Growth Formulas in Class II Treatment

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In a recent study Rubin[1] made a rather extensive survey of Class II treatment plans submitted by a number of orthodontists and concluded, in the light of his own experience, that twenty-six per cent of the cases would be doomed to failure before a band was placed.

This is a rather severe indictment and some may not agree with this subjective evaluation but the fact is we continue to have troubles producing good occlusions in Class II treatments in spite of all of our diagnostic aids and improved techniques. It is not uncommon, for example, to spend two years of active treatment on a four biscuspid extraction case and fail to completely correct the molar relation or to reach an impasse in nonextraction treatment after nearly two years of headgear, or to watch the molar relation relapse after a long difficult treatment or to create a dual bite displacing the mandible forward.

Often there is a temptation to explain these troubles on the basis of poor cooperation, but a more careful analysis may reveal otherwise. Certainly the treatment plan is high on the list of factors contributing to success or failure and the plan selected depends to a large extent on our understanding of the relationship between growth and treatment response. In spite of the many fine contributions dealing with Class II problems, it seems quite certain that this relationship has not been explained to the satisfaction of many clinicians.

It is therefore the purpose of this study to analyze the differences between easy and difficult treatments in an effort to determine if growth really does affect the spatial relation between upper and lower dental arches to such an extent that it could account for variations in treatment response. Following the growth analysis, certain skeletal characteristics will be compared in an effort to find clues that might have predictive value.

Review of Literature

Many of the more recent studies on Class II treatment have emphasized the importance of good mechanics and these authors have built a strong case to support their views.

Schudy[2,3] and Ricketts[4] were among the first to point out the danger of extruding molars and rotating the mandible, especially in hyperdivergent or retrognathic facial types.

Root[5] has improved headgear design and he believes that the direction of chin movement during treatment can be controlled to some extent by using mechanics that do not allow for extrusion of molars.

Armstrong[6] has demonstrated dramatic correction in the late mixed dentition period by controlling the duration, magnitude and direction of the force applied. He states, "Lack of precise control of the mechanical variables in treatment may be responsible for the general feeling among many orthodontists that there is great biologic variation between patients of the same dental age which results in wide difference in treatment response."

Merrifield and Cross have no time for the cervical headgear and they don't believe the often heard statement that cervical traction will retard the growth in the maxilla while the mandible grows forward to a Class I relation. They state,[7] "Mandibular growth is neutralized by approximately the

same amount of downward and forward growth in the maxilla and the jaw relation remains the same. The only thing that has changed is the dental relationship and this is due to the movement of teeth in either or both arches."

In contrast to this attitude there are those who believe that intra-arch tooth movements are only part of the total picture in correction of Class II malocclusions and that many of our problems stem from the fact that there is not enough variation in treatment planning. Coben states,[8] "As long as you treat children, growth is as much a factor in treatment as the appliance itself. While you are manipulating the appliance and regulating the teeth, growth is also working—working for you or nullifying your treatment efforts." In applying his growth concepts to treatment planning he suggests that some Class II cases require no extractions, others maxillary bicuspids only, others four bicuspid removal and, in some, he advocates the extraction of six teeth: the four first bicuspids and the upper first molars.

Creekmore[9] points out that growth is generally unfavorable in high angle facial types, and that these cases should be treated like nongrowing individuals. He recommends the extraction of upper first bicuspids in such cases and the use of mechanics that will not extrude buccal teeth.

In another recent article Ackerman and Proffit[10] suggest the use of therapeutic diagnosis (testing the response) as an aid in treatment planning. They point out that there is strength, not weakness, in recognizing true uncertainty.

No matter which of these attitudes we subscribe to we must agree that one of the most important objectives in treating a Class II malocclusion is to produce a good centric relation. So it becomes an important consideration in treatment planning to at least try to determine if molar relation is going to be easy or difficult to correct.

Following the growth analysis, certain skeletal characteristics will be compared in an effort to find clues that might have predictive value.

Method and Material

Sixty-five treated Class II cases were first divided into two groups. Those that were treated in nineteen months or less were considered easy and those that required twenty months or more of active treatment were placed in the difficult group. In selecting the cases it was observed that the difficult cases seemed more plentiful so thirty-five were placed in this group while only thirty were placed in the easy group.

The average age of the easy cases was twelve years while the average age of the difficult cases was eleven years.

Two x-rays were used for each patient; the average time between them was 24.2 months for the easy cases, and 26.5 months for the difficult cases.

At the time these cases were treated more cervical headgear was being used than at present, but the proportion between cervical and high pull was about the same in each group.

Only two treatment plans were used in the easy cases, twenty nonextraction and ten four-bicuspid extraction. In the difficult group there were seventeen nonextraction, eight four-bicuspid extraction, and ten upper bicuspid extraction cases.

To study the horizontal growth, the face was divided into three main parts: the anterior midface which grows forward carrying the upper denture with it, the posterior midface which grows backward carrying the mandible and lower denture with it, and the mandible itself which increases in length (Fig. 1).

In making the measurements articulare and Point A were connected to form the midface plane. The mid-

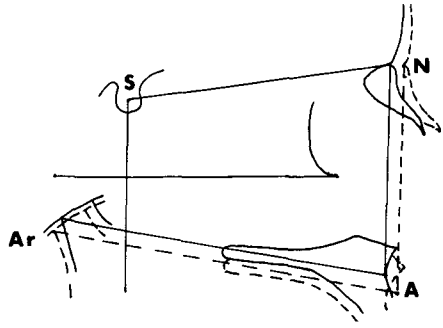

Fig. 1 Horizontal midface growth was measured by superimposing tracings on SN with S registered. A perpendicular to Frankfort plane thru S on the first tracing divides the anterior and posterior midface. Posterior midface increase is the amount that articulare moved backward. Anterior midface increase is the amount that point A would have moved forward without treatmen. (Probable point A was constructed on second tracing by assuming the SNA angle does not change during growth without treatment.)

face plane was divided into anterior and posterior by drawing a perpendicular to Frankfort plane through sella. In doing this we make the assumption that sella is a relatively stable cranial point. Since the inclination of Frankfort plane often varies between the first and second tracing, only the original Frankfort plane was used in constructing the perpendicular S lines on both tracings.

