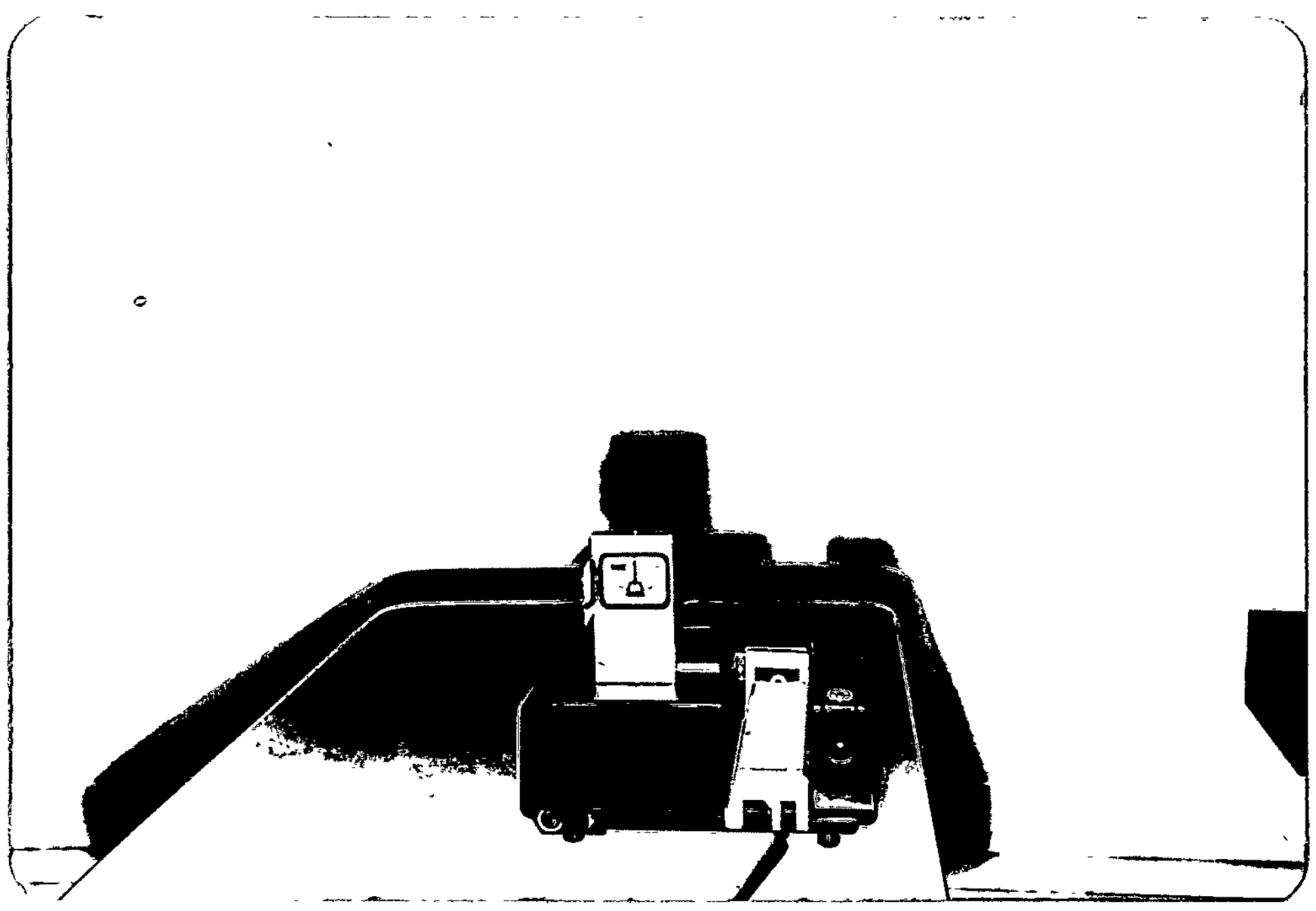


Figure 5.5. The method of drawing the profile from slides. (The indicator level is on the slide projector).

b) The horizontal level line was drawn on a sheet of drawing paper and this paper was superimposed on the wall screen. The horizontal line on the paper was adjusted to the same position as the horizontal line on the projected image. Then the right side screened profile was traced on the paper which had been secured to the wall screen. This represented the real size profile of the sample.

c) The representative profile tracing was reduced about 38.2% by a reducing photocopying machine in order to reproduce an appropriate size for the questionnaire sheet. The representative reduced profile was filled in using black ink.

5.5. Method of Statistical Analysis

a) The ranks are converted to scores according to the method of Fisher and Yates (Larmond, 1977) in order to normalize the data. Table A-1 of Appendix A is used to determine the scores given to each. Sample means can be computed.

b) Analysis of variance (Larmond, 1977) is used to determine the significance of any judgement of the sample among the observers. (It was not practicable for the observers to repeat the experiment).

c) Tukey's test (Larmond, 1977). This tests the significance of differences between the various steps in the rank ordering as determined by each observer group.

d) Spearman's rank correlation coefficient. This analysis can show how a series of rankings made by one person or one group can be correlated with a series of ranking made by another person or another group (Fraunhofer and Murray, 1976).

e) Kendall's "W" method is used for testing the degree of similarity among more than 2 sets of ranks of level for a quantitative variable measured at the ordinal level (Mendenhall et al., 1974).

5.6. Findings and Results

All data can be divided into three major groups: total patient group, total parent group, and orthodontist group. For each group, the raw data are transformed from the rank order to scores by Fisher and Yates' method (Larmond, 1977), as shown in Tables A-8, A-12 and A-13 of Appendix A. The reason for transforming data is to normalize the data. From 3 different groups, each sample mean can be computed as shown in Tables A-8, A-12 and A-13.

From Table A-8 of Appendix A, which records observation of the total parent group, the sample means are arranged according to magnitude in order of preference, as shown in Table 5.1.

The analysis of variance by Larmond (1977) can be carried out on such data (in Table A-8) by using the computer program (1)*. The variance ratio (F value) is shown on Table 5.2, and can be used to determine the significance of differences between samples.

* See page 157.