

Vertical Response To Class II, Division 1 Therapy

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INTRODUCTION

Twenty-five Class II, Division 1 cases, treated by use of full edgewise technique, were subjected to cephalometric analysis in an attempt to determine the nature of the vertical changes that had occurred. Three criteria were used in selection: (1) those selected were deep overbite problems (2) the treatment results were judged good and (3) the headplates were excellent for purposes of tracing.

The first bicuspid was extracted in all but six cases. In these the upper first bicuspid and the lower second bicuspid were removed. Bite plates and cervical gear were used to supplement treatment.

A few words concerning cephalometric analysis are in order. Our methods are well established when we analyze the profile and profile changes. The axial inclination of the incisors, their relationship to each other, to the facial plane, and to underlying and supporting structures, the relative positions of points *A* and *B* to the facial plane and to each other, are all of proven worth.

In contrast with profile analysis, methods of assessing vertical problems and changes are not nearly as universal. In consequence, there is a good deal of room for improving our knowledge of this aspect of orthodontics. A simplified method of vertical appraisal is much to be desired.

There exists a dentofacial character-

istic, remarkable in its dimensional constancy, which has definite applicability in this direction. I refer to the fact that occlusal and incisal surface reference-points representing the maxillary permanent first molar and maxillary permanent central incisor teeth lie nearly equidistant from nasion. Four different studies substantiate the validity of this relationship.

Table I is a condensation of the findings of two of these investigations.^{1,2} In this group the distances nasion to upper incisor point and nasion to upper molar point were individually measured. On the average the upper incisor point and the upper molar point were found to be nearly equidistant from nasion, