The Soft Tissue Profile, Growth And Treatment Changes

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Introduction

The improvement of facial esthetics has rapidly become one of the desirable objectives of orthodontic treatment. Despite this, present day concepts of what constitutes a favorable facial appearance are quite controversial in nature and have not been clearly formulated. In many instances evaluations of facial esthetics seem to be singularly influenced by the individual orthodontist's concept of a pleasing face.

At the present time it does not seem possible to devise a "prescription" for differentiating a desirable from an undesirable soft tissue facial profile. Whether such an analysis can be simplified to the degree that it has been done for the skeletal face, so that it may be offered for diagnostic purposes, remains strongly questionable. However, this should not prohibit the presentation of some reference information to guide the thinking and practice of the orthodontist. In his clinical capacity each orthodontist has numerous opportunities to enhance significantly facial appearance, and thus has a need for such reference information. It may be comfortable to think of the soft tissue as a drape over the facial skeleton; however, orthodontists can't relax in the assumption that an analysis of the skeletal profile will correlate directly with an analysis of the soft tissue profile. Therefore, if the orthodontist is to adapt his treatment to modifying facial appearance, it would seem important to know what changes will usually occur within the soft tissue profile as a consequence of growth. After all, it is the soft tissue that primarily determines the facial appearance of any given individual. It should also be stimulating to speculate relative to soft tissue changes which may be expected to occur as a direct consequence of orthodontic therapy and the resulting changes in the underlying hard tissue structures.

Changes Incident to Growth

A. The Skeletal Foundation. A consideration of changes in the skeletal profile, incident to growth, could add little to the vast reservoir of information already available to the orthodontist for use in diagnosis and treatment planning. However, it should be realized that a comprehensive knowledge of changes in the skeletal profile is necessary to provide a base line from which soft tissue profile changes can be assessed. Any description of changes in the soft tissue profile alone would not make it possible to specify how much of the total change results from soft tissue alteration and how much results from modification of the underlying skeletal structures.

In the past a good starting point in the interpretation of facial form has been an evaluation of the position of the skeletal chin. The mandible, forming the lower aspect of the face, makes a good skeletal reference structure from which the characteristics of the face

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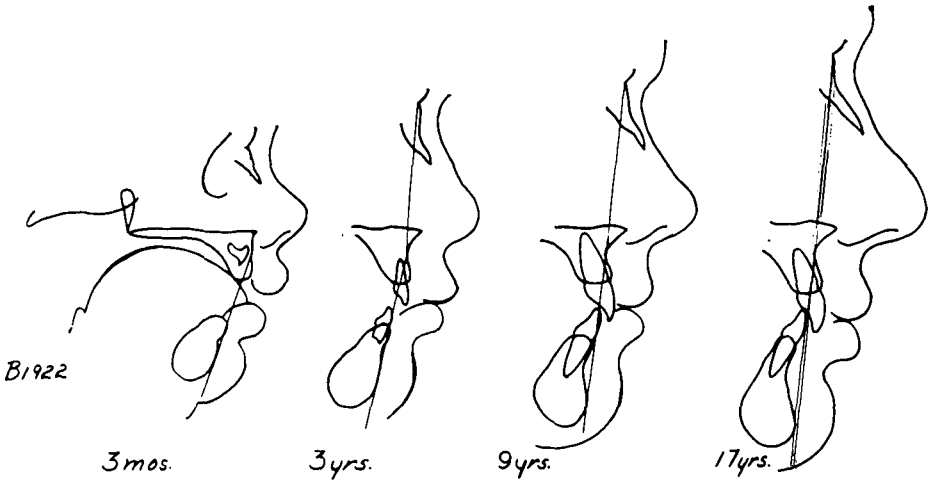

Fig. 1 Tracings of serial cephalometric roentgenograms of a case obtained from the files of the Bolton Study at Western Reserve University. Progressive forward positioning of the chin is evident.

could be formulated. Thus it would seem propitious to briefly consider changes in the position of the skeletal chin incident to growth. On the basis of many studies, [2-8] it can be safely stated that with continuing growth the chin will tend usually to assume a more forward position relative to the forehead and the more superior aspects of the skeletal face (Figure 1). Everyone is familiar with the fairly common facial appearance of most babies at the time of birth. Their chins are usually quite receded while there appears to be a more or less pronounced protrusion of the maxillary aspect of the face. With growth there usually is a marked transformation of the face. The general tendency seems to be for the mandible to grow from the more retruded to a less retruded position. This will usually be true regardless of the individual facial type at the onset and completion of growth.

Of course, differences in the degree of change in the position of the skeletal chin must be considered on the basis of sex as well as individual variation. For instance, it can be anticipated that over the years males will usually show a greater increase in mandibular prognathism. It should also be remembered that in males a significant proportion of the total changes occurring in lower face prognathism will be expressed during and after puberty. In contrast to this, females will usually show a proportionately smaller degree of mandibular development after puberty. Although, in the last analysis, there may be little difference in mandibular prognathism when the female adult is compared with the male adult, the differential in the timing of mandibular growth may be important when treatment procedures are being considered.

Without question the facial appearance of any individual is not only dependent on mandibular position but, in addition, on the anteroposterior relationship of the maxillary jaw to the mandible or vice versa. Briefly, and at the risk of being too elementary, the following seem to be the generally accepted changes in the characteristics of the skeletal profile with growth. It can be generalized that during the growth span from childhood to adulthood the

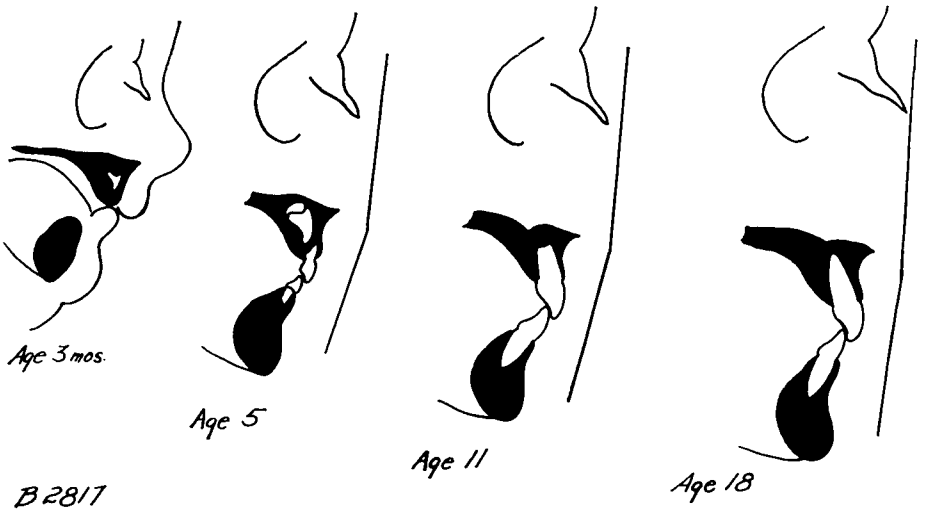

Fig. 2 Tracings of serial cephalometric roentgenograms of a case obtained from the files of the Bolton Study at Western Reserve University. Progressive decrease in skeletal convexity can be noted.

maxillary jaw will tend to become less and less protrusive relative to the rest of the skeletal profile. That is, there is a definite tendency for the skeletal profile to become less convex with growth (Figure 2).