It seems obvious that only one of these three areas would be affected by treatment, namely, the anterior midface increases. So, in measuring this horizontal increase, a probable Point A was used on the second tracing instead of the actual Point A. If one assumes that the SNA angle doesn't change during growth, he can locate where Point A would have been without treatment. In measuring the midface increases the tracings were superimposed on SN with S registered. The posterior midface increases were measured from the S line to articulare, and the anterior midface increases were measured from the S line to Point A using the probable Point A on the second tracing.

In the mandible, points B and Go were connected and this line was extended posteriorly to a perpendicular to articulare (Fig. 2). This was called the mandibular length plane. One reason for selecting this plane and the midface plane is that in most cases they are nearly parallel and also parallel to the occlusal plane. It was also felt that the BGo plane might be more reliable than the mandibular plane because Björk has pointed out that the lower border of the mandible undergoes extensive remodeling during growth. In measuring the horizontal growth of the mandible the tracings were superimposed on the symphyses and lower borders and the increase was measured between the two perpendiculars to articulare.

When the midface and mandibular horizontal increases were measured in this way, one arrives at what might be called a growth formula for each patient. For example, if the growth formula was found to be 1-3 over 6 (Fig. 3), this would mean that, while the mandible is increasing 6 mm in length, it is being carried backward 1 mm so the lower denture would tend to move

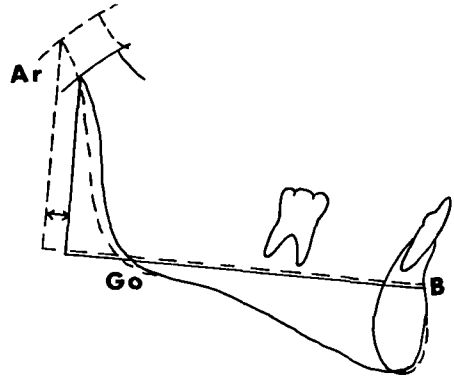

Fig. 2 Horizontal mandibular growth was measured by superimposing mandibles on symphyses and lower borders. The increase in length of the mandible was measured between the two perpendiculars to articulare.

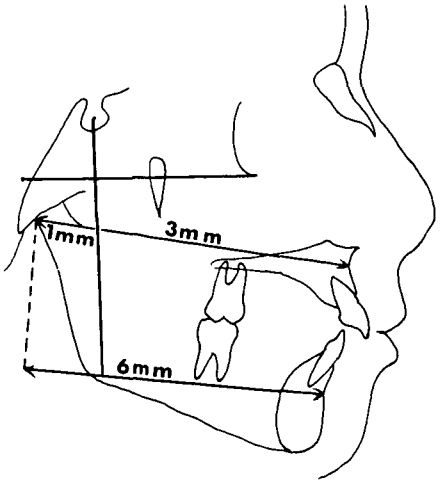

Fig. 3 Favorable horizontal growth for correction of Class II malocclusion. Lower denture would tend to move forward faster than the upper denture making correction of molar relation relatively easy.

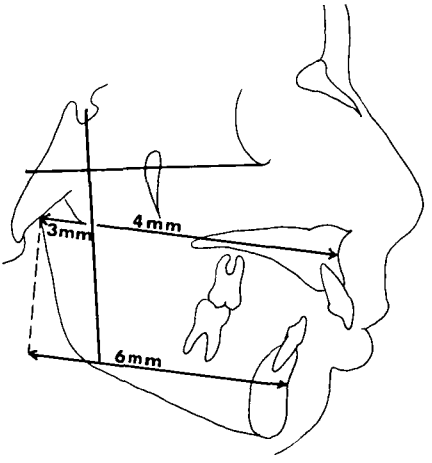

Fig. 4 Unfavorable horizontal growth for correction of Class II malocclusion. Although mandibular growth is adequate, backward growth in posterior midface cancels out half of the increase in length of the mandible. The spatial relationship between upper and lower denture would not improve appreciably so correction of molar relation would be more difficult.

forward 5 mm. The upper denture at the same time would tend to move forward 3 mm and part of this could be controlled with the headgear or Class II mechanics, so this would be a very

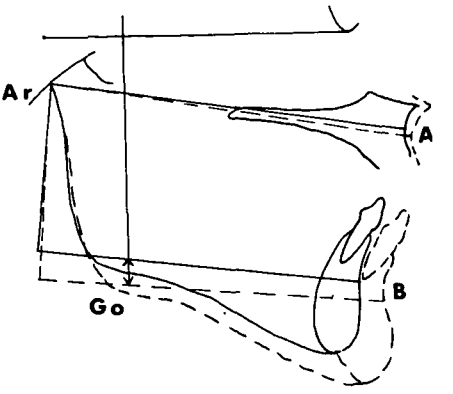

Fig. 5 Vertical mandibular growth was measured by superimposing tracings on articulare with the vertical S lines parallel. The increase in vertical or ramus height is measured between the two B-Go planes just anterior to the gonial angle.

favorable growth formula from a treatment standpoint.

Or on the other hand, if the formula was found to be 3-4 over 6 (Fig. 4), this would mean that, while the mandible was growing in length 6 mm, it was being carried backward 3, so the lower denture would tend to move forward only 3 mm. The upper denture at the same time would tend to move forward 4 mm and, though treatment mechanics might reduce this somewhat, the spatial relationship between upper and lower denture would not improve appreciably.

The correction of the Class II relation would then have to be brought about mainly by intra-arch tooth movements which require time, good mechanics, and a tremendous amount of cooperation. The horizontal growth vectors, at least, would be of no help in treatment.

The analysis is carried one step further to complete the growth formula for each patient. To measure the vertical increase, or what amounts to ramus height increase, the tracings were superimposed on articulare with the vertical S lines parallel and the increase

measured just ahead of the gonial angle (Fig. 5).

