Variations In Profile Change And Their Significance In Timing Treatment

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Introduction

The age and sex of a patient beginning orthodontic treatment with a Class II, Division 1 malocclusion may determine his potential for certain quantitative changes in the hard and soft tissue profiles of the face. This report concerns some of these growth and treatment changes in boys and girls at various ages. The data were secured from cephalometric headplates taken before and after orthodontic treatment and the information obtained therefrom supports our concept of treatment timing.

Most of us agree that both age and sex may determine the potential for improvement during treatment. That potential, of course, is growth along with a plasticity of the alveolar process that apparently is not as great when growth slows or ceases. How growth occurs and where it occurs are well documented; but we have only an educated guess as to how much will occur and specifically when. We know that the timing of growth differs according to sex. We can visualize how growth helps in our concept of treatment for Class II, Division 1 malocclusions; but knowledge of the amount and timing of this growth is nebulous. In analyzing quantitative changes as they relate to the sex and age of the patient, it may be possible to anticipate what changes to expect in treating Class II, Division 1 malocclusions at a given age in boys and girls. A knowledge of possible quantitative growth and treatment changes for various ages may provide a rational basis for timing the start of orthodontic treatment.

Read before the Edward H. Angle Society, Colorado Springs, October 1959.

Review of the Literature

The pubertal growth spurt has been referred to as an aid to treatment. Recently Graber (1955) noted that the chances of success were greater if treatment were coordinated with the pubertal growth spurt; but, also, he acknowledged the unpredictability of growth. He indicated that the best results were most likely in girls when treatment is started between ten and twelve years of age and in boys between twelve and seventeen years of age. In keeping with such a concept many orthodontists plan treatment whenever possible to coincide with an active growth period. Yet, on further inquiry as to when this growth is to occur in good quantity we receive many diverse opinions.

A different approach was expressed by Kloehn (1947) in which he urged early treatment of Class II, Division 1 malocclusions to inhibit forward growth of the maxillary teeth and alveolar process while normal growth carried the mandible forward. He held that early treatment was important because of a "declining rate gradient of growth of the jaws and alveolar process."

Turning to the profile, Lande (1955) made some observations regarding males that are pertinent here. His was a cephalometric study in which he superimposed headplate tracings on the sella-nasion plane at nasion. The tracings were oriented on the Frankfort plane. He observed that the mandible became more prognathic relative to the brain case and the maxilla. Thus, the convexity of the face tended to decrease as age advanced. Similarly, Bjork (1947) observed that the mandible tended to become more prognathic with growth in males. His study was done with groups of males twelve years of age and from twenty-one to twenty-three years of age. On the basis of these findings it seems that the orthodontist may accent and facilitate some of those changes that are natural and to be expected regarding a reduction in the convexity of the face.

Epstein (1949) presented cephalometric evidence of the effectiveness of extraoral anchorage in holding back the forward growth of the maxillary first permanent molars. This would seem a necessary requirement for restricting profile points on the maxilla such as the incisors and point A. In a cephalometric study, King (1957) corroborated Epstein's findings and added that extraoral anchorage apparently slowed the forward growth of subspinale (point A). Furthermore, he noted that a relationship existed between starting age and the quantity of change that occurred.

Material and Method

The data in this study came from before and after treatment headplate tracings of one hundred and three consecutively treated Class II, Division 1 malocclusions. In terms of treatment, all of the cases had a common denominator; the Class II condition was corrected by extraoral anchorage, either a neckstrap of the kind described by Kloehn or a few cases of headcap or both. All cases had full or partial appliances in addition to attachments on the maxillary molars.

The time interval between headplates

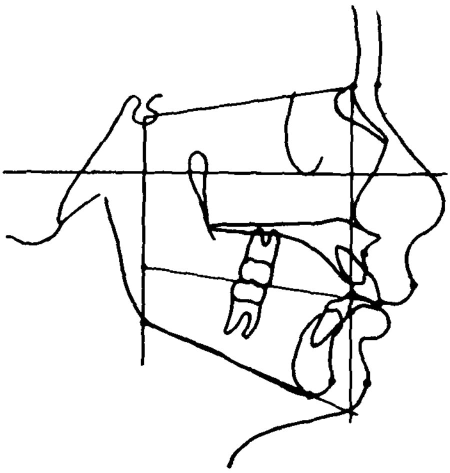

Fig. 1.

was usually from twenty-two to twenty-six months. The data derived from these were classified according to the sex and the age of the patient at the start of orthodontic treatment. The points measured appear in Figure 1 and are indicated by the heavy dots. They are, reading from top to bottom: nasion, subspinale (point A), the maxillary central incisor, and pogonion. The soft tissue points were measured opposite nasion, the upper lip, and opposite pogonion. The vertical height was the distance from nasion to menton. These measurements were recorded in millimeters. The degree of occlusal and mandibular plane changes was recorded to check its effect on the position of pogonion.