This finding that the maxillary jaw tends to become less prominent relative to the rest of the skeletal profile indicates some disproportionality in facial growth. The maxilla tends to be positioned in a forward direction much more slowly than does the mandible, resulting in a decrease in the convexity of the facial profile. This difference in the degree of jaw growth in an anterior direction will determine the final facial type when growth has been completed.

Some differences must be anticipated in facial profile changes on the basis of sex. As has been mentioned, female subjects will usually not become as prognathic in the mandibular region as will male subjects. Therefore, females will usually not attain the same degree of straightness in the skeletal profile when compared with males.

Despite these changes in jaw relationships with g r o w t h, comparable changes have *not* been noted at the approximate levels of the bases of the alveolar processes. It has been stated that after approximately seven to nine years of age, point B, or the supposed level of delineation between the mandibular alveolar process and skeletal bone, does not exhibit much forward change relative to point A[3],[9] the comparable landmark in the maxillary region. Thus it can be generalized that the alveolar processes can be expected to exhibit some stability in their anteroposterior relationship to each other after nine years of age while their supporting skeletal bases will continue to grow and change in anteroposterior relationship.

B. The Soft Tissue Profile

Prior to a discussion of changes in the position of the dentition this seems the opportune time to present some of the more recent information related to growth changes in the soft tissue structures which cover the skeletal profile. Wherever possible, changing characteristics of the soft tissue profile will be

defined as they relate to the underlying skeletal profile.

It has been demonstrated that the position of the integumental chin is very closely related to the position of the skeletal chin[10]. That is, as the skeletal chin assumes a more forward relationship to the cranium with growth, so will the soft tissue chin (Figure 3). In addition, the amount of increase in the prominence of the soft tissue chin will closely correlate with the degree of change in the prominence of the skeletal chin. Therefore, when considering basic facial form and mandibular position, it can be anticipated that the soft tissue profile of most individuals will usually tend to become less retrognathic with progressive growth and development. Of course, the same fundamental differences, relative to age and sex, can be noted when comparing integumental and skeletal mandibular prognathism.

Although, when considering mandibular prominence, the soft tissue chin has been found to follow closely the skeletal chin, the same close correlation could not be demonstrated when the convexity of the soft tissue profile was studied[10]. Soft tissue landmarks, which are closely analogous to the bony landmarks used for measuring the convexity of the skeletal profile, were established. Analysis of the measurements revealed that the soft tissue structures overlying these skeletal landmarks did not show the same pattern of change as that observed for the bony profile. Whereas the average hard tissue profile definitely tends to become straighter with age, the analogous soft tissue profile tends to remain comparatively stable in its convexity. On the average, although showing a very slight tendency to straighten with age, little change in the angular degree of soft tissue convexity was found to take place after approximately six years of age.

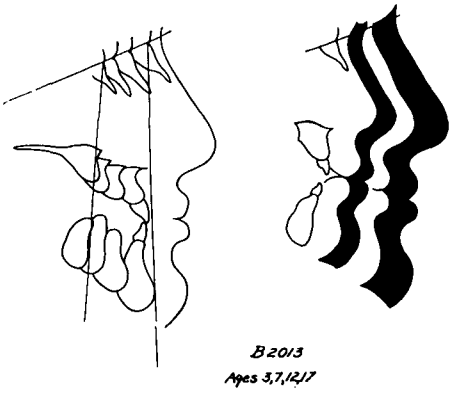

Fig. 3 Serial tracings depicting the forward positioning of the soft tissue chin with the forward positioning of the skeletal chin.

The fact that the soft tissue covering does not follow the apparent tendency of the bony profile to straighten with age seems of considerable importance. For one thing it indicates that there may be a growth differential in the thickness of the soft tissue covering the various aspects of the underlying hard tissue. Obviously, the configuration of the midsagittal soft tissue profile can be affected by differences in the thickness of the soft tissue overlying skeletal structures. To a degree this possibility has been substantiated by the finding that there is a comparatively greater increase in the thickness of the soft tissue covering the maxillary jaw than in the soft tissue covering the mandibular symphysis and the forehead area[10]. Thus, considering the soft tissue covering alone, this would tend to swing the soft tissue profile toward the direction of a more convex rather than a less convex facial profile. The difference in the forward growth of the bony chin carrying its overlying soft tissue and the comparatively reduced forward growth of the anterior part of the bony maxillary jaw seems to be partially compensated for by this differential in the increase in

soft tissue thickness covering the upper face.

It is also credible that the upper lip, by virtue of its attachment to the nose, may be affected in its thickness and position by growth tendencies of the nose itself. Therefore, it would seem important to consider the growth of the nose and its influence on the soft tissue profile.

When the nose is included in the profile appraisal, the soft tissue profile can be expected to increase in convexity with progressive growth and development. This can be expected since it has been shown that the nose will grow in a forward direction to a proportionately greater degree than will the other soft tissues of the facial profile. That is, with continuing growth, the nose will increase in its projection relative to the total facial profile.

The human nose will continue to grow in a downward and forward direction at least until early adulthood (Figure 4). Surprisingly enough, the external nose seems to undergo an appreciable amount of growth during the later stages of development as well as during the earlier stages. There does not seem to be an appreciable decrease in the rate of nasal growth as is typical of the growth pattern established for the skeletal structures of the upper face which form the nasal cavity. There appears to be an average yearly increase of one to one and a third millimeters in the overall length of the external nose. The degree of increase can be expected to be approximately the same for male and female subjects.

In most instances the profile of the external nose will tend to maintain the same general contour with growth except for a few modifications. The nose will usually become more inclined in a forward direction and the tip of the nose, formed by a continuation of the bridge of the nose and the columella,

Fig. 4 Serial tracings, superimposed on the sella-nasion plane, registering on nasion, depicting the downward and forward growth of the nose at ages five, eleven, and eighteen years.

will become more acute during the later stages of development[11]. In many males a growth spurt for the nose can be found to occur somewhere between ten to sixteen years of age. Subjects who do show this growth spurt will also show some difference in the contour of the nose with a forward positioning of the nasal bone and concomitant elevation of the bridge of the nose.