Findings and Discussion

The following is a summary of what was found when growth of the easy cases was compared with growth of the difficult cases.

The total horizontal increases for the thirty easy cases was found to be 16, 42, over 96 while the total vertical increase was 103 mm.

When these figures are divided by thirty, we get the average growth in each area over a period of twenty-four months, .5, 1.4 over 3.2; the average vertical increase was 3.5 mm.

Total horizontal increases for the difficult cases for twenty-six months were 48, 64, over 92; the vertical was 136 mm.

Since the difficult cases grew for an eight per cent longer time (2.3 months) than the easy cases, we adjust this by subtracting this percentage from these figures.

This gives us horizontal totals of 44, 59 over 85 and vertical growth of 125 mm for twenty-four months.

Now these figures are divided by 35 to get the average for each difficult case, 1.3, 1.4 over 2.4 and 3.5 vertically.

Observe that the anterior midface growth and the vertical or ramus growth are identical for each group. But the posterior midface increase is almost three times as great in the difficult cases, and the horizontal increase of the mandible is about one third less in the same cases.

So the two trouble spots appear to be the posterior cranial base which grows too much and the mandibular body which does not grow enough. In other words, posterior midface growth cancels out over half of the horizontal increase of the mandible in the difficult cases while in the easy cases it cancels out only 15%. Another way of saying it is that there is more effective mandibular horizontal growth in easy cases.

The effective mandibular growth is the increase in length of the mandible minus the distance it was moved backward by posterior cranial base growth. In the easy cases this amounted to approximately 3 mm for twenty-four months while in the difficult cases it was only about 1 mm for the same period. The average effective mandibular growth for sixty-five cases was about 2 mm, or approximately 1 mm per year which is nearly the same as the forward growth of the maxilla.

Some may question whether these differences are great enough to account for the variation in response observed in treatment. I believe it shows that there are biologic forces at work and this is certainly a better way of explaining variation in response than the rather common practice of crediting the technique when we are successful and blaming the patient when we are not. There is no doubt that excellent cooperation and good mechanics can sometimes overcome undesirable forces, but it is very misleading to conclude that one technique is better than another unless the growth of the individual patient is also considered.

Cervical headgear has been blamed for many of our troubles, but it is important to point out that when the posterior cranial base is carrying the mandible backward and this is compounded by relatively little increase in the length of the mandible, the chin is not going to move forward no matter what mechanics are used or how much precaution is taken to avoid extruding molars. The treatment plan, either nonextraction or four bicuspid extraction, is going to be difficult, time consuming and, perhaps, even impossible.

Now let us examine the two groups of cases in another way.

If this figure of one mm a year is

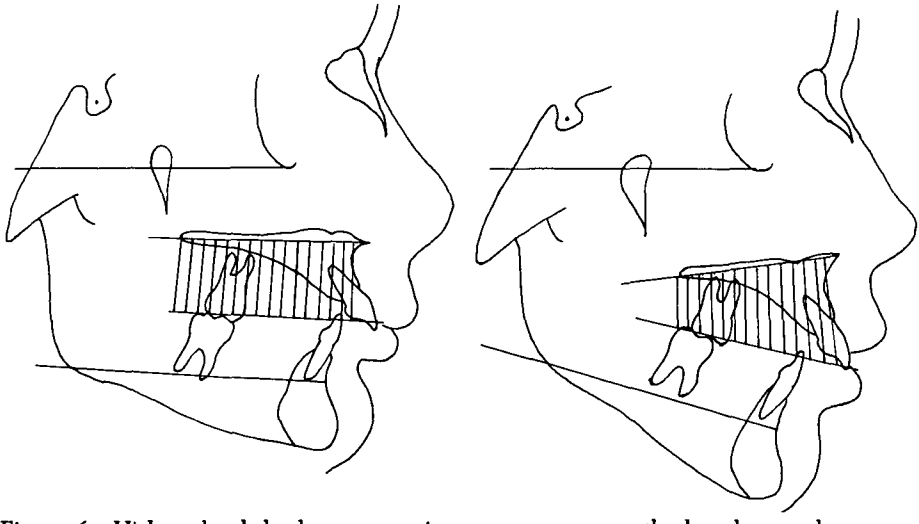

Figure 6 High-angle skeletal types require more ramus growth than low angle cases to counteract mandibular rotation induced by mechanics.

used as a yardstick to evaluate the effective horizontal mandibular growth in individual cases, they can be rated good, average or poor. This was done with the following results. Sixty-three per cent of the easy cases had effective horizontal mandibular growth that was better than average while in the difficult group, seventy-one per cent had less than average effective horizontal mandibular growth.

These figures indicate that there are, no doubt, other variables than horizontal growth that affect treatment response. It also seems evident that there is a close relationship between effective horizontal mandibular growth and ease of correcting molar relation.

Next, the same thing was done with vertical or ramus growth using the figure of 1.7 mm per year as average. This showed that approximately half of the cases in each group were poor vertical growers. In other words, there does not seem to be a close relationship between increase in ramus height and the ability to correct molar relation.

This statement should be qualified somewhat, however, because in certain skeletal types growth in this area can indirectly be an important factor in accomplishing mesiodistal tooth movements.

Different skeletal types require different amounts of ramus growth to counteract mandibular rotation induced by our mechanics. For example, in low angle cases a small amount of ramus growth would be adequate to counteract rotation but in high angle cases where the palatal plane and occlusal plane diverge greatly, more ramus growth would be needed to offset the rotation brought on by posterior movement of upper buccal teeth or extrusion of upper or lower molars (Fig. 6).