All headplate tracings were oriented on the Frankfort horizontal plane. To minimize error in each pair of tracings the Frankfort plane was located in the pretreatment tracing and was then transferred to the posttreatment tracing by superimposing the two tracings on the sella-nasion plane registered at sella.

In evaluating profile changes I have selected nasion as the reference point, although with growth, of course, it

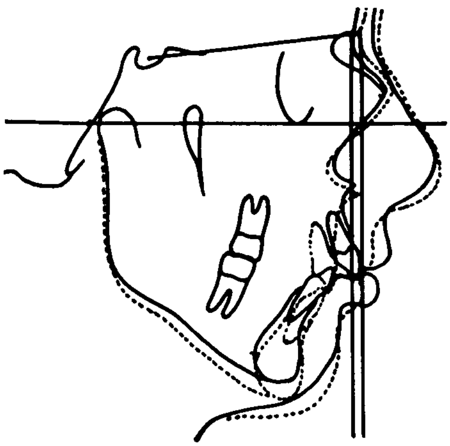

Fig. 2. Nasion planes in superimposed before and after treatment tracings.

moves forward relative to sella or registration point or basion. In assessing the changes that occurred, a line was drawn from nasion, perpendicular to the Frankfort plane and extending the full length of the face as in Figure 2. For convenience I called this line the nasion plane, and it served as a plane of reference in both tracings.

The anteroposterior changes that occurred at the several points mentioned above were measured relative to this plane. For example, in the pair of tracings superimposed in Figure 2, it was determined that nasion grew forward three millimeters by measuring the distance between the nasion planes in the pre and posttreatment tracings while they were superimposed at sella. Next, point A was measured relative to the nasion plane in the pretreatment tracing, as in Figure 3A. It was four millimeters in front of the nasion plane. In the posttreatment tracing, Figure 3B, point A is on the nasion plane. The net change is then posteriorly four millimeters which was recorded as minus four. Changes at the other points were recorded similarly with anterior movement indicated by a plus reading and posterior by a minus. In this instance point A was held back three millimeters and moved back one millimeter.

The vertical measurement was recorded simply as the distance between nasion and menton as in Figure 3. This was of interest along with the mandibular and occlusal plane changes because vertical increase, change at pogonion and tipping of the mandibular and occlusal planes could all be interrelated.

Convexity of the face according to Downs' (1949) analysis was measured to provide an index of the severity of the malocclusion. It was felt that this would avoid errors in the conclusions due to differences in the severity of the malocclusions between the various age groups. These differences were not too significant and will not be discussed.

I shall omit tabulations of the data for the absolute values are not as important as the general comparisons between the age groups and between the sexes. For the sake of brevity the data

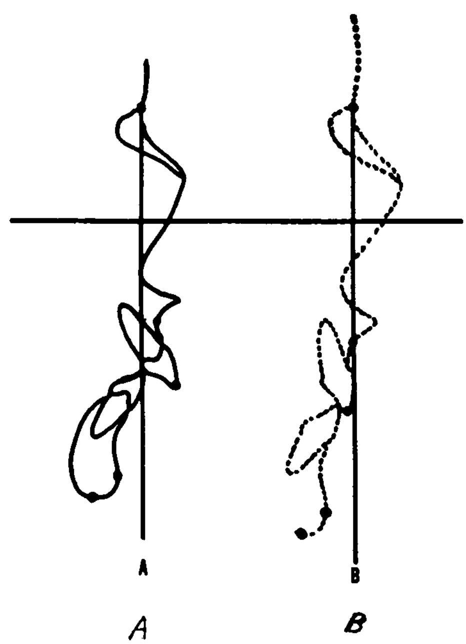

Fig. 3.

appear in graphic form to show the differences in behavior that occurred due to sex and the age differentials.

Findings

Distribution of the sample is shown in Table I.