While studying growth of the nose, it also became obvious that there is a difference in the amount of growth of the horizontal and the vertical dimensions of the nose. In most instances the nose tends to grow longer vertically to a greater extent than it does horizontally. It is in the anteroposterior or the horizontal growth of the nose that a sex difference can be noted. Females will usually show a greater increase in the depth of the nose than will males. In fact from nine to fifteen years of age, the nose tip will usually increase on the average of one millimeter per year anterior to the facial plane [11]. Thus the sum total of the effect of the growth of the nose on the configuration of the soft tissue profile is to make the facial profile more convex with age. This, of course, is related to the increase in

nasal prominence relative to the facial profile.

In the last analysis it must be anticipated that not all of the soft tissue facial profile will manifest the characteristics of the underlying skeletal profile. The apparent incongruity between the convexity of the skeletal and the soft tissue profiles indicates that the soft tissue of the upper face is not directly related to the hard tissue of the upper face. In contrast to this the position of the soft tissue overlying the mandibular symphysis seems to be directly dependent on the position of the chin.

Integration of information which is to be useful to the orthodontist must, of necessity, also evaluate the soft tissues forming the profile of the mouth. The lips are closely related to the dentition and being partially composed of muscle have a functional influence on the underlying dental structures.

The growth of the lips was found to follow the general growth curve for muscle and other connective tissue within the body[12]. The upper and lower lips gradually increase in length; the upper lip was found to grow away from the level of the palate while the lower lip was also growing away from the chin. A progressive increase in lip length was found to take place until approximately fifteen years or age. After this age growth in length seemed to slow down markedly. With this increase in lip length there was also an increase in thickness, especially in the vermillion region of the upper lip. In both sexes the lips attained a proportionately greater thickness in the vermillion regions than in the regions overlying skeletal points A and B. In fact, as the growth of the lips was studied, it was observed that the upper lip increased in thickness at the vermillion level approximately the same amount as it increased in length.

It is interesting that, despite this progressive increase in length, both lips tended to show a fairly constant vertical relationship to their respective underlying alveolar processes. After approximately nine years of age, that is, after the approximate time of the full eruption of the central incisors, there is little, if any, increase in the vertical distance between the crest of the alveolar process and the vermillion border of the lip at the level of lip approximation. This permits the hypothesis that, after this age level, vertical growth of the alveolar processes and vertical growth of the lips tend to keep pace with each other. The question also arises as to whether the lips maintain an equally constant relationship to the incisal edges of the anterior teeth. Here also, a fairly close relationship was observed to exist. After the time of the complete eruption of the central incisors, the tips of the lips have been found to be closely related to their incisal edges. Specifically, after about nine years of age, the tip of the upper lip was found to cover usually sixty-one to sixty-seven per cent of the maxillary central incisor crown. The remainder of this tooth, of course, is usually covered by the vermillion aspect of the lower lip.

The anteroposterior posture of the vermillion aspect of the lips was also found to be closely related to their supporting hard tissue structures, that is, the teeth and alveolar processes. When serial tracings of the same individual have been superimposed, it has been observed that in a majority of the cases there is an uprighting of the mandibular alveolar process and the central incisor (Figure 5). The mandibular alveolar process was seen to become more retruded relative to its supporting skeletal bone, that is, the chin. The maxillary dentition and alveolar process were also observed to become less protrusive relative to the facial plane of the skele-

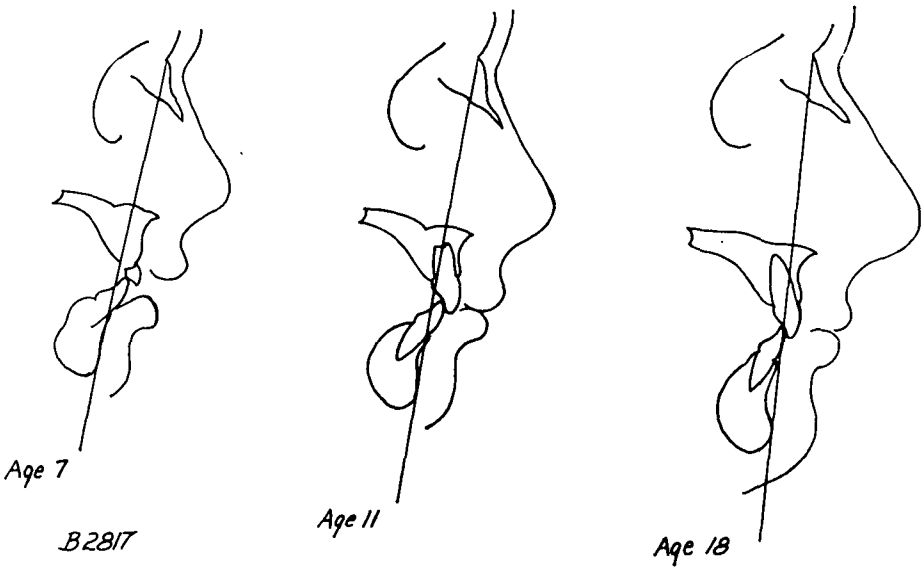

Fig. 5 Tracings of cephalometric headplates of the same subject illustrating the uprighting of the mandibular central incisor relative to the facial plane.

tal profile. The uprighting and retrusion of the dento-alveolar structures were found to take place during the times of increase in mandibular prognathism and decrease in the convexity of the bony profile. As an interesting side note, it was noticed that whereas the mandibular central incisor tended to become more upright and retruded relative to its skeletal foundation, it exhibited some degree of constancy in its angular position relative to the profile of the skeletal jaws. The angle formed by the long axis of the mandibular deciduous and/or permanent central incisor and a line connecting point A with pogonion was measured in thirty cases with longitudinal cephalometric records. On an average this angle increased until nine years of age; that is, this tooth tended to become progressively more procumbent relative to the AP plane. From nine to eighteen years of age, the average angular relationship between the lower incisor and this plane tended to become more stable. Of the thirty cases, twelve cases showed no change in the angular relation of the lower incisor to the AP plane during this time interval; twelve cases showed an increase in this angle or a greater procumbency of the lower incisor, while six cases exhibited the tendency for this angular relationship to decrease. Of the latter two groups which showed change, in the majority of the cases it was found to be of the small magnitude of four to five degrees during this nine year interval.

If the mandibular alvèolar process and the mandibular incisor are supposedly uprighting relative to the chin, the question may arise as to why this tooth maintains a reasonably stable relationship to the AP plane. It has been pointed out that with growth pogonion is going forward more rapidly than point A resulting in a straightening of the skeletal profile. The very fact that the mandibular incisor is becoming more upright with growth permits it to maintain a somewhat constant angular relationship to the jaw profile.