It should also be mentioned that in those cases where Class II correction must be brought about mainly by intra-arch tooth movements, some vertical or ramus growth is better than no growth at all. This is no more than a clinical observation but I believe that mesiodistal movements combined with varying amounts of extrusion are easier to accomplish than straight mesiodistal movements. Increase in ramus height provides room in the posterior alveolar

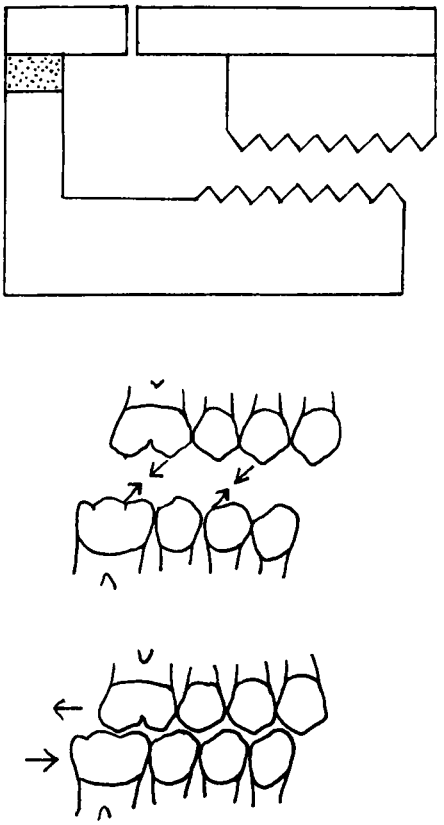

Fig. 7 Vertical mandibular growth makes Class II correction easier by creating room to extrude molars.

Mesiodistal movements combined with varying amounts of extrusion are easier to accomplish than straight mesiodistal movements.

area to allow this type of tooth movement (Fig. 7). It has been my observation that response is slow without the help of favorable horizontal growth.

One of the most interesting things about the fact that half of these cases were poor vertical growers concerns our mechanics. If we assume that these sixty-five cases are typical of those we treat every day, this observation should be rather disturbing to those who use only cervical headgear or Class II elastics to correct Class II malocclusions. I see no reason to condemn the cervical headgear but, as many others have pointed out, there is certainly reason to question the routine use of mechanics that tend to extrude molars, at least in children of this range.

To pursue the analysis of the sixty-five cases still further, let us examine the effective horizontal mandibular growth again. It was observed that thirty-eight per cent of all the cases were better than average in this respect, fifteen were average, and forty-seven per cent were less than average.

Assuming again that these sixty-five cases are typical of late mixed dentition and early permanent dentition cases that most of us treat, it seems reasonable to conclude that favorable changes in spatial relationship between upper and lower dental arches as a result of growth and treatment take place in only thirty-five to forty per cent of our cases. In the remainder of our treatments, correction is brought about mainly by intra-arch tooth movements and horizontal growth is of no help.

This implies that eight hours of headgear a day is probably not going to do the job in most of our cases. This observation has caused me to strive for a minimum of twelve hours and, if I can't get this after a period of clinical trial, I will often change from nonextraction to the upper bicuspid extraction plan.

This also implies that appliances like the activator would have limited success if mass treatments are attempted since they depend to a large extent on favorable growth.

Another point worth considering is that over half of the unfavorable horizontal growers were also poor vertical growers. This means that about one-fourth of the children in this age range will have growth which is so unfavorable that molar relation will be very difficult to correct. When one adds to this other adverse conditions such as poor mouth hygiene and poor coopera-

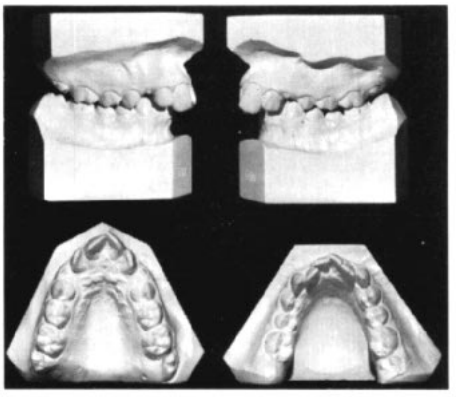

Fig. 8

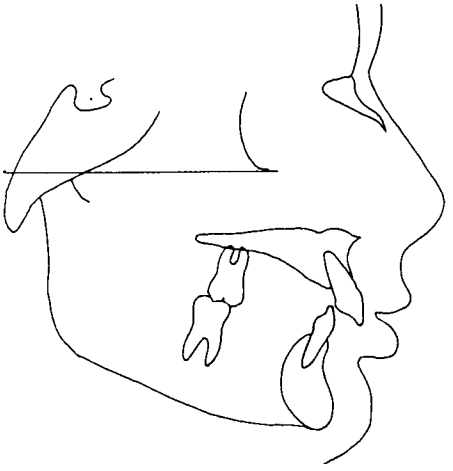

Fig. 9

tion, it seems practical to consider upper bicuspid extraction or some variation of this plan in a fairly large proportion of Class II cases.

Yet, some orthodontists don't accept this concept at all. Others will select this plan only in nongrowing cases, and some will include high angle cases and open bites in this category. Many have trouble accepting the idea that growing cases should ever be treated this way, probably because they have the mistaken idea that growth is always helpful. We have tried to point out that this is not so and, furthermore, that unfavorable growth is not restricted to high angle cases.

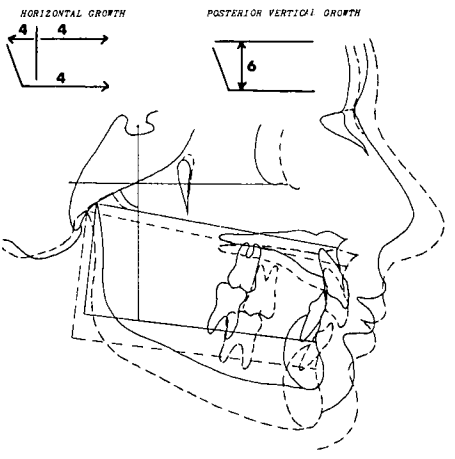

Fig. 10 Gregory M., ages 11 years 7 months and 16 years 6 months. Horizontal growth analysis over a five year period explains why molar relation could not be corrected with headgear. Increase in length of mandible was completely cancelled out by backward growth in posterior midface. From a treatment standpoint this could be considered equivalent to a nongrowing patient.

To illustrate, the casts of a boy age eleven years and seven months at the start of treatment are in Figure 8. He had a deep overbite with severe lower anterior crowding.

His facial type would have to be considered hypodivergent and most orthodontists would predict that growth would be favorable (Fig. 9). But, as his growth formula over a five year period indicates, it was extremely unfavorable from a treatment standpoint (Fig. 10). Growth in the posterior cranial base completely concelled out the increase in length of the mandible so in this respect it was equivalent to a nongrowing case or even worse. Not only this, the increase in ramus height was less than average, 6 mm for five years.

From this it should be easy to guess that the case did not respond to headgear treatment. Cooperation was good but the treatment plan had to be changed from nonextraction to upper first biscuspid extraction.

Many orthodontists whose techniques

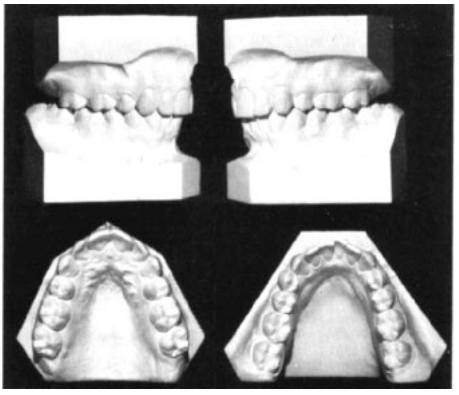

Fig. 11 Casts of Gregory M. two years out of retention at age 19.

are devoted mainly to the four-bicuspid extraction plan would disagree with this treatment because of the severe crowding in the lower arch. It is true that lower anterior alignment did relapse slightly. Figure 11 shows the casts made at age nineteen, two years out of retention and Figure 12 the photos. I feel that extraction of four bicuspids would have made this patient a dental cripple with a dished-in face. As far as nonextraction is concerned, it may have been possible to correct the molar relation with headgear worn nearly full time, but with unfavorable growth like this it is almost certain that the relapse tendency would have been so great that this plan also would have been impractical.

Now consider the possibility of predicting this kind of growth and the poor response that goes along with it. In order to predict response one must be able to predict not only *when* a child will grow but also how *much* growth will occur in at least four different areas of the face. I wonder if growth prediction will ever amount to more than educated guesswork. No one seems to know when the backward growth in the temporal area will cease; it is also impossible to predict whether a mandible will be body grower, a ramus grower or both. A mandible may grow vertically for a time and then start to grow horizontally. With unknowns like these it seems doubtful that we are ready for computerized case analysis.

Fig. 12 Photographs of Gregory M. before treatment and at end of retention.

The best we can do at present, whether our cephalometrics are simple or sophisticated, is to predict response within general limits and then make allowances for uncertainty when we plan treatment.

We can get a reasonably good idea of how difficult the correction of molar relation will be by making one simple appraisal of the vertical and horizontal disharmony in the face. From the few simple comparisons made in this study, I have gained the impression that the divergence between the occlusal plane and palatal plane describes vertical disharmony as well as any other measurement.

In our two groups of cases a number of cephalometric readings were compared including the mandibular plane angle, the inclination of the occlusal plane, the occlusal-mandibular (OM) angle, the occlusal-palatal (OP) angle and upper face height to lower face height. In most of these readings the averages for the difficult cases were almost identical to the averages for the easy cases. The average OM angle (17) for the difficult cases, for example, was only one degree higher than that of the easy cases. The average OP angle (12.5) for the difficult cases, on the other hand, was three degrees more divergent than that of the easy cases. Possibly this is not significant but it makes sense when one tries to explain the reason that we have troubles with openbite Class II malocclusions. More often than not these patients also have rather divergent skeletal patterns (Fig. 13). In such patients attempts to move upper teeth backward into the narrowing area between occlusal plane and palatal plane can cause trouble because more than an average amount of increase in ramus height is needed to prevent the mandible from rotating. It has been pointed out that half of the cases in this age range have less than average increase in ramus height so the

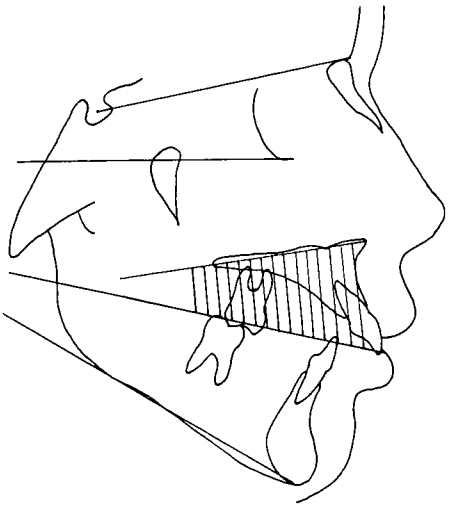

Fig. 13. The average OP angle (occlusal plane to palatal plane) was 3 degrees more divergent in the difficult cases than in the other cases. This angle seems to describe vertical disharmony in the face as well as any cephalometric reading.

chances are fairly good that molar relation may be difficult to correct if this angle is high. Even with high-pull headgear to the upper molars the mandible will rotate unless the increase in ramus height is greater than average. This explains why extractions in the upper arch only have proved to be a good treatment plan in high-angle Class II cases. If upper molars are held where they are or moved forward slightly into a wider area between occlusal plane and palatal plane, the mandible tends to close rather than open.

In appraising the horizontal disharmony of the face, the ANB angle is the most commonly used measurement, but it doesn't tell one much about the difficulty he might expect in treatment. I believe there is a better way to measure the disharmony between upper and lower denture bases (Fig. 14). To make this measurement a line is drawn through the palatal plane and a perpendicular is erected at point A. Then another perpendicular is erected from BGo through point B. The horizontal

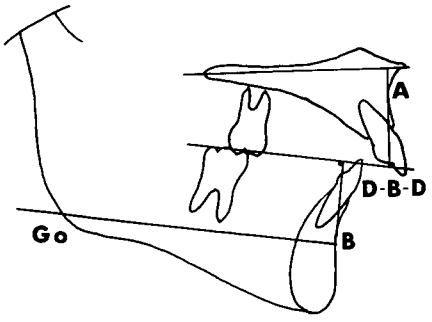

Fig. 14 To judge the severity of the Class II problem, appraise the vertical and horizontal disharmony in the face by measuring the Denture Base Disharmony (D.B.D.). If it is 8 mm or more one can be reasonably certain of a long difficult treatment and extractions in the lower arch should be considered risky.

distance between the two is measured in mm at the occlusal plane. This combines an appraisal of the vertical and horizontal disharmony into one reading.

This measurement, which may be called Denture Base Disharmony, was compared with the ANB angle in the following manner (Fig. 15):

Observe that the easy cases had an average ANB angle of five degrees with a range of one to nine degrees, while the difficult cases had an average ANB angle of seven degrees with a range of two to eleven. There was only a two degree difference between the averages with the ranges overlapping considerably.

If we eliminate those between the averages as having no predictive value,

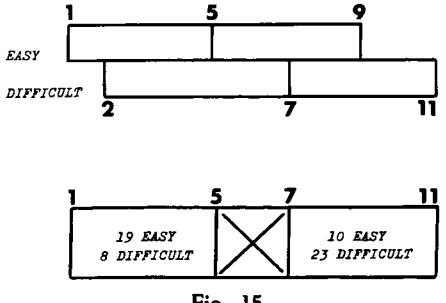

Fig. 15

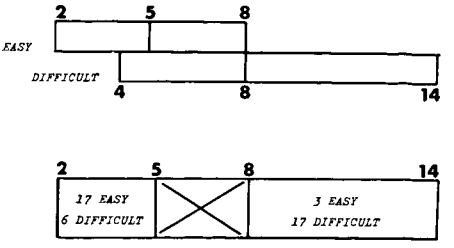

Fig. 16

we find that sixty per cent of the cases with an ANB of five degrees or less were easy and sixty per cent of those with an ANB of seven degrees or more were difficult. In other words, this isn't much better than fifty per cent accuracy as a clue to the difficulty in treatment.

When the D.B.D. is analyzed in the same way, (Fig. 16) we find an average disharmony of 5 mm for the easy cases with a range of 2 to 8 mm. The average for the difficult cases was 8 mm with a range of 4 to 14 mm. Then, if we eliminate those between the averages as having no predictive value, we find that seventy-four per cent of the cases with D.B.D. of 5 or less were easy, while eighty-five per cent of the cases with D.B.D. of 8 or more were severe. If this method of evaluating these two measurements is fair, then this latter procedure is considerably more accurate.

This is about as close as I have been able to come to predicting response in Class II treatment. It is not infallible and is not a prediction of how a child is going to grow, but one can be reasonably sure that a denture base disharmony of 8 mm or more means a long, difficult treatment and it should make an orthodontist think twice before extracting in the lower arch.

Such cases require more than an average amount of mandibular growth during treatment and there is better than an even chance that the amount will not be sufficient. If half of our

cases are either poor vertical growers or poor horizontal growers as this study seems to indicate, and some are poor in both respects, the odds are definitely not in our favor when it comes to correcting molar relationship in high denture base disharmonies.

Without doubt one of the most common mistakes in orthodontics is the extraction of four teeth in Class II malocclusions at the beginning of treatment giving no thought to the possibility that it may be impossible to make upper and lower teeth fit together properly. Many orthodontists will extract four teeth mainly on the basis of a large ANB angle reasoning that this is the only way to reduce a bad convexity. Tweed used to say that these were the cases that separated the men from the boys. This may be so, but it is also true that many of these cases are doomed to failure before a band is placed, simply because the irreversible course of extracting four bicuspids was taken without first testing the response.

Theoretically, four bicuspid extraction may be the ideal plan in such cases because skeletal changes are desirable treatment goals, but it is wrong to assume that this plan will be any more successful in reducing convexity than nonextraction or upper bicuspid extraction.

When our treatment affects only one of three main areas of horizontal growth, it is unrealistic to expect dramatic skeletal changes routinely despite the method of treatment employed.

When actual anterior midface increases were compared with probable increases, it was found that Class II mechanics reduced the horizontal growth in this area to approximately one fourth of what it would have been without treatment. This was true in both the easy and difficult cases and it was also true for the extraction cases alone.

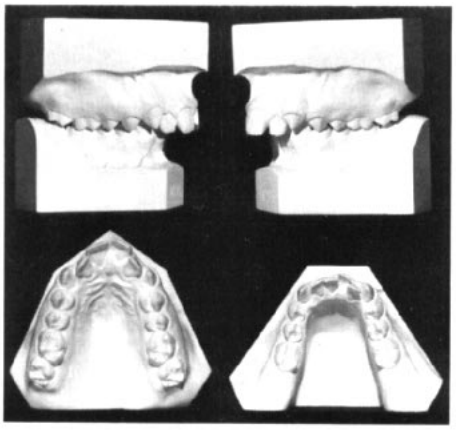

Fig. 17 Casts of Alvin B., age 12, before treatment.

Even if anterior midface increases could be held to zero, reduction in convexity is not always assured, because horizontal growth in the mandible and in the posterior cranial base is what ultimately determines the extent of the change.

This case will illustrate: The patient was a boy, age twelve, with full Class II molar relation, deep overbite and lower incisors that were crowded and slightly behind the APo plane (Fig. 17).

The ANB angle was ten degrees and the denture base disharmony was 14 mm, the highest of any of the cases in this study (Figs. 18 and 19).

Four teeth were extracted at the beginning of treatment and, though cooperation was excellent, the molar relation was still Class II after nearly two years of high-pull headgear to the upper incisors, then to the upper molars. In desperation Class II elastics were also used part time.

The appliance was removed after thirty-six months of treatment but during the retention period molar relation began to relapse so a retainer was made which allowed the use of high-pull headgear again. This was worn off and on for two more years. It is interesting to note that during this time this

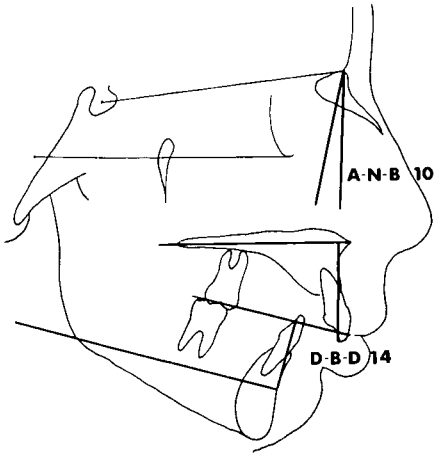

Fig. 18 Tracing of Alvin B. before treatment. Note the extreme convexity and high denture base disharmony.

Fig. 19 Photograph of Alvin B. before treatment.

boy grew about six inches in height.

Finally after five years, the centric relation seemed good and records were made. The upper anterior teeth were too upright even though a great effort was made to torque roots lingually during treatment (Fig. 20).

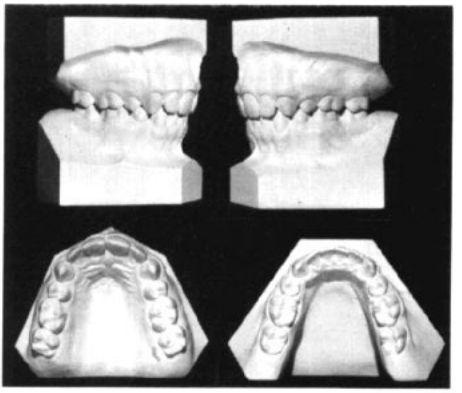

Fig. 20 Casts of Alvin B. after a long, difficult treatment.

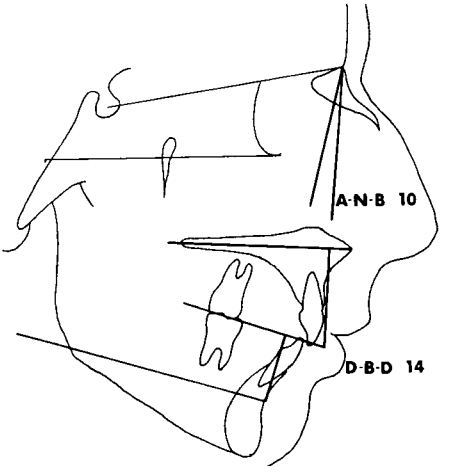

Fig. 21 Tracing of Alvin B. after treatment. This treatment plan did not produce a change in the convexity or denture base disharmony.

There was a reasonably good profile change because upper anterior teeth and point A were moved back considerably in relation to anterior nasal spine. But the convexity and denture base disharmony did not change (Figs. 21 and 22).

Some would argue that better mechanics might have reduced the convexity and that molar relation should not have been so difficult to correct. But when the effective mandibular growth is a minus 2 mm, instead of a plus 4 mm which would be average for this length of time, you have a prescription for

Fig. 22 Profile photograph of Alvin B. after treatment.

trouble no matter which technique is used, how good the cooperation is, or when treatment is started. When it takes four or five years to establish a good centric relation there is reason to question the practicality of such a heroic treatment plan.

To further emphasize the uncertainties in Class II treatment, let us consider another case. As stated before, this unfavorable growth is not restricted to high-angle cases nor to high denture base disharmonies.

This girl, age eleven, had an ANB angle of six degrees and a denture base disharmony of 6 mm. In other respects, the skeletal pattern was reasonably good (Fig. 23), but the case did not respond to headgear treatment despite good cooperation. The treatment plan had to be changed from nonextraction to upper biscuspid extraction and even then it was difficult to establish a good centric relation.

Analysis of the growth over approximately three and a half years shows that mandibular horizontal growth was equal to that of the midface (4-1 over 5), but nearly all the midface increase was posterior to the S line where it could not be controlled with headgear (Fig. 24). Convexity in this case was not reduced even though upper anterior

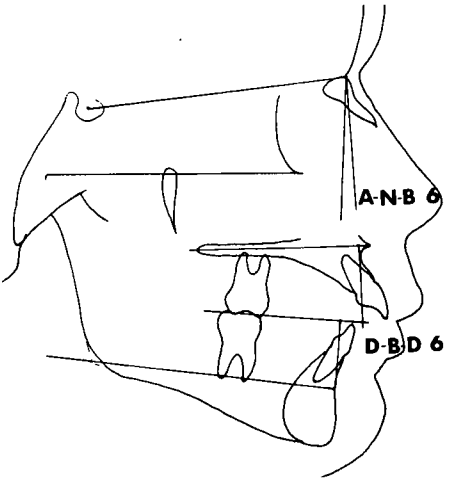

Fig. 23 Tracing of Joan G., age 11 before treatment.

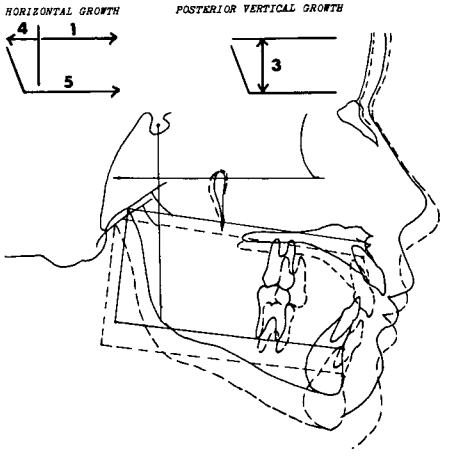

Fig. 24 Growth analysis of Joan G. over three and one half years explains why this case did not respond to headgear treatment. Although the mandible increased in length by 5 mm, this growth was nullified by 4 mm of backward translation. Most of the midface horizontal growth occurred posteriorly where it could not be controlled with headgear.

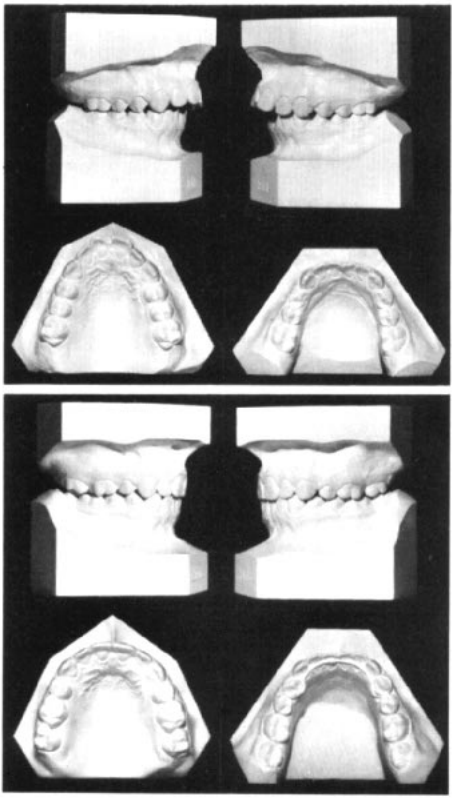

Fig. 25 Casts of Joan G. before treatment, above, and after (below).

teeth were moved posteriorly into the extraction sites. The casts before and after treatment are shown in Figure 25.

It is not completely accurate, however, to say that treatment will be difficult if midface horizontal growth equals or exceeds that of the mandible. This case (Fig. 26), for example, grew forward rather than backward. Although the probable midface increase was equal to the horizontal increase in length of the mandible, there was little or no backward translation of the mandible, and horizontal growth in the midface was in the anterior area where Class II mechanics could retard the forward growth of the maxilla.

This patient had a unilateral Class II problem which was corrected without difficulty in sixteen months with considerable reduction in convexity (Figs. 27 and 28).

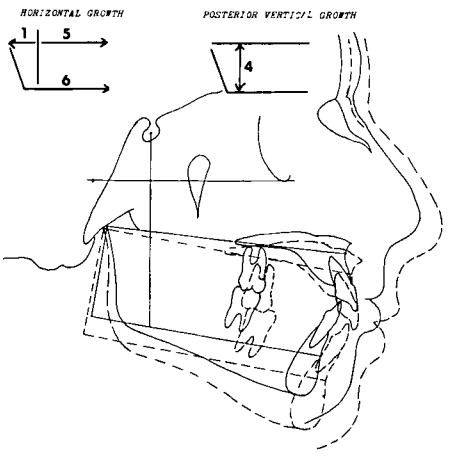

Fig. 26 Growth analysis of Jay R. over a three year period. Although probable midface growth was equal to the increase in length of the mandible, as in the last case, the response was quite different. Treatment was relatively easy and convexity was reduced considerably because there was little or no backward translation of the mandible; the anterior midface growth was controlled to some extent with Class II mechanics.

It is risky trying to predict whether a child will be a forward or a backward grower and this can mean the difference between success and failure when it comes to producing a good occlusion. One way to reduce this risk is to test the response for about six months with headgear, then select a treatment plan which is compatible with the cooperation and biologic response observed.

In instances where arch length is deficient and the Class II relation is unilateral, consideration should be given to extraction of three bicuspids instead of four. Sometimes a compromise plan of extracting upper bicuspids and a lower incisor is indicated, especially in cases where upper lateral incisors are small. Many times such variations have a better chance of success than the more common or so-called ideal treatment plans.

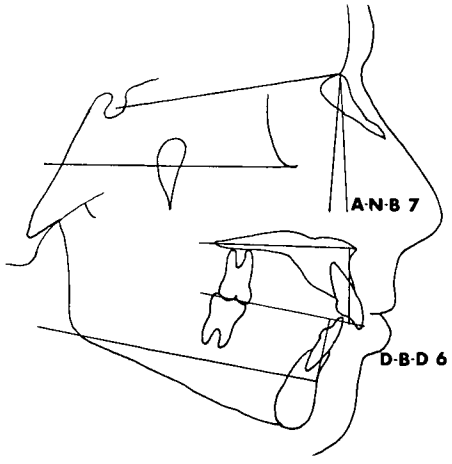

Fig. 27

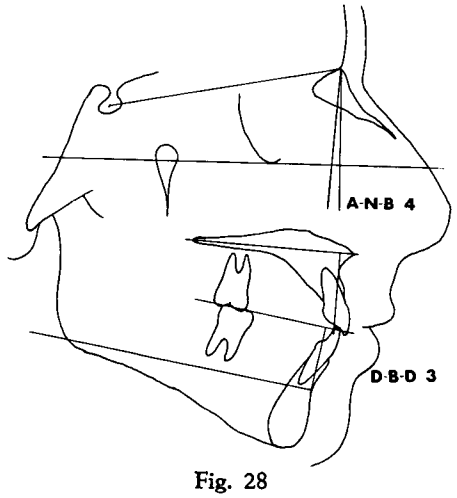

Fig. 28

Summary

This has been an effort to analyze facial growth in a manner that might have more meaning for the clinical orthodontist.

To understand the relationship between growth and treatment response, one has to study movement of parts as well as increase in size; it is also helpful to consider vertical and horizontal growth vectors separately. Measuring mandibular growth along the Y axis or from condyle to chin does not tell the whole story and can be misleading.

This analysis of easy and difficult treatments suggests that mechanics is often given too much credit and sometimes too much blame for the changes that occur during treatment.

It shows that growth is helpful in some cases, is borderline in some, and positively unfavorable in others.

It implies that treatment may or may not be easier during a so-called growth spurt.

It explains why response is so difficult to predict and supports the view that it is not always possible to select the right treatment plan at the beginning of treatment.

Altogether, the evidence suggests that many troubles in Class II treatment are indirectly related to overconfidence in growth prediction and overconfidence in mechanics. One thing that will go a long way toward eliminating these troubles is to acknowledge that molar relation can sometimes be so difficult to correct, even in growing cases, that conventional treatment plans are impractical.

If success is measured by the kind of occlusions produced, there is no doubt that individualized treatment planning, often based on a period of clinical trial, is the safest approach in solving Class II problems.

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