TABLE I

Age	8	9	10	11	12	13	14	15
Males	3	6	7	9	12	5	5	3
Females		10	14	10	6	5	4	4

The forward growth at nasion is shown in Figure 4 and the changes that occurred at point A in Figure 5.

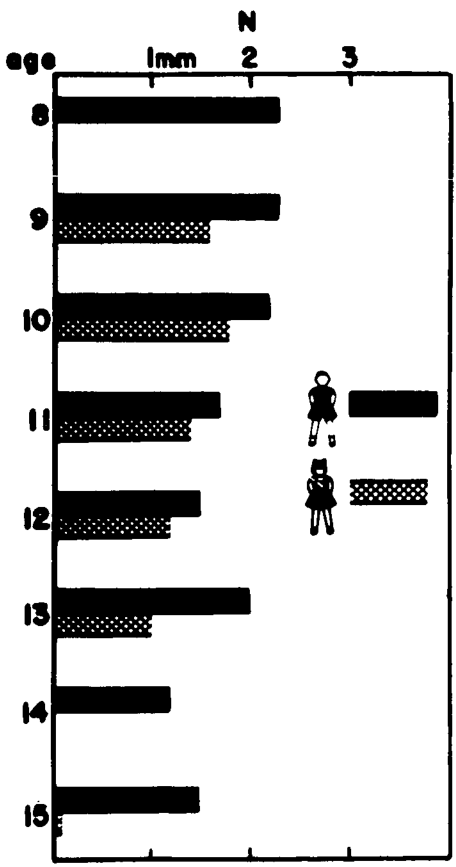

Fig. 4. Forward growth of nasion.

Fig. 5. The net posterior changes recorded at point A.

Discussion

Before commenting on the findings I want to point out some limitations imposed by the method. In recent years it has been popular for orthodontists to present evaluations of treated cases. In this discussion it is convenient to present data as a statistical analysis and herein may lie trouble, as was pointed out by Thurow (1958). In this study we are dealing with averages and usually the average will not apply to any one individual. When evaluating treated cases it has often been customary in the past to group together children of several different ages for statistical analysis and draw conclusions from such a classification of the data. With no standard regarding age, individuals who may be growing actively and individuals who may not be growing at all have been grouped together for statistical purposes. The author did this in a paper published in 1957. The above grouping of the data on children using as a standard the chronological age along with the type of malocclusion and sex of the patient has its limitations; but some errors regarding growth may be minimized by this handling of the data.

Other variables are apparent that could affect the validity of the results. Some seemed practically impossible to eliminate in a clinical study using linear measurements. Variations in size between individuals make one millimeter of change in a small girl far more significant than one millimeter in a large boy. The cooperation of the patient in wearing the extraoral appliance or in following other instructions can affect the duration of treatment. Variations in pain tolerance affect the amount of pressure permissible in the appliances. Differences between individuals in the rate of growth would directly affect the quantitative changes. All of these factors and many more, such as the health and well-being of the child, size of the roots of the teeth and even the amount of chewing function could introduce errors in the findings. Above all, remember that in applying any conclusions from this study one is playing the averages.

It is apparent that younger individuals have a greater potential for achieving favorable changes than older ones; and, of course, boys have a greater growth potential and thus greater potential for improvement than do girls. The data lend further weight to facts which we already know. Also, they do provide some information about timing treatment relative to the quantity of change needed for a satisfactory improvement in boys and in girls. With older patients they may better equip us to prognosticate those changes that we can reasonably expect to occur during treatment.

It is not now possible to establish exact values of expected improvement for any age group. However, the data, as shown in graphic form, indicated generally a greater amount of growth and favorable change occurred per unit of time in the younger age groups. The growth process and possibility for orthodontic improvement extends over many years and orthodontic treatment uses a small segment of the total. In planning treatment relative to the amount of change needed, a problem with a severe denture base discrepancy obviously would require more growth to be treated satisfactorily than one less severe. In the severe cases it seems that treatment should be timed to start earlier.

The changes that occurred at point A and pogonion confirmed the recommendations of Kloehn regarding the desirability of starting treatment early. The slowing of growth with advancing age decreased the possibility for reducing the prominence of point A as well as obtaining favorable growth response indicated by pogonion. Furthermore, the decreasing quantity of change that occurred as age advanced emphasizes the fallacy of depending upon the so-called pubertal growth spurt to provide sufficient growth for a desirable improvement in the more severe problems.

The findings seem to support, in part, the observations of Graber regarding girls, that treatment should start between ten and twelve years, but they indicate inclusion of nine year olds and possibly even younger groups. The data do not support Graber's statement that twelve to seventeen years is the best time to start boys. It appears, depending upon the severity of the problem, that it would be desirable to start them as early as eight or nine years and possibly no later than thirteen years of age if good growth at nasion is to accompany a favorable change at point A and a minimum of unfavorable change at pogonion.

The work of Lande referred to earlier indicated that nasion, point A, and pogonion may grow forward simultaneously and in approximately equal amounts. Forward growth of nasion and pogonion while holding back or moving back point A by proper manipulation of the maxillary denture is perhaps the ideal situation for optimum improvement in treating a Class II malocclusion.

Diagrammatically, nasion, point A, and pogonion represent a triangle standing on end as in Figure 6. Nasion and pogonion indicate the base of it with the apex at point A as in Figure 6A. If nasion and pogonion move forward equally and point A remains stationary, the triangle has flattened much as we would desire in treating a Class II malocclusion, Figure 6A. If nasion and pogonion grow forward and point A moves back, the triangle becomes a straight line making possible an even better result, Figure 6B. If pogonion fails to move forward, the triangle does not change as much, Figure 6C; but if point A moves back as well as pogonion and no growth occurs at nasion, we have a much less favorable change as in Figure 6D. This is an oversimplification of some possibilities for changes at nasion, pogonion, and point A; but changes at these points do noticeably affect the results of treatment.

Obviously we should plan treatment to make the most of the favorable changes that growth offers and also to make the most of these changes per unit of time expended in treatment. To do this we must anticipate favorable forward growth in the upper face indicated by nasion and in the lower face indicated by pogonion. If change at these points can be favorable and, if in the middle face we can restrict or move lingually the maxillary incisors with the alveolar process indicated by point A and, if the upper lip follows along, then we have a favorable improvement. A failure of one or more of these factors obviously limits the improvement.

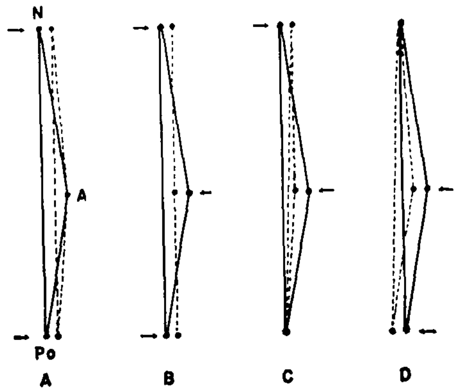

Fig. 6.

According to this sample of cases the growth expectancy at nasion for boys is reasonably good at all ages from eight through fifteen; but more growth apparently occurred per unit of time in the younger age groups. We may say that about one millimeter of forward growth occurred per year at eight, nine and ten and somewhat less from eleven to fifteen, thirteen excepted. In girls the amount constantly diminished from one millimeter per year at nine years until at age fourteen none occurred.

Pogonion is the problem. In boys, according to Lande and Bjork, this point should grow forward at least as fast as nasion and perhaps slightly more so. Under the influence of orthodontic treatment it did not, Fig. 7. The events surrounding this unfavorable behavior are a separate discussion in themselves, but some of the factors that seem to influence pogonion during treatment are: vertical growth, depth of the overbite, use of intermaxillary elastics, facial type and severity of the malocclusion. The significant fact here is

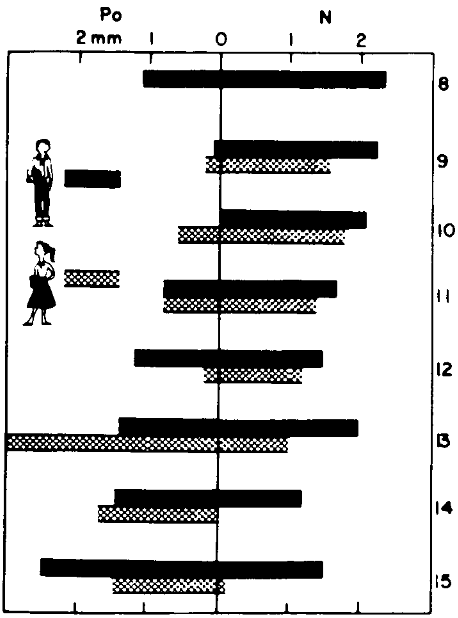

Fig. 7. Bars on the right of the zero or base line, which represents the nasion plane, indicate the forward growth of nasion as in Fig. 4. The bars on the left indicate the amount by which the forward movements of pogonion *lagged* behind growth registered at nasion.

that the changes were more unfavorable as age advanced.