Of particular interest to orthodon-

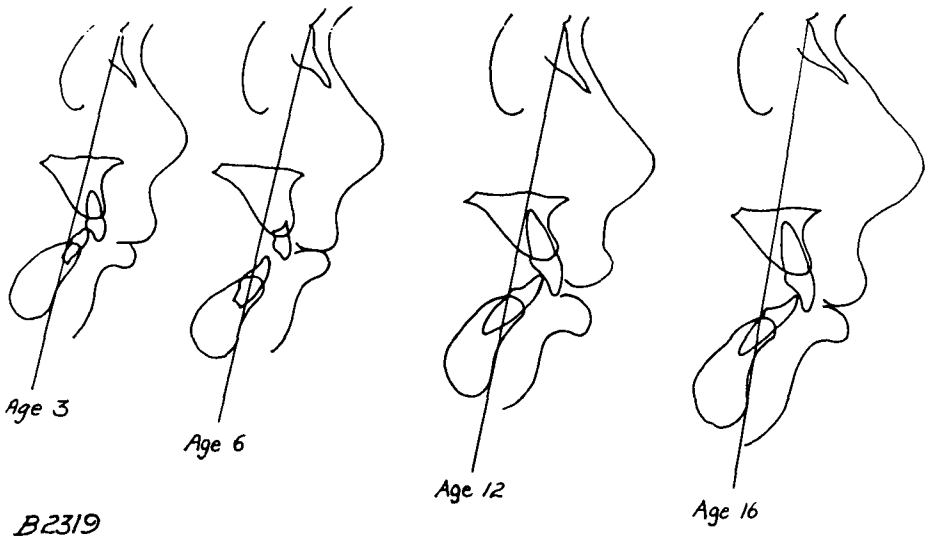

Fig. 6 Superimpositioning of tracings of the same individual on the facial plane to indicate progressive protrusiveness of the central incisors and the lips.

tists is the observation that the vermillion aspect of the lips tended to maintain a close postural relationship to their supporting structures. When the denture and alveolar process became more upright relative to the facial profile, the lips were found to become more retruded relative to the facial profile. In a few instances where the dentures and alveolar processes became more protrusive relative to the facial plane, the lips also showed the same directional modification and were protrusive within the facial profile (Figure 6). Thus it may be generally stated that the posture of the lips is strongly dependent on the position of the underlying dento-alveolar complex.

In summary then, it can be re-emphasized that the position of the soft tissues covering the upper face, exclusive of the dental area, does not closely reflect the position of the hard structures of the same area. In contrast to this, the position of the soft tissues covering the lower jaw as well as the mandibular and maxillary dento-alveolar areas is strongly dependent on the position of these hard tissue structures. This strong interrelationship between the lips and the dental structures is obviously important to the orthodontist. He is attempting directly to regulate the position of at least one of these structures.

This brings us to the point of attempting to discuss some of the clinical implications of this information. How can we utilize this information to help us in our diagnosis and to augment our treatment procedures? The wisdom and skill of the orthodontist is most usually directed toward improving his patient's masticatory function and facial esthetics. There has been some controversial discussion as to whether improvement of facial esthetics should receive any emphasis whatsoever as a part of orthodontic diagnosis and treatment planning. Such discussions may have some justification in the sense that direct correlations between functional occlusal relationships and dentofacial esthetics have not been clearly established. However, whether this correlation does or does not exist, it must

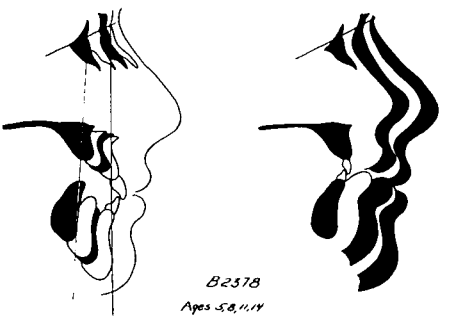

Fig. 7 Superimpositions of tracings of the same individual illustrating changes in the soft tissues of the face with progressive growth.

be recognized that the improvement of facial aesthetics has been considered by many capable individuals to be an important objective of orthodontic treatment[13-15]. Therefore, an intelligent anticipation of soft tissue modifications which may occur incident to normal growth and those which may occur incident to treatment can only be helpful in achieving one of the aforementioned objectives.

One cannot question that improvement in the configuration of the facial profile can occur with or without the help of orthodontic treatment. Growth itself, with no orthodontic procedures, can bring about changes in the contour of the soft tissues of the face (Figure 7). For one thing, growth of the mandible will cause the skeletal chin to move forward — which in turn will carry the soft tissue chin forward to a comparable degree. If adequate growth occurs, the inferior aspect of the face could assume a good postural relationship, one which may be well positioned for a pleasing facial profile. Without it the foundation for a good superstructure may be lost.

Growth of the nose will usually take place whether or not orthodontic treatment is initiated in any given individual. Normally it must be anticipated that the growth of the nose can improve the contour of the soft tissue profile. During the later growth stages, as has been mentioned, the nose and soft tissue chin are observed to move forward relative to the lips.

In fact, the forward positioning of the nose occurs to a greater extent than does the forward positioning of the chin. The rapid and disproportionate forward positioning of the nose and chin causes the lips to seem to be receding within the facial profile. One can readily see that in certain facial types this would be desirable. This may be a feasible explanation for some of the cases reported to have protrusive lips at a young age and said to show an improvement in the position of the lips by adulthood. This has reputedly occurred with little or no orthodontic treatment, or treatment without extraction procedures, when such would presently be indicated.

It should also be noted that in some cases with inherently poor nasal characteristics, growth of the nose may serve to the disadvantage of both the patient and the orthodontist. For example, an individual with a very prominent nose will probably continue to maintain a prominent nose. With growth, this type of face may become even more convex (Figure 8). In such instances some procumbency of the lips and denture may be desirable. Anything which would serve to retract excessively the lips may be strongly undesirable since it may only result in exaggerating an already prominent nose. On the other hand, in an individual with an inherently small nose, it may be desirable to institute procedures which will cause the lips to retract (Figure 9). In this instance retraction of the lips and continued facial growth may dramatically improve facial appearance. These simple examples are projected solely for the purpose of demonstrating that a knowledge of the growth tendencies of the soft tissues as

