Inhibition or Stimulation of the Vertical Growth of the Facial Complex, Its Significance to Treatment

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If it were possible to control the vertical growth of the face it would be possible to solve almost all of our orthodontic problems. This statement may seem quite ridiculous, but data presented in this study should provide ample verification of this thesis. Other than overbite correction, few orthodontists give vertical changes any consideration in their case analysis.

Vertical growth increments have different effects on different facial types. Certainly, not all cases can be treated alike because all faces are not alike. Some have too much vertical growth, some too little. We must learn to recognize these and treat them accordingly. We must realize that the facial pattern is *not* constant, that it is changed by growth, and that it is changed by orthodontic treatment. This information, if properly used, can erase many of the adverse changes that are assuredly happening every day.

The purpose of this study is to document the influence of orthodontic treatment on the vertical growth of the face and to show how this vertical growth is inseparately related to the anteroposterior growth. Hence, in order to discuss vertical growth in a comprehensive manner it will also be necessary to discuss horizontal growth.

REVIEW OF THE LITERATURE

Brodie[1] conducted a study on the growth pattern of the human head from three months to eight years of life. He determined from this study that the morphogenetic pattern of the head was established by the age of three months and did not change thereafter. In this comprehensive study Brodie identified the growth sites and sutures responsible for the growth and development of the facial complex. He stated "when all of the findings on upper and lower face are considered together it is possible to derive certain facts. We have two anatomical parts, nose and upper denture, each of which contributes an increment to height, which increments are summated at the occlusal plane. Since the occlusal plane marks the junction with the mandible, it can be seen that all of this growth would result in a pushing downward of the mandible, away from the cranium, to which it is attached. The mandible itself has been shown to be increasing in vertical height by additions to its alveolar margins, and this would again have the effect of forcing this bone down. But since its angular relation with the cranial base is not disturbed by growth we can infer that the condyle must be growing at a rate that is equal to the sum of all the other increments in order to adjust the mandible to the growth of the middle face."

Brodie's[2] subsequent studies showed the occlusal plane and mandibular plane to tip down in back. He concluded that "one can not but be impressed with the orderly development of the various types of faces and the adherence to an original proportionality which seems to be characteristic of each."

Hellman,[3] in 1935, concluded that

"the infant face is transformed into that of the adult by increases in size, by changes in proportion and by adjustment in position." He noted that the face gradually drifted forward and changed in relative position to the cranium.

Goldstein[4] found height of the face to grow most, then depth, and width the least. In depth, the lower portion of the face grew more rapidly than the upper.

Lande[5] found a very distinct difference between the growth behavior of the maxilla and mandible in an anteroposterior direction. While the mandible tended to become more prognathic, the maxilla showed very little change. Associated with the increase in mandibular prognathism was a decrease in the inclination of the lower border of the mandible, that is, it became more horizontal. Regardless of differences in facial type, all cases showed the same general tendencies in their growth behavior. The thought that has been expressed that a so-called "unesthetic" pattern becomes progressively more unesthetic with age was not borne out.

Silverstein,[6] in comparing treated with untreated cases, concluded that forward movement of pogonion was inhibited with treatment to the extent that the expected growth potential was not attained.

King[7] concluded that forward growth of pogonion was disappointing in all treated cases except non-extraction males.

Blueher[8] found that the facial angle and SNB angle varied together. In his sample of thirty-four, sixteen showed an increase in the mandibular plane angle, thirteen decreased, and five had no change.

Poulton[9] found in cases treated with occipital headgear the entire maxillary dentition, including the erupted and unerupted teeth, was about three mm farther back than it would have been without treatment. However, this movement could not be obtained without an increase in lower face height which often occurs during Class II therapy. The excessive downward movement of the chin is really an opening swing of the mandible resulting in an inhibition of the normal forward chin progress. Even though this retardation is slight, it may accentuate the retrusive profile common in Class II malocclusion. The inhibition of forward chin movement was not due to any lessening in growth of the mandible, but a difference in direction of mandibular growth. From present knowledge it seems doubtful that any treatment method could materially affect growth in length of the mandible.

Hanes,[10] in comparing profile changes resulting from cervical anchorage with those resulting from intermaxillary elastics, concluded that Class II treatment effects a distal positioning of point B except in a few cases, but to a smaller degree than the change in point A. With few exceptions, the use of intermaxillary elastics did not succeed in making the chin more prominent. In both types of treatment the increase in dental height was similar.

Schudy[11] made a comprehensive study of four hundred malocclusions and found the OM and SN-MP angles excellent indicators of facial type, which he referred to as prognathic and retrognathic. He[12] later introduced the term, facial divergence, the extremes being hypodivergent and hyperdivergent, as more descriptive terms for facial type. Prognathic faces were characterized by low mandibular plane and OM angles, square jaws, deep overbites, and short, wide symphyses. Retrognathic faces have high OM and high mandibular plane angles, open bites, and tall, narrow symphyses.

Ricketts[14] refers to facial types as

retrognathic, mesognathic, and prognathic and classifies them according to facial angle and X-Y axis. He mentions that mandibular planes are usually high in retrognathic and low in prognathic cases.

Schudy,[13] in a random sample of fifty malocclusions, found the relationship of facial height to depth to have a very high correlation with the OM, SN-MP, Y-axis, and X-Y axis. He also correlated these measurements to lower face proportions and found highly significant readings for OM and SN-MP angles, but the Y-axis and X-Y axis had very low insignificant readings. He concluded that the Y-axis and X-Y axis were not closely associated with the morphology of the lower face, whereas both the mandibular plane and OM angles were.

Ricketts[15] noted the effect of different kinds of treatment on rotation or opening of the mandible. He states, "the headgear tended to open the X-Y axis angle in both the retrognathic and prognathic cases. This, therefore, was the ideal method in prognathic closed bite cases. However, elongation of the upper molars was unfavorable in retrognathic cases."

Schudy[12] and Ricketts[15] both stated that the effect of intermaxillary elastics could be disastrous on some retrognathic cases due to an opening rotation of the mandible. Ricketts found that "the lower molar came forward an average of almost 2 mm with intermaxillary elastics and was *elevated* an average of 3.3 mm. Some cases showed 7 or 8 mm elevation." Schudy later documented the manner in which molar elevation contributed to the rotation of the mandible.

Ricketts states, "we can no longer accept the maxilla as an immutable structure. Vigorous retraction force on the teeth appears to prevent forward growth and even causes the maxilla to grow downward and backward. It still appears that the amount of mandibular growth was not influenced by treatment, at least by the appliances employed for this study."

MATERIAL

The untreated group consisted of sixty-two children taken from the growth studies of the Universities of Texas and Michigan, and the private records of Dr. F. F. Schudy. Two cephalograms on each patient were used in this study. Age at the time of the initial headfilm varied from 7 years to 14 years with a mean initial age of 10.14 years. The interval between the cephalograms ranged from 1 year to 3.5 years, the mean being 2.45 years.

Of the thirty-two males and thirty females there were fifty exhibiting Class I molar relationships and twelve Class II. Twelve of the Class I cases had a malocclusion to some degree and thirty-eight possessed good occlusions. The SN-MP angle averaged 33.77° with a range of 22° - 47°. The OM angle averaged 16.41° and ranged from 8° - 22.5°.

The treated group consisted of routinely treated cases taken from the practice of Dr. Schudy. Of the fifty in this group, eighteen were males and thirty-two females. Starting age varied from 8 years to 15 years, the mean 12.09 years. Interval between the before and after headfilms ranged from 1.2 years to 4.1 years with a mean of 2.42 years.

There were twenty-five cases with a Class I molar relationship and twenty-five with Class II. Sixteen of the cases had no discrepancy on the lower arch; five had spacing and twenty-nine were crowded. Discrepancy varied from 6 mm crowding to 10 mm spacing.

The SN-MP angle averaged 31.57° with a range of 25.5° - 38.5°. All but seven cases fell between 29° - 37°. The OM angle averaged 14.64° and ranged from 7° - 20°.

All cases were treated with the .018 edgewise appliance without the removal of dental units. Extraoral anchorage was used on all patients. It consisted of a neck elastic pulling on soldered hooks which projected gingivally between the laterals and cuspids. The force applied was approximately one pound. The patients were requested to wear the headgear 12-14 hours per day. Mandibular discrepancies were corrected with Class III elastics backed up by extraoral anchorage to the maxillary arch.

The objective in this study was to secure for comparison two groups with average growth increments as nearly equal as possible. Age, sex, and time interval can vary a great deal between individual cases without reducing the validity of the data. Comparable average growth increments of the face are the criteria for both groups as shown in the chart below.

Growth Increments Showing Similarity Of Groups

	SN	AR-PO	V-Cond.	Time	H-Cond.
Untreated	1.93	6.09	7.18	2.45	1.65
Treated	1.99	6.45	6.73	2.42	2.77

H-condyle is the only growth increment showing significant difference and is thought to be due to repositioning of the condyle slightly forward in the glenoid fossa, and/or could be partially due to gonial angle changes.

Method

Tracings of the cephalograms were made on matte acetate paper with varied colored pencils to facilitate visualization while superimposing. Dual images of bilateral structures were bisected to reduce them to the midline.

The following angular measurements were made on each cephalogram for each patient: (Fig. 1) SNA, SNB, ANB, SN-MP, OM, NSBa, NSAr, NSGo, ArGoMn.

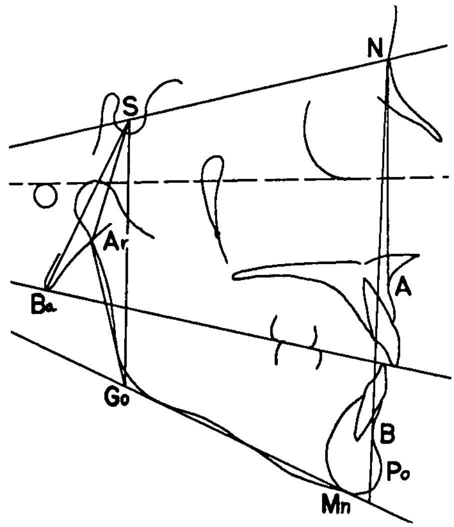

Fig. 1 Angular measurements.

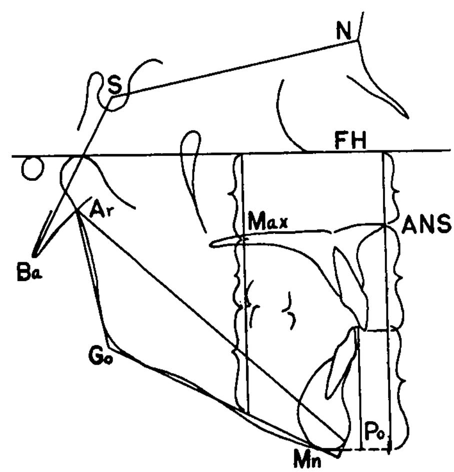

Fig. 2 Linear measurements in millimeters.

The following linear measurements were made on all cephalograms: (Fig. 2) SN, ArPo, GoPo, SBa, FH-Mn, FH-ANS, ANS-$\underline{1}$, $\overline{1}$-Mn, FH-MP, FH-Max, Max-$\underline{6}$, $\overline{6}$-MP.

Linear measurements were made with the tracings superimposed along SN registering at S. Measurements were made parallel to and perpendicular to the original Frankfort plane and are called horizontal and vertical measurements. Horizontal and vertical changes were measured on the following: ANS, $\underline{1}$, $\overline{1}$, Po, Max, $\underline{6}$, and $\overline{6}$.

Measurements of the condyle are extremely difficult to attain with any degree of accuracy. A technique was devised to yield an accurate, measurable entity called the *effective condylar growth*. This is a composite increment which is a summation of condylar growth, glenoid fossa changes, and positional changes of the condyle in the fossa. A hole is punched through both tracings in the area of the head of the condyle with the tracings superimposed along SN registering at S. Then, with the mandibles superimposed along the mandibular plane and registering at the posterior, inferior border of the symphysis and oriented to the original Frankfort horizontal, changes of the following were measured:

(1) horizontal — condyle, $\overline{1}$, and $\overline{6}$

(2) vertical — condyle, $\overline{1}$, and $\overline{6}$

(3) and appositional growth at Po.

Means, variances, standard deviations, correlation coefficients, and T-tests were computed on all before and difference measurements.*

Discussion

The scope of this study is so extensive that the discussion of each variable is impossible. Only those considered to have the greatest clinical significance will be discussed.

Growth without influence of treatment

The anteroposterior relationship of maxilla to mandible, as indicated by the ANB angle, decreases as the face matures. This decrease is brought about by an increase in the SNB angle while the SNA angle remains practically the same. This means that the maxilla grows forward, only slightly more than nasion, whereas the mandible grows forward one to one and one-half times faster. This is indicated by the following linear measurements and corroborated by the angular measurements.

Horizontal Growth Increments

SN	1.93	$\underline{1}$	2.88	SNA	.10°
ANS	2.60	$\overline{1}$	2.72	SNB	.60°
Max	1.81	$\underline{6}$	2.90	ANB	–.52°
Po	3.48	$\overline{6}$	3.03		

It is interesting to note that the occlusal relationships of the maxillary and mandibular teeth remain practically the same, both in malocclusion and good occlusions, in spite of the wide variations in denture base relationships that exist during growth. The unique adaptability of the alveolar processes to environmental changes accounts for this phenomenon.

The occlusal stability is made possible by differential migration of teeth within their respective bases. These movements can be mass movements, as observed generally in the maxillary arch, or as quadrant or individual movements. Quadrant movements are observed in the mandibular arch during the transition from mixed to permanent dentition. The posterior teeth drift forward while the incisors migrate lingually.

Appositional growth at Po was practically insignificant, averaging only .38 mm in untreated and .40 mm in the treated cases. Approximately two thirds of the cases had *none* at all. The saying, "them that has, gets", which refers to the size of Po anterior to line NB, is perhaps valid, but *not* because of appositional growth at Po. Schudy[12] has shown these changes to be from incisor movements which change B point; or from rotation of the mandible which rotates the chin forward and the incisor backward, relative to NB.

* These statistics may be obtained from the author.

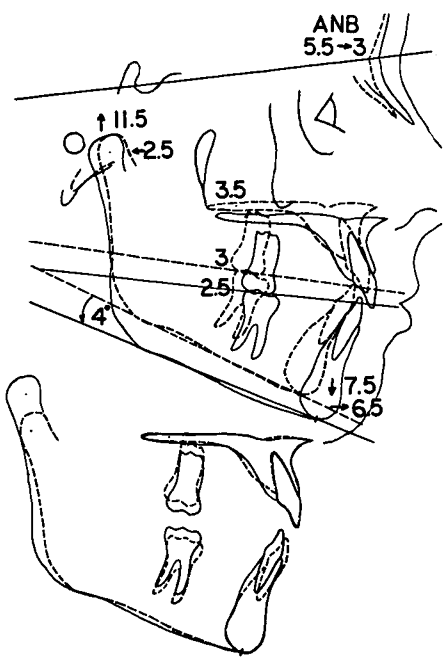

Fig. 3 Female growth study whereby Po came forward 6.5 mm yet the effective horizontal condylar growth was only 2.5 mm. The 2.5 mm excessive vertical condylar growth, 11.5 — (3.5 + 3 + 2.5) = 2.5, produced a 4° rotation of the mandible and thrust Po forward an additional 4 mm.

Examination of condylar growth increments reveals interesting and enlightening facts. Effective horizontal growth at the condyle is 1.65 mm, yet Po came forward 3.48 mm. How can 1.65 mm growth push the chin forward 3.48 mm? Schudy calls this "rotation" of the mandible (Fig. 3). Vertical growth at the condyle (V-condyle) is greater than vertical growth of the chin (FH-Mn) indicating a rotation of the mandible. Further, the mandibular plane angle changes substantiate the linear measurements and register the rotational effect.

Rotation of the mandible is the result of a difference in the vertical growth at the condyle and the total vertical growth in the molar area. The forward growth at Po equals the effective horizontal growth of the condyle when there is no rotation of the mandible, i.e., vertical growth of the condyle *equals* vertical growth of the molar area. However, when vertical growth of the condyles is greater than vertical growth of the molars, as occurs in normal growth, then forward growth of the mandible is greater than the actual horizontal growth. The following formula is submitted to indicate the importance and influence of vertical growth of the molars on the anteroposterior position of the chin and consequently the lower denture. This formula is for average SN-Mp cases since the ratio, 1 2/3, varies as the mandibular plane angle varies.

Po = Hor. condyle + 1 2/3 X (vert. condyle — vert. molar)

Here Po = anteroposterior changes of Po in mm. The other measurements are also in mm.

Vertical growth of the teeth within their individual bases is not uniform as one would expect. Posterior teeth behave independently and differently when compared to anterior teeth thus rendering the occlusal plane completely inadequate as an indicator of the tipping of the maxillary and mandibular bases.

Vertical Growth Increments

Max - $\underline{6}$	1.98	Man - $\overline{6}$	1.59
Max - $\underline{1}$	1.11	Man - $\overline{1}$	1.81

These measurements show that the upper molar grows down more than the upper incisor, and conversely, the lower incisor grows up more than the lower molar. It is this combination that causes the occlusal plane to drop down in back as observed in normal growth.

Metallic implant studies by Björk[16] have shown that the superimposing technique used in this study is not capable of describing the complete picture of facial growth. Independent rotational changes of maxillary and mandibular denture bases and migration of teeth is even greater than described here. Metallic implants eliminate subjectivity and is the method of choice for studying the dynamics of growth and growth responses to treatment.

Summarizing facial growth without the influence of orthodontic treatment, the following conclusions can be derived:

1. Lower face outgrows the middle and upper face primarily due to a rotational change of the mandible caused by vertical growth of the condyle which normally exceeds vertical growth of the molar area causing this rotation of the mandible that pushes the chin forward.
2. Adaptability of the alveolar processes is the compensating element that maintains stability of intercuspation in spite of the independence of growth of the denture bases, both horizontally and vertically.
3. Vertical growth of teeth in relation to their base is not uniform and must be divided into anterior and posterior segments.

Growth with the influence of Orthodontic treatment

With the introduction of extraoral force to a growing face the anteroposterior relationship of the denture bases (ANB angle) reduces significantly. As stated earlier, the decrease in the ANB angle in untreated cases was due to an increase in SNB. However, unlike that in untreated cases, this decrease is due primarily to a decrease in the SNA angle.

Horizontal Growth Increments

	ANB	SNA	SNB	ANS	Max
Untreated	– .52	.10	.60	2.60	1.81
Treated	–1.85	–1.72	.13	1.34	.84
T-Test	5.28	7.64	2.23	3.43	3.42

Significance Levels

.05 - 2.00 .01 - 2.66 .001 - 3.46

All of the T-tests associated with the

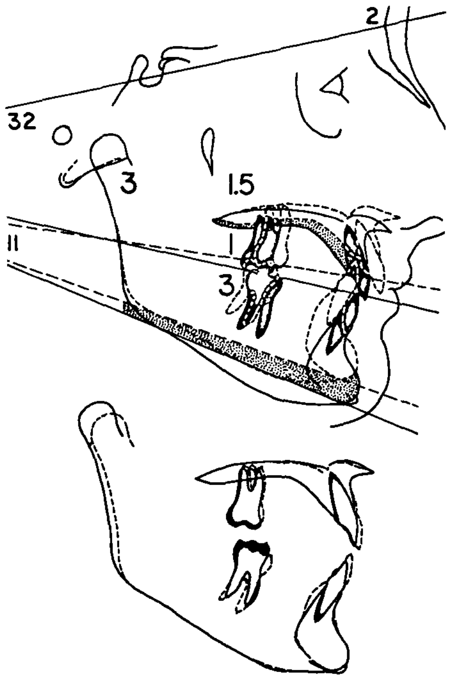

Fig. 4 Entire maxillary denture was moved posteriorly relative to S under the influence of extraoral force.

maxillary measurements indicate, at an extremely high significance level, that its forward growth is inhibited by orthodontic treatment. It should be noted that the maxilla is not usually moved posteriorly in relation to sella, but rather it fails to grow forward as much as the upper and lower face. Isolated cases showed apparent distal movement of the maxilla but these were the exception rather than the rule (Fig. 4).

Behavior of maxillary molars relative to their base was rather surprising, while incisor movements were as expected.

Horizontal Growth Increments

	Max	$\underline{6}$	$\overline{6}$	$\underline{1}$	$\overline{1}$
Untreated	1.81	2.90	3.03	2.88	2.72
Treated	.84	1.63	3.17	–.91	1.45
T-Test	3.42	2.92	.31	7.79	3.39

Upper and lower incisors were moved backward significantly, without displacing the lower molars forward on the mandible, even though fifty per cent of the cases were Class II. However, the maxillary molars moved forward relative to their bases even under the influence of extraoral forces. This figure was probably due to the large number of Class I cases involved and would have been slightly different if all had been Class II's.

This distinction between moving maxillary teeth distally, per se, and holding the maxilla while the rest of the face grows forward is extremely important. A favorably growing patient, contrasted to a non-growing patient, is the *key* factor in differential treatment procedures in Class II cases. It is virtually impossible to correct a complete Class II malocclusion on a non-growing patient, using extraoral force only, regardless of cooperation. Extraction of upper bicuspids is usually indicated. By the same token, it is common knowledge that severe Class II malocclusions can be corrected with two molar bands and a face bow without spacing of the maxillary teeth.

Vertical growth of lower molars and incisors showed statistically significant differences due to the influence of orthodontic treatment. Lower molars were elevated significantly beyond that observed in normal growth, whereas eruption of lower incisors was inhibited. Eruption of maxillary molars and incisors was statistically insignificant.

The response of the teeth to the pull of Class II and Class III elastics was quite apparent. However, the response was *vertical* as well as horizontal. The vertical component of force from these elastics is sometimes overlooked when, in reality, it produces a very effective bite-opening reaction due to the eruption of the posterior teeth. It was possible in most cases to tell the amount of Class II or Class III elastics used during treatment just from the tracings alone.

Upper and lower incisor depression, contrary to the opinions of some outstanding clinicians, *can* and *did* occur, especially that of the lower incisor. Range of lower incisor depression was from 1 to 5 mm. Depression, as used here, is a more gingival positioning of the centroid of the teeth when superimposed on their denture base.

Vertical Growth Increments

	$\underline{1}$	$\overline{1}$	$\underline{6}$	$\overline{6}$
Untreated	1.11	1.81	1.98	1.59
Treated	1.10	.55	2.44	2.22
T-Test	.04	4.23	1.79	2.80

Orthodontic treatment has an influence on the mandible but in a rather indirect way. Forward growth of the mandible, as indicated by SNB angle and Po, was significantly inhibited when compared with the untreated group. This might lead one to believe that Class III elastics retard mandibular growth. But, measurements indicate that the growth of the mandibles in the two groups was equal; in fact, horizontal condylar growth was one mm greater in the treated group. The *clinically important* difference, as shown in Table I, is in the vertical growth of mandibular molars. The mean eruption of maxillary molars is also greater, but not sufficient to be statistically significant. This study supports previous findings that Class III elastics, as used here, do not influence growth of the mandibular condyles (Fig. 5).

Findings indicate that the cant of the mandible, as indicated by the mandibu-

TABLE I

	H-Condyle	V-Condyle	Po	SNB	SN-MP
Untreated	1.65	7.18	3.48	.60	-1.03
Treated	2.77	6.73	2.49	.13	.68
T-Test	4.07	.76	2.05	2.23	5.38

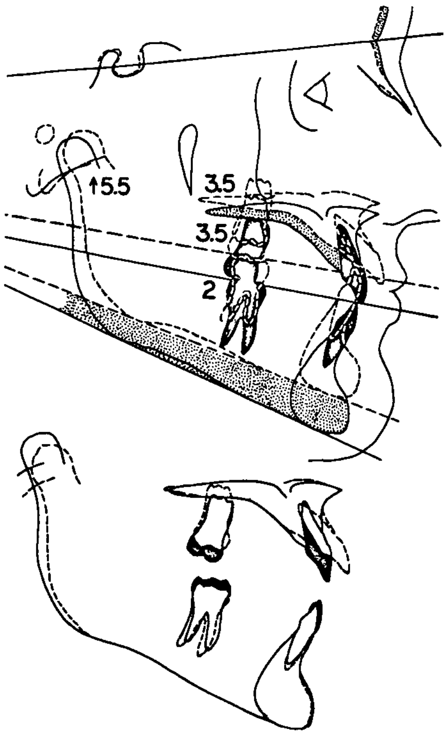

Fig. 5 Class I, deep overbite case which illustrates inhibitory effect of treatment on forward growth of mandible due to vertical influence on posterior teeth. Note bite was opened without intrusion of the incisors.

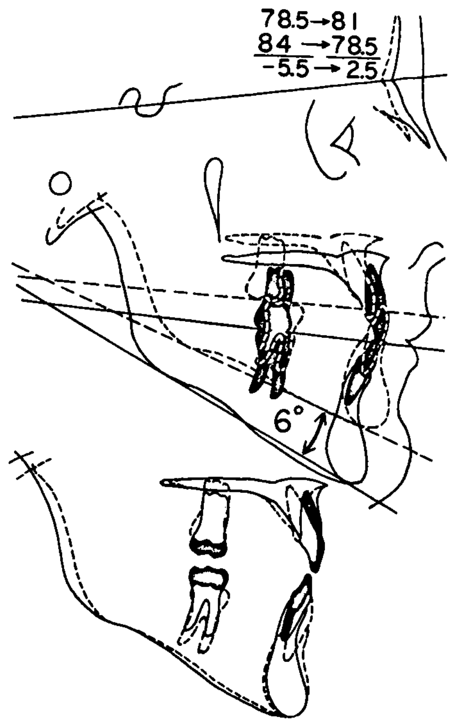

Fig. 6 Eruption of posterior teeth was used to advantage to effect a more distal positioning of the lower jaw. Note increase in anterior dental height and amount anterior teeth were elongated to prevent an open bite.

lar plane angle, is the factor responsible for the inhibitory effect on forward chin positioning rather than the absolute growth of the mandible itself. This cant of the mandible is influenced by orthodontic treatment through vertical development of posterior teeth and can be used to advantage, as shown in Figure 6, or it can be disastrous as shown in Figure 7.

Summarizing growth with the influence of orthodontic treatment, the following conclusions can be made:

1. Forward growth of the middle face can be inhibited.

2. Distal movement of maxillary or mandibular molars within their respective bases is limited and generally insufficient to effect a complete Class II or Class III correction.

3. Class II corrections are generally made by a combination of tooth movements within their bases plus denture base changes.

4. Vertical growth of anterior facial height is significantly increased. Post-treatment studies, not shown here, have shown these increases to be permanent.

5. Mandibular growth is not significantly affected by Class III elastics as used in this study.

6. Forward growth of the mandible was significantly inhibited.

7. The cant of the mandible is subject to change. It is increased by treatment; this change affects both the horizontal

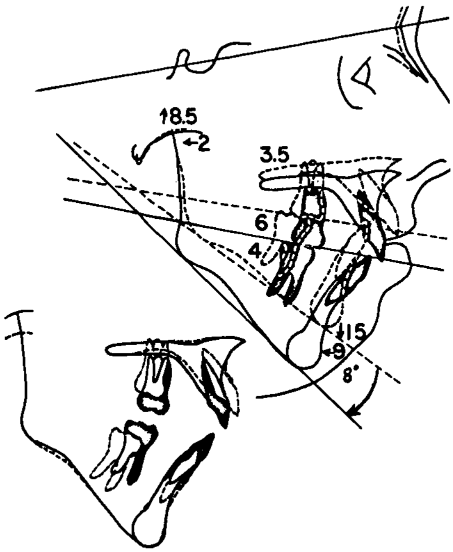

Fig. 7 Before and after four years treatment which illustrates disastrous vertical response—a response very much like that shown in Fig. 6. The lower molars and incisors were moved forward in the mandible yet the Class II molar relationship could not be corrected! Note the amount the incisors were extruded to close the bite.

and vertical position of the lower denture. This increase is permanent unless there is posttreatment growth of the condyles in excess of the vertical growth of the molars.

The criterion for selection of patients in the treated group was that they be *average* facial type. This in itself gives a biased result and does not indicate how extreme facial types react to treatment. To complete the picture of the reaction of the facial complex to orthodontic treatment, a coordinated study was conducted by Dr. Larry Price. Price compared twenty-five *high* angle and twenty-five *low* angle facial types. Our two studies were then compared with each other, and with the untreated sample for statistical evaluation (Table II).

It is interesting to note that the high angle group, which had the highest average ANB angle before treatment, had the least reduction. In fact, there was less reduction than in the group that wasn't treated at all. SNA changes show that all groups had a significant reduction in point A, so treatment was effective on anteroposterior dimension of the upper arch. Growth of the condyles was almost exactly equal. The difference in ANB changes was the difference in the behavior of the mandible (Table II).

It becomes apparent that high angle faces are more susceptible to vertical development than average faces, whereas low angle faces are less susceptible. At a glance, one might expect the different facial types to become more like average types, but unfortunately, just the opposite is true. The high angles tend to become even higher whereas the low angle faces tend to get lower.

When we examine the dental areas of these opposite types, certain observations become obvious (Figs. 8 and 9). In the high angle face the distance from ANS to menton is great and the anterior teeth are supraerupted to reach each other. Conversely, PNS and the lower border of the mandible are relatively close together and the posterior teeth seem to be infraerupted. Notice

TABLE II
MEANS OF 4 GROUPS

	Untreated	Average	High	Low
ANB Before	3.09	4.13	5.14	3.10
ANB Changes	–0.52	–1.85	–0.20	–1.28
SNA Changes	.10	–1.72	–0.96	–1.10
SNB Changes	.60	.13	–0.76	.20
Hor-Menton	3.10	2.09	0.14	3.32
SN-MP Changes	–1.03	.68	1.24	–0.48

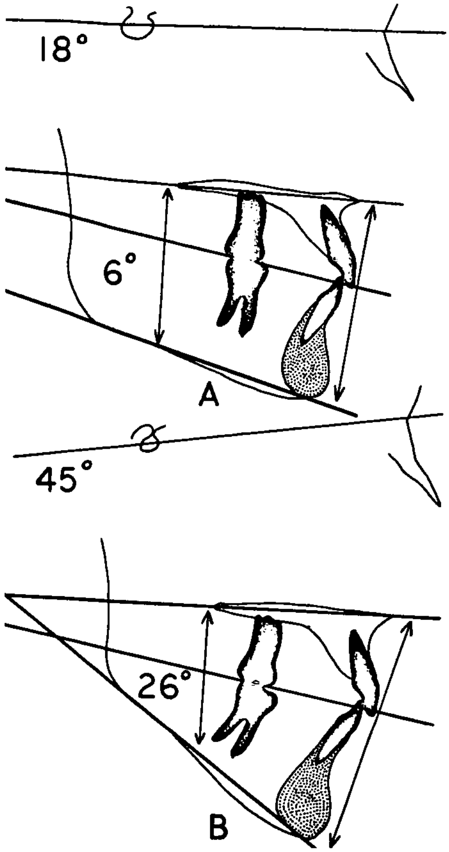

Fig. 8 High and low angle facial types of untreated, good occlusions. Courtesy of the U. of Indiana.

the converging dimension into which the second and third molars must erupt. One's imagination does not have to wander far to envision that these molars could be induced to erupt farther if given the slightest "nudge". Nor is it hard to imagine that if, during treatment, the molars raise and the bite opens, and the already supraerupted incisors are further elongated to close the bite, the open bite could easily return.

In faces with low angles the incisors are infraerupted because the anterior dental height is short. Conversely, the molars are supraerupted due to the abundant posterior dental height. No-

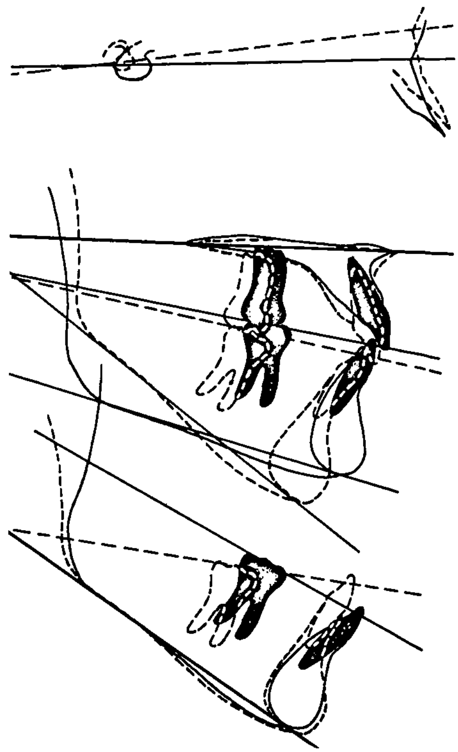

Fig. 9 Same individuals in Figure 8 superimposed along the palatal plane to demonstrate differences in upper, middle, and lower face. Difference is primarily in the mandible. Lower figure shows the mandibles superimposed along their lower borders illustrating the tremendous differences in molar and incisor height. This is precisely what the OM angle measures and is the reason why this angle is such a valuable diagnostic aid in determining facial type and predicting response to treatment.

tice the available room vertically for the eruption of the second and third molars. Is it not possible these molars might be difficult to raise occlusally since they are already situated relatively high? Clinically, this is just what we find to be true. In these types, then, since molars cannot usually be induced to move occlusally, bites must be opened by depressing anterior teeth that are already infraerupted! When thus corrected, what chances are there that the deep bite will return? Merritt,[17] in an unpublished study, found that relapse of vertical overbite was significantly related to lower incisor depression and lower molar elevation. Incisor depression was directly related to relapse from subsequent reeruption of the incisors whereas molar elevation was directly related to stability of vertical overbite.

Furthermore, as high angle faces grow, one could imagine that as the second and third molars erupt into that ever-decreasing space, the eruption of these teeth could prop the jaws open even to the extent of an open bite from the first molars forward.

These data clearly reveal rationale essential to the clinical orthodontist for everyday decisions and case management. It also brings to light that, for the most part, average cases respond favorably to treatment, and a fair degree of success can be achieved by most mechanical approaches. However, it also points out that opposite facial types should be treated with specific mechanics which are diametrically opposite.

Average facial types offer no particular problems in treatment. Growth is generally favorable for correction of a Class II or deep overbite. Extraction or nonextraction treatment has a favorable prognosis. Most analyses, such as Tweed's and Steiner's, are completely valid. Any type extraoral anchorage is satisfactory. Facial esthetics is good.

Low angle facial types offer problems in correction and retention of deep overbites. Growth is favorable for Class II correction but not for the correction of deep overbites since these facial types resist vertical development of the posterior teeth. Preference should be given for nonextraction treatment, preferably with a cervical facebow. Use of Class II, III, and posterior vertical elastics is indicated. Facial profiles tend to be flat with a prominent chin. The face can become "dished in" if caution is not exercised. Faces tend to be too flat if the recommendations of Tweed's analysis are followed. Retention of choice is a fixed cuspid-to-cuspid retainer and a bite plane for an extended period and then at night until growth ceases.

High angle facial types offer problems in the correction and prevention of open bites and the correction of Class II molar relationships. Growth is generally unfavorable and, therefore, these cases should be treated like nongrowing individuals. Removal of upper first bicuspids is usually indicated in Class II molar relationships. Cervical headgear is contraindicated, as well as Class II, III, or posterior vertical elastics. Extraoral anchorage of choice is a high-pull facebow directed at the upper molars, which inhibits their downward and forward growth. Class III elastics can then be used with impunity to effect nonextraction treatment of the lower arch. Facial esthetics is poor regardless of the anteroposterior position of the teeth. Anterior dental height is so great that the mentalis muscle is strained when the lips are placed together. Practically all cephalometric analyses are not valid for these cases which have a Class II molar relationship because they require a position of the lower incisor to which it is impossible to retract the upper denture.

Any one technique or philosophy of treatment which treats all cases without consideration of facial type is inadequate. Our armamentarium must be enlarged so that we can offer the variety of treatment procedures indicated by the variety of problems we encounter. Vertical growth must be stimulated or inhibited according to the needs of the individual patient.

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