Fortunately, one modifying circumstance prevailed; to some extent the unfavorable change at pogonion seemed to be a reversible change. In many patients the mandible tended to come forward somewhat with growth and the settling of the teeth following orthodontic treatment. A headplate taken a year or two following treatment usually is encouraging regarding pogonion.

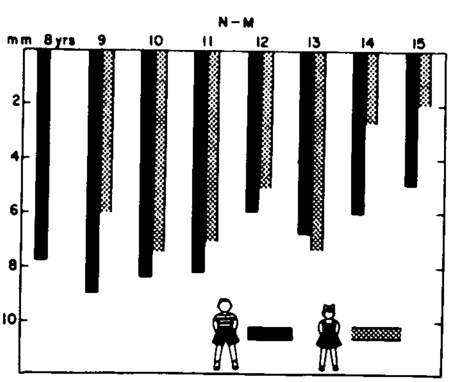

Fig. 8. The vertical change between nasion and menton.

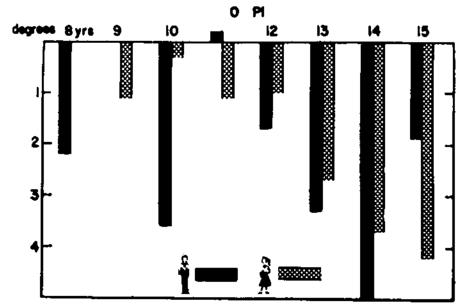

Fig. 9. Occlusal plane changes.

During treatment vertical change tended to decrease with advancing age, Fig. 8. Concurrently pogonion dropped back with advancing age. It is possible that vertical growth tended to cancel out the bite opening that apparently occurred in eliminating the deep overbites that are a part of Class II malocclusions. It may be that the alveolar growth that occurs with increase in height of the face facilitated correction of the deep overbites. When alveolar growth slowed, the bite was opened at the expense of tipping downward the occlusal and mandibular planes, Figures 9 and 10. As the mandible tips downward, it tends also to drop backward. We have, then, two factors which if present may favorably influence the profile change at pogonion

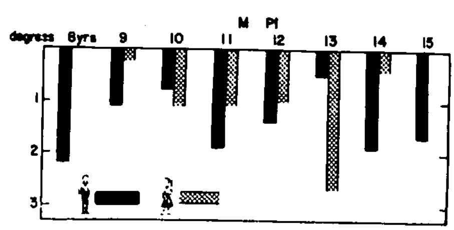

Fig. 10. Mandibular plane changes.

during treatment: namely, the forward growth of the mandible and vertical growth of the alveolar processes.

It is our impression that the orthodontist can influence most, in addition to the teeth, the anterior region of the maxillary alveolar process, approximated by point A. Furthermore, the area around point A seemed most amenable to change when growth was active. This point, Figure 5, exhibited a definite pattern of decreasing change relative to advancing age. In both sexes the change that occurred was approximately three millimeters in the eight, nine, ten and eleven year old groups. At twelve years the amount decreased slightly. At fourteen and fifteen it dropped off to between one and two millimeters. The younger age groups had the advantage.

What makes these changes more significant is that at the same time point A is moving or being moved posteriorly, nasion and pogonion were also changing. For example, in the nine year old group, pogonion did not drop back much, Fig. 7. It was growing forward at almost the same rate as nasion, while point A moved back approximately three millimeters. This was a worthwhile improvement. In the thirteen year old group, point A changed almost as much as at nine, but nasion grew forward much less, particularly in the girls. Even more striking is what happened at pogonion. It dropped back one and one-half millimeters in boys and more in girls. To achieve the same amount of profile change as indicated by the three points on the triangle shown earlier, point A would need to be moved back much more. Again the younger patients had the advantage.

Before finishing we want to comment briefly on the soft tissue profile, Figures 11 and 12. Those points opposite nasion and pogonion followed closely the

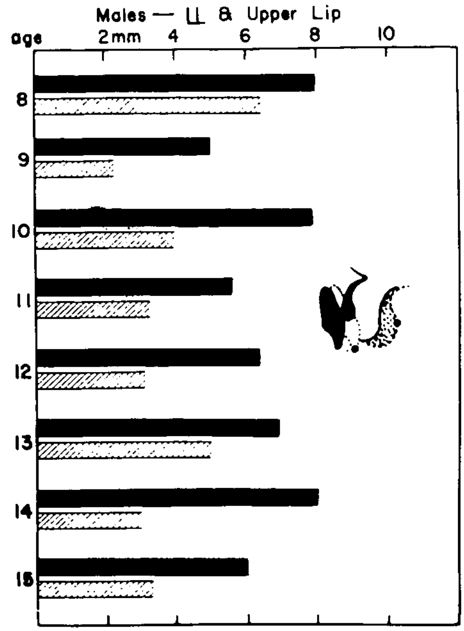

Fig. 11. The bar graphs illustrate the changes in the position of the upper lip relative to the maxillary central incisor. The solid black bar represents the incisor and the diagonally-lined bar, the upper lip.

skeletal changes and little change occurred in the thickness of the soft tissue. Thus these changes were not shown graphically with the others. Changes in the upper lip were of interest because they bore a definite relationship to change in position of the incisors. Generally, for each millimeter of posterior movement of the incisors, the prominence of the upper lip decreased about one-half millimeter. Exceptions to this were thin-lipped children in whom the labial change followed more closely that of the incisors. Conversely, much less change occurred in prominence of the upper lip in thick-lipped children.

Specific procedures for planning treatment, bringing into focus the changes relative to age and sex as described in this discussion, are beyond the scope of this paper. The consideration of age and severity of the prob-

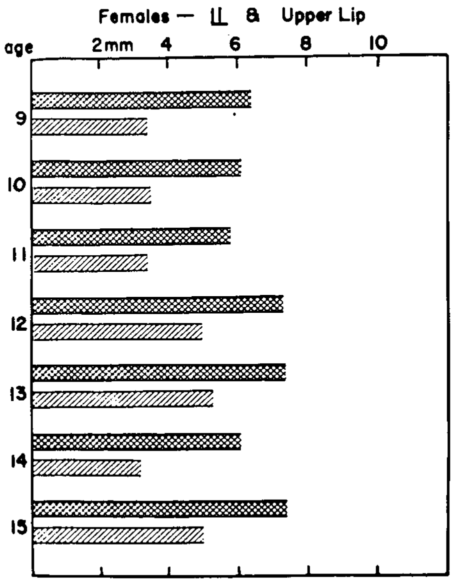

Fig. 12. The same changes indicated in Fig. 11, but for females. Bars with crossed lines represent the upper incisor and the diagonally-lined bars, the upper lip.

lem as primary factors in timing and planning treatment offers many possibilities regarding the prognosis and treatment for Class II, Division 1 malocclusions.

With the above facts in mind relative to nasion, point A, and pogonion in particular, I think it is possible to be selective in planning and timing orthodontic treatment of Class II, Division 1 malocclusions. For cases of moderate severity or moderate denture base discrepancy or less, it may be expedient to let dental age determine the time to start treatment. In many of these moderate cases it is usually more convenient and efficient in appliance manipulation to have most of the adult teeth in place when treatment begins. In more severe cases with a severe denture base discrepancy, it seems better to consider the severity of the problem, the quantity of change necessary for improvement, the sex of the patient and the chronological age in planning treatment, rather than dental age and convenience in appliance manipulation.

Summary

To summarize, the author analyzed certain quantitative changes in the profile of the face that occurred in treated Class II, Division 1 cases. The data were classified according to sex and the age at the start of orthodontic treatment. Generally, the growth and treatment changes that occurred were more favorable in the younger age groups. In discussing timing, orthodontic treatment seemed indicated early in proportion to the severity of the problem in both sexes with less leeway apparent in timing the start of treatment in girls than in boys.

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Discussion

Dr. R. C. Thurow

Dr. King's paper will be discussed in detail by Dr. Brader but I would like to touch on one phase of his cephalometric evaluation. This is the frequently used procedure of fixing the angular relationship between the SN line and the Frankfort plane for serial evaluations. The usual method of accomplishing this standardization is to measure the angle between SN and Frankfort on one film (usually the first) and then adjust the position of porion on the other films to maintain the same angular relationship.

The reason for using this procedure is twofold. First, Frankfort provides an essentially horizontal reference plane which maintains a natural orientation for study. Second, porion is too variable to provide a reliable reference for measurement of serial changes.

The disadvantage in using this procedure is that we are actually measuring our serial changes to SN, not Frankfort. What we speak of as the angle to Frankfort is actually the angle to SN plus or minus the angular correction which has been applied. This means that it is impossible to evaluate any changes which might be influenced by a change in the relationship between the Frankfort plane and the SN line.

It seems to me that it would be very useful to make a new effort at locating a posterior point on the Frankfort plane, or a plane closely approximating Frankfort. Ricketts uses the external auditory meatus which would be much more desirable than a part of the head positioning apparatus. Brodie has mentioned work done at Illinois using a point on the internal surface of the cranium in the same general area. If adequate reliability could be established for either of the points, or for some other point, it should be a definite improvement over our present methods.

As one of the few cephalometric planes with a direct relationship to the integumental face, Frankfort deserves serious attention and study. Its importance is obvious from the very fact that it is found to be useful in a large number of studies even with its present limitations.

Dr. Allen C. Brader

We are listed on this program as discussers. Now, to me the word "discussion" does not necessarily imply the application of favorable comment. Personally, I do not subscribe to the principle of burning souls for their own salvation. In any event, by agreeable division of the material, I have the pleasure of discussing Doctor King's work primarily. Like all good studies and like the work of all good students the report which he rendered poses many additional questions.

I do not purport to know the answers to these questions; however, I feel that scientifically there is enough reasonable doubt as to the positiveness of some of these statements to cast them into the air for your consideration.

Doctor King spoke in his introduction about the plasticity of the alveolar process being less when growth slows or ceases. Perhaps this is a semantic problem, but I think that the choice of the word "plasticity" leaves that open to some question. Whether the statement is true or not may be a matter of interpretation. For example, we are all aware of the differences in treatment that we experience when treating children as opposed to treating adults, yet we all treat adults; and, in most instances, it has been my clinical experience and I think yours, that the adult patient is frequently rendered a successful service.

Also, there is a tremendous difference while we are thinking about plasticity, whether we are thinking of moving individual teeth or groups of teeth. I am not sure what I gathered from the use of the word "plasticity." I think that King was implying greater osseous change than we have been accustomed to thinking about heretofore. Certainly Doctor Ricketts bore on that subject too, when he spoke about the extensive changes which he felt he observed, particularly within the maxilla, under the application of strong extraoral forces. These are things which I think we were not considering following the Brodie, Downs, Goldstein and Myer report of some years ago.

Now, as far as growth is concerned: this implies quantity, time and place. You divide quantity by time and you get rate, and the dynamics of growth implies direction. I would like to pose this question: Can we assume that growth is always in a favorable direction for the individual? There is little evidence, I think, in the reports given that we are capable of changing quantitative growth, that we are capable of changing the time at which it occurs, or therefore the rate. There is definite indication, however, that we may be able to alter the direction of growth.

There is at least one view of growth which is held by some of our colleagues in orthopedics who hold that growth is an almost immutable expansive force. Orthodontists are in the habit of speaking rather glibly about restraining growth and this is an alien concept to at least one of our allied fields.

Again, what is the evidence available to show that the degree of improvement with treatment is greater in quantity if the cases are treated during active growth spurts? I suggest that it is possible that treatment duration may be reduced by treating during these accelerated growing periods, giving us a mental picture of greater change only because the same quantity occurs within a lesser time.

Now, about the timing of treatment, I would like to cast this question into the air: Do untreated Class II, Division I cases routinely get worse in increasing annual increments following the establishment of occlusal interdigitation? Do Class II cases become "more Class II" after molar relations are established? There have been numerous reports, Lande, Bjork, Ricketts and others, that the angle SNA remains constant. This would not imply a worsening of the situation. Furthermore, Ricketts reported that the angle SNPo improved one degree in his *untreated* sample.

How much is one degree? I think this is a related question. We measure these angles in degrees, but they are not the same thing when applied to various areas of the face. For example, an angle measured from nasion to point A would have a leg of about fifty-five or sixty millimeters in length. By actual measurement the chord of a one-degree angle at fifty-five or sixty degree length is one millimeter, and on this basis I think Doctor Ricketts felt that he could translate directly linear measurement in millimeters from point A to his facial plane to an equivalent figure in degrees; however, if that same angle of one degree is extended to the area of pogonion, which is, in the usual face, a distance of 115 to 125 millimeters, we then find that the chord of a one-degree angle is the equivalent of two millimeters. This means the same number of degrees needs interpretation, I think, when you are reporting these figures.

With regard to the matter of timing, if these untreated cases do not become worse with increasing age, then it would seem to me that timing of treatment is not necessarily geared to our knowledge of growing, but that it is possible that the peripheral considerations may deserve added weight, for example: the availability of tooth material, the longterm effect of muscular imbalance, the degree of the severity of the problem, parental pressure and other factors. It appears to me that too early treatment of the so-called borderline case risks prejudgment of the child with respect to the eventual facial outline, the severity of the problem, and perhaps even the amount of arch length deficiency. It is conceivable that after additional growth the treatment plan may require a change.

With respect to the data which Doctor King reported, I would like to say that the observed changes in selected points along the profile, such as point A, I found a bit confusing. This appears to be a matter of change in which point A is posterior relative to the plane, but is anterior relative to its original position. Simultaneously the change in point A is an absolute one with respect to its original spatial orientation, and of course this leads to some confusion. The way it was explained to me, such change occurred something in this fashion: Consider a man called "A" on a station platform who boards a train which we might call the anterior facial plane, and as soon as he boards the train he proceeds toward the rear of the train to his compartment.

At the time he begins his steps toward his compartment the train pulls out of the station. Now, his position relative to the train is becoming more posterior. His position relative to the station is vastly anterior to what it had been. The important thing is not what direction the train travels or how far or fast it goes toward its destination, but whether the man is on the train when it gets there. So then, there appears to be a decided relationship between point A and the facial plane which we are setting as an objective in treatment.

About Doctor King's grouping in the slides which he showed, I would like to inquire if the age classes listed were determined by the age of the original headplate. This is the way that it seemed to read to me and, if that would be true, the changes recorded over the twenty-two to twenty-six months reported would not be attributable to the group age posted on the graphs. It might be necessary to select the median age or change the age in some manner to improve relation to the interval which it represented.

Of course, the class sample size was small. I say this very kindly because anyone who has undertaken to do such work understands very clearly the problems involved in accumulating massive samples for evaluation.

Again with regard to the graphs which were shown I would like to inquire whether the recorded changes represented the total change occurring over the approximately two-year interval. It seems to me that they did. If that were true, I think that the findings might be more valid or more useful, perhaps, if they had been reduced to annual increments. I think that this would contribute to the objectives toward which these people are working. King and Ricketts have been working along a definite line — I think that they are trying to eventuate a degree of prediction, or a state of knowledge which would give them a reasonable anticipation for the behavior of future patients.

About the slides which Doctor King showed, the slide on point N indicated that the magnitude of the rate change is about a half a millimeter from the age of eight or nine to thirteen. I would suggest that the quantity is within the range of experimental and operator error. I don't feel that this is a quantity of change which is significant. As to his slide on point A, the maximum rate change between eight and fifteen is the order of about one millimeter. Again, I question the significance of such a quantity, although there did appear to be a definite trend established.

As far as Doctor Ricketts' paper is concerned, I shall mention it only in so far as there was a relationship between both of the papers presented; it is very difficult to discuss raw reported data, of which there were volumes; however, I think Ricketts' paper is an attempt to quantitate the necessarily dynamic situation of growth *and* treatment and to compare the natural happenings with those which are affected by treatment procedures.

The utilization of knowledge of annual incremental change at selected points for which there is a reasonable degree of expectancy would appear to be a valid system to use in some effort to predict, estimate or assess the future possibilities of our problems; however it is considered, I think that all treatment planning, all analyses, encompass in some degree and in some manner an effort to evaluate the future of the patient. I can't conceive of a treatment plan which does not attempt to evaluate what will become the frame of reference within which we will eventuate our dental arrangement. It seems to me that Doctor Ricketts' work is a noble effort to quantitate what has been heretofore largely a subjective procedure with most us.

Doctor Krogman once said to me, "We must recognize the frailties of techniques," and surely any effort to predict the framework for the future of our patient has many frailties. I am sure that Doctor Ricketts and Doctor King would both readily admit to this. It was Krogman's further suggestion that we must temper our techniques with a kind of reasoning that permits us to be practical about things. He suggested that, "Idealism may be our wish, but adequacy is our goal," and I think there is much truth in this notion.

In closing, I think that there might be some comment made about the future of these studies. It would be interesting, for example, to observe what would be the longterm effects of these treatment procedures and, to note whether or not the treated case would tend to return in the direction of its original pattern. These are suggestions for additional studies which surely must follow the fine papers presented by King and Ricketts at this meeting.