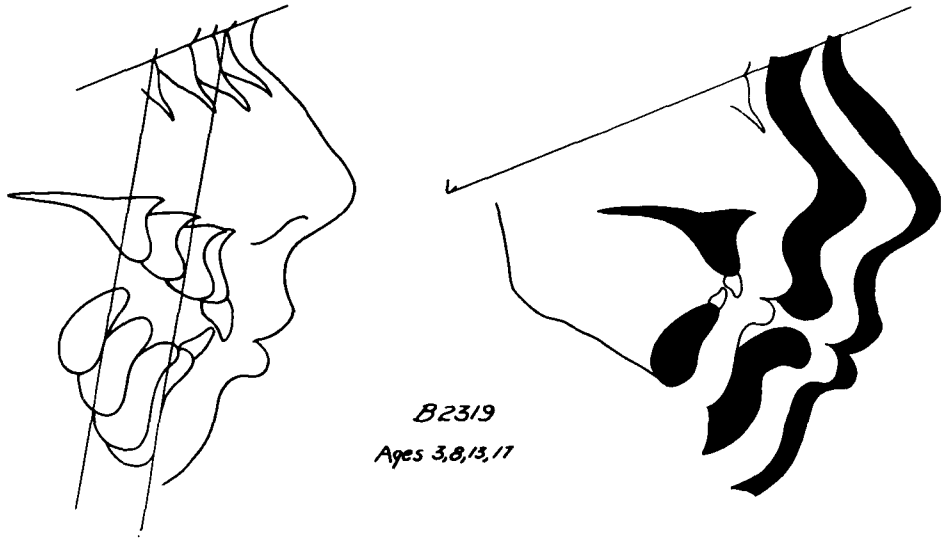

Fig. 8 Superimposed tracings revealing increase in soft tissue profile convexity, somewhat correlated with nasal prominence.

well as the underlying hard tissues may function to guide treatment planning. Any evaluation of the dentition and the skeletal structures of the face must be tempered with an evaluation of the size configuration, relative position and growth potential of the soft tissues of the nose, lips and chin.

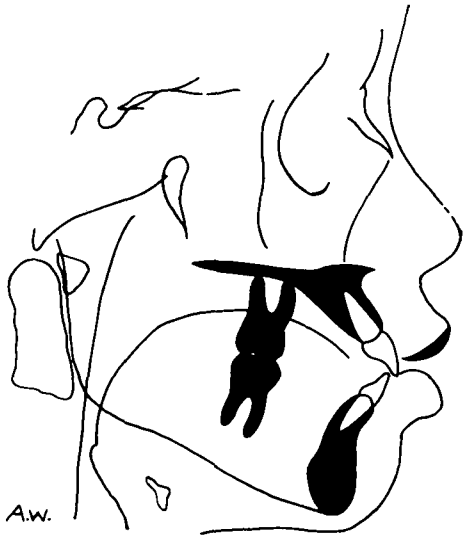

Fig. 9 Tracing of a young individual with an inherently small nose and concomitant protrusive dentures and lips.

It must be emphasized that changes in the basic position of the soft tissue nose and the soft tissue chin occur primarily as a function of growth and there is little that an orthodontist can do to alter them. Within reason, he could possibly exert some control over only one of these structures, that is the position of the soft tissue chin. This can be accomplished only if the mandible is, or needs to be, repositioned during treatment, or if orthodontic appliances can be effectively used to stimulate or to restrict the growth of the skeletal mandible. To date, the potential for effectively controlling the growth of the mandible with appliance therapy does not seem exceptionally good. To my mind any effect that the orthodontist can presently exert would be relatively small and, in most cases, quite inadequate.

The question then arises as to what tissue changes can be expected as a consequent of orthodontic treatment.

Since the lips are closely related to underlying structures, it can reasonably be assumed that lip contour can be modified while changing dento-alveolar position. The mouth profile is important to the appearance of the total soft tissue profile. Since the mouth profile can be modified, changes brought about by appliance therapy can affect the soft tissue profile. It is true that the lips themselves will fall back in reference to the soft tissue profile with growth. However, in so doing the lips have been found to maintain the same approximate relationship to each other, much as the skeletal points A and B maintain a proportionate relationship with age. Thus, while the lips may change relative to the profile, there is little change that we can usually hope for in one lip as it relates to the other lip, that is without orthodontic treatment. If normal growth changes will not be adequate for the desired changes, then it may be necessary to resort to orthodontic treatment to attain a favorable lip profile. Whereas growth does not usually alter the relationship of skeletal points A and B, orthodontic procedures reputedly can alter their spatial relationships as well as the position of teeth. With change in teeth and alveolar position come changes in lip position and contour. Indeed, a reliance upon the interrelationship between dento-alveolar and soft tissue contours of the mouth can constitute many times the rationale for orthodontic treatment to improve facial esthetics.

It is not my intention to argue the relative merits of the upper or lower incisor as they relate to changes in the soft tissue profile. Suffice it to say that the most dramatic changes in facial appearance seem to be correlated with cases exhibiting lip protrusions whether it be one or both lips. If we are discussing facial changes, then the instances where a definite retrusion of maxillary incisors has taken place will show considerable amount of change in lip contour and facial esthetics. This is especially true since the lower lip which normally covers the incisal third of the maxillary incisors is also greatly affected by the position of these teeth. It would be foolhardy to surmise that it is only with the correction of the position of the maxillary incisor teeth that dramatic results are elicited. In effect, equally large changes may be noted where the mandibular incisors have to be repositioned over great distances. It seems to me that it can be concisely stated that soft tissue changes incident to treatment will center around the lips, whereas soft tissue changes incident to growth will encompass a greater aspect of the soft tissue profile — the nose and chin as well as the lips. The sum total of both growth and treatment will determine the final facial configuration of any given individual. However, with the lips forming a very important part of the face, modifications in this area can have a dramatic influence on facial appearance.

Case Presentations

This seems a good time to evaluate some of these concepts within the scope of a few treated cases. Because lip protrusions have been stressed, to a degree, several cases where a measurable change in incisor position has occurred as a result of treatment were selected for presentation. It was felt that these cases represented some diversity in changes that were observed to take place in the soft tissue profile. In addition, all of the cases have something in common in that each presented a Class II molar relationship prior to orthodontic treatment. The cephalometric tracings will be stressed since they reveal clearly the changes in the soft tissue profile.

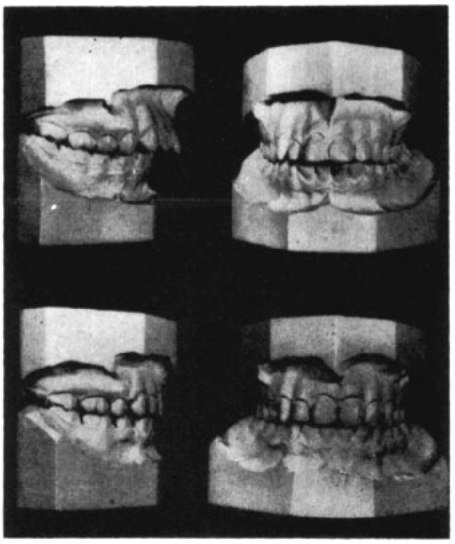

Fig. 10

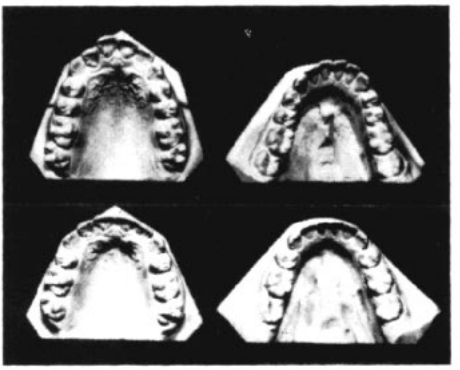

Fig. 11

Case 1 (Figures 10, 11 and 12) This is a case in which little growth was anticipated since this young lady was approaching late adolescence. Analysis of her profile and other characteristics of the case indicated that the extraction of four bicuspids would be advisable. The basic skeletal pattern was not good in that there was a discrepancy in the anteroposterior relationship of the denture bases, in addition to the discrepancies located within the denture itself. After approximately two years of treatment the case was considered ready for retention with an adequate result.

The "before" and "after" tracings were superimposed on the basion-nasion plane, registering on nasion, and the following changes were noted. The analysis of the cephalometric films revealed little growth of the facial skeleton during the two year period. There was a slight increase in the vertical height of the face with some vertical growth of the mandible. Anteroposteriorly, there was little change in the position of the mandibular incisor, while the maxillary incisors were re-

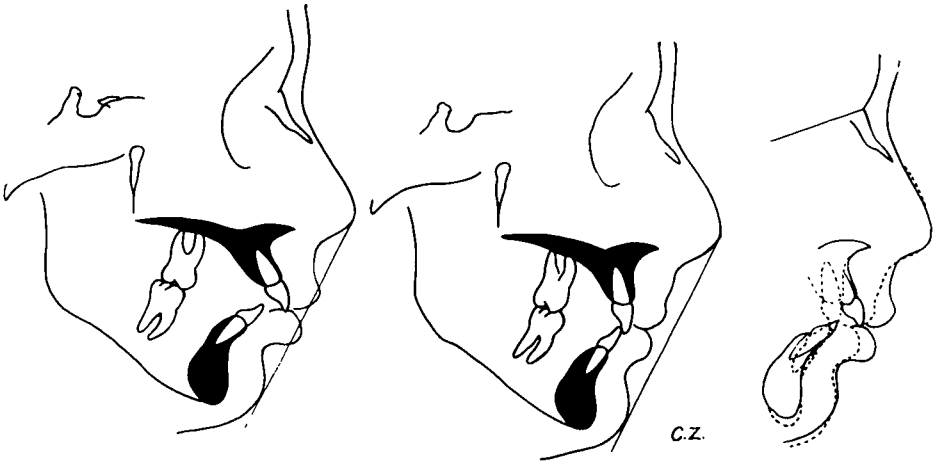

Fig. 12

Fig. 13

Fig. 14

tracted to a considerable degree. Marked improvement was noted in the soft tissue; this was true in spite of limited growth of the skeletal and soft tissue profiles. No appreciable growth of the nose was noted and the soft tissue chin was observed to follow the skeletal chin. It seems evident that the retraction of the upper incisors was followed by a retrusion of the upper and lower lips. The reduction in the prominence of both lips seems to account for the marked improvement in the soft tissue facial profile.

Case 2 (Figures 13, 14 and 15) This case was obviously a severe protrusion of the maxillary denture. The face of this fourteen year old girl was found to be retrognathic with a pronounced convexity to the configuration of the facial profile. A more concise appraisal revealed considerable discrepancy in the relationship of the denture bases, that is the A-B relationship as well as considerable steepness to the lower border of the mandible. It was further determined that while the maxillary den-

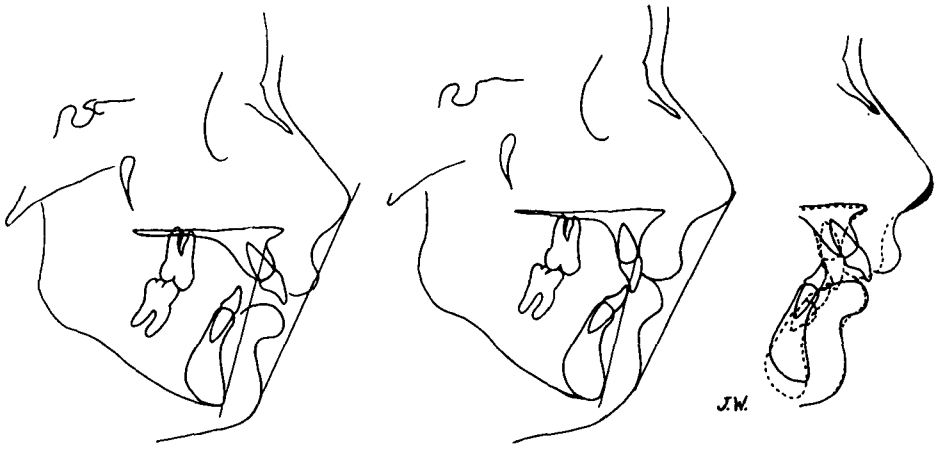

Fig. 15

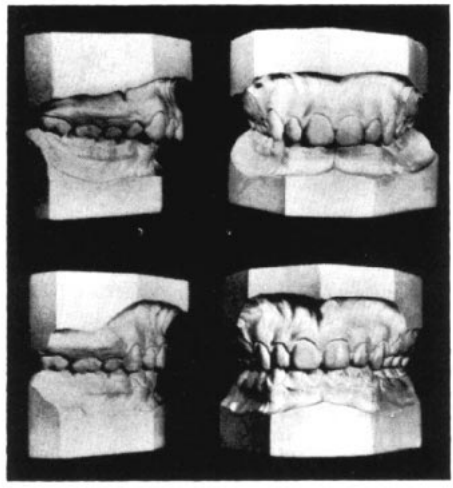

Fig. 16

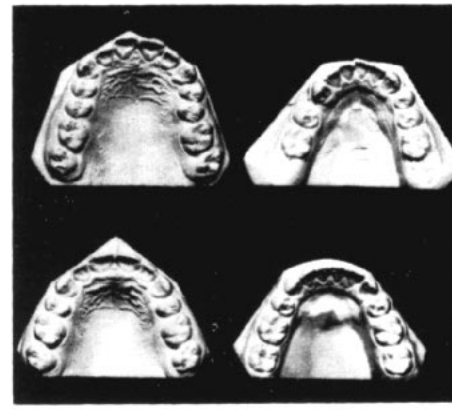

Fig. 17

ture was protruded, there was also a retrusion of the mandibular denture on its base. A reduction in the maxillary dentition seemed indicated. Since the maxillary lateral incisors were congenitally malformed and severely reduced in size, these teeth rather than bicuspids were extracted.

The permanent cuspids were moved into the positions of the extracted laterals and the case was treated within an eighteen month period. A comparison of the cephalometric tracings shows that some growth had taken place during the treatment period. The chin seemed to grow almost directly downward with no forward growth, relative to the profile. As a consequence, the soft tissue chin, following the skeletal chin, did not assume a more forward position. A little forward growth of the soft tissue nose was observed; this seemed to aid in the improvement of the facial profile. Once again, a marked reduction in the prominence of the upper lip served to improve dramatically the facial profile. Considerable retraction of the maxillary incisors and concomitant small advancement of the lower incisors is evident. Whereas the lower lip does not seem to be forward to its previous position, the upper lip has moved back to a considerable de-

Fig. 18

gree. Although more growth was evident in this case, in comparison to the previous case, the improvement in the soft tissue profile in both cases seems to be closely correlated to change in lip position.

Case 3 (Figures 16, 17 and 18) This twelve year old boy presented maxillary and mandibular jaws that were well formed though poorly related to each other. An excessive overbite was evident with some loss in the vertical dimension of the lower face. In this case it seemed advisable to restrict extractions to the maxillary jaw. However, an impaction of the left mandibular first bicuspid caused a decision to extract in the lower arch as well. In this case adequate growth of the mandible was anticipated and hoped for.

As can be seen from the cephalometric tracings, considerable growth did take place during the treatment period. The mandible did grow vertically and forward, relative to the forehead. In so doing the soft tissue chin progressed in the same direction and to a comparable extent. In this individual, growth of the nose occurred to a notable extent progressing in a downward and forward direction relative to the forehead. The forward growth of the nose and the chin coupled with the vertical growth of the face served to appreciably improve facial appearance. The contour of the lips was greatly improved with the retraction of the upper incisors. However, it must be noted that the retraction of the upper lip was not as great as observed in the previous cases. In the last analysis it must be said that growth was most instrumental in improving the soft tissue profile. Some recontouring of the lips and improvement in vertical dimension subsequent to orthodontic correction also helped to improve facial esthetics.

Case 4 (Figures 19, 20 and 21) This case, that of a seventeen year old boy, was characterized by an extremely deep overbite and maxillary buccal occlusion in the bicuspid regions. The patient exhibited some distal repositioning of the mandible when teeth were brought into complete occlusion. This case was treated without extractions. Attempts were made to increase orthodontically the vertical dimension of the lower face to help improve facial esthetics.

The tracings reveal that there was some improvement of the soft tissue profile although not as much as hoped for. The mandible was repositioned in a more forward relationship to the maxillary jaw. This repositioning, plus some mandibular growth, accounted for the forward repositioning of the chin and the lower lip. A small amount of nose growth also took place during this interval. The anterior teeth were tipped forward in both the maxillary and mandibular regions; this also served to bring both lips farther forward. This combination of events certainly improved the soft tissue profile, although facial esthetics could still be improved. Unfortunately, the treatment procedures applied were not able to increase the vertical dimension between the jaws. If success had been attained relative to apparent requirements in vertical dimension, it is felt that the esthetic results would have been considerably better in this patient. Correction of the deep overbite occurred as a result of considerable depression of the lower incisors. This case was presented to show that increased protrusion of the lips can be quite beneficial to facial esthetics where it is indicated. It also emphasizes the repositioning of the soft tissue chin with repositioning, as well as with growth, of the skeletal mandible.

Case 5 (Figures 22, 23 and 24) This patient, a ten year old boy, was ob-

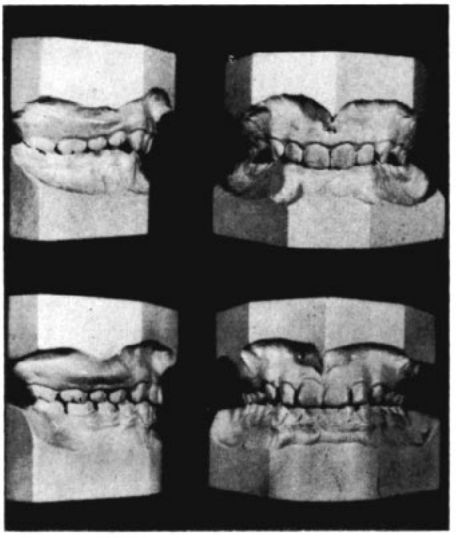

Fig. 19

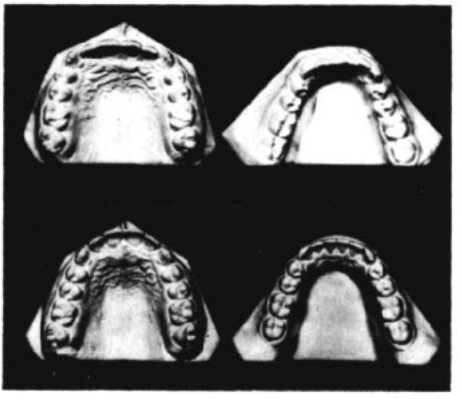

Fig. 20

served to have a pronounced discrepancy in the anteroposterior relationship of the anterior teeth. The maxillary incisors, although in good axial inclination, were protruded while the mandibular incisors were severely retruded and excessively inclined lingually. The upper arch seemed adequately formed while the lower had mandibular cuspids blocked out of the arch.

The youngster was noted to have a pronounced mentalis habit which seemed to account for the severe retrusion of the mandibular incisors. After initial guiding treatment which included a headcap and a lip bumper, the case was subjected to full treatment and completed. The resulting soft tissue profile seemed quite acceptable and markedly improved in comparison with its configuration prior to treatment. In this case a considerable amount of growth expressed itself during the treatment period.

Superimposition on nasion revealed growth and treatment changes with the profile area. Growth of the nose was pronounced as the nose tip progressed in a downward and forward direction. There was a small amount of forward positioning of the soft tissue chin. How-

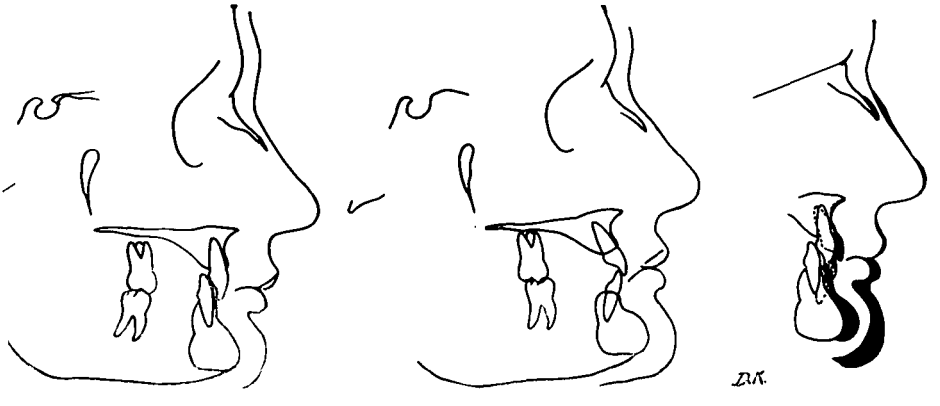

Fig. 21

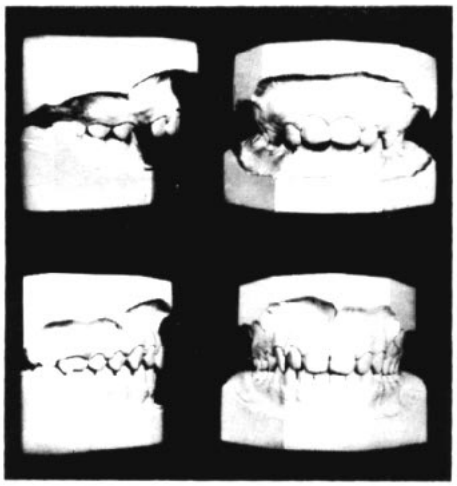

Fig. 22

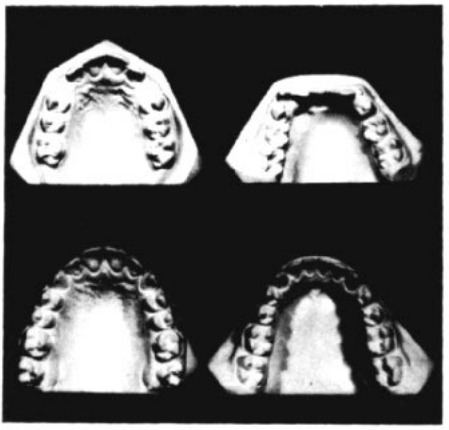

Fig. 23

ever, increase in the vertical dimension of the face was pronounced and consequently there was much change in the vertical position of the soft tissue chin. There was a slight posterior positioning of the upper lip which seems to go hand in hand with the posterior positioning of the upper incisors. In this case, as in the previous, there was a pronounced forward positioning of the lower lip. However in contrast to the other case, this forward positioning of the lower lip was not correlated with any change in chin position but with considerable forward repositioning of the mandibular incisors. The greatest amount of improvement in the 'mouth profile' of this case seems correlated with forward movement of the lower lip.

When tracings are superimposed on more posterior structures, it is obvious that considerable growth of the mandible has taken place with the skeletal chin progressing downward and forward. Nasion has moved upward and forward while point A of the maxilla seemed to progress in a downward and

Fig. 24

slightly backward direction. It is felt that orthodontic therapy had restricted the growth of the maxilla.

Summary

In summary, it would seem wise to emphasize that growth changes within the soft tissue profile will be expressed in the areas of the nose, the chin and the lips. The soft tissue changes that we can anticipate, incident to treatment, will center around the lips, primarily in the vermillion area. Lip posture was found to be correlated closely with the posture of underlying dental and alveolar structures. This is important to the orthodontist since he is capable of modifying, to a degree, the position of teeth and alveolar structures.

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References

1. Downs, W.B.: Variations in Facial Relationships; Their Significance in Treatment and Prognosis, *Am. J. Ortho.* 34: 812, 1948.
2. Bjork, A.: The Face in Profile, Svensk Landlakare - Lidskr., Vol. 405B, translated into English, Lund 1947, Berlingska Boktryckeriet.
3. Lande, M.J.: Growth Behavior of the Human Bony Facial Profile as Revealed by Serial Cephalometric Roentgenology, *Angle Ortho.* 22: 78, 1952.
4. Coben, S.E.: The Integration of Certain Variants of the Facial Skeleton: A Serial Cephalometric Roentgenographic Analysis of Craniofacial Form and Growth, *Am. J. Ortho.* 41: 407, 1955.
5. Ricketts, R.M.: Facial and Denture Changes During Orthodontic Treatment as Analyzed from the Temporomandibular Joint., *Am. J. Ortho.* 49: 3, 1955.
6. Broadbent, B.H.: The Face of the Normal Child, *Angle Ortho.* 7: 183, 1937.
7. Brodie, A. G.: Late Growth Changes in the Human Face, *Angle Ortho.* 23: 146, 1953.
8. Pruzansky, S., and Richmond, J. B.: Growth of the Mandible in Infants With Micrognathia, *Am. J. Dis. Child.* 88: 29, 1954.
9. Bjork, A.: The Significance of Growth Changes in Facial Pattern and Their Relationship to Changes in Occlusion, *D. Record* 71: 197, 1951.
10. Subtelny, J.D.: A Longitudinal Study of Soft Tissue Facial Structures and Their Profile Characteristics, Defined in Relation to Underlying Skeletal Structures, *Am. J. Ortho.* 45: 481, 1959.
11. Manera, J. and Subtelny, J.D.: A Cephalometric Study of the Growth of the Nose. — To be published.
12. Scammon, R.E., Harris, J.A., Jackson, C.M., and Patterson, D.G.: The Measurement of Man, Minneapolis, 1930, *University of Minnesota Press.*
13. Riedel, R.A.: An Analysis of Dentofacial Relationships, *Am. J. Ortho.* 43: 103, 1957.
14. Tweed, C.H.: The Frankfort Mandibular Incisor Angle (FMIA) in Orthodontic Diagnosis, Treatment Planning and Prognosis, *Angle Ortho,* 24: 121, 1954.
15. Stoner et al.: A Cephalometric Evaluation of Fifty-Seven Consecutive Cases Treated by Dr. Charles H. Tweed, *Angle Ortho.;* 26: 68, 1956.
16. Ricketts, R.M.: Planning Treatment on The Basis of The Facial Pattern and an Estimate of Its Growth, *Angle Ortho.;* 27: 14, 1957.
17. Steiner, C.C.: Cephalometrics for You and Me, *Am. J. Ortho.;* 39: 729, 1953.
18. Lindquist, J.T.: The Lower Incisor — Its Influence on Treatment and Esthetics. *Am. J. Ortho.;* 44, 112, 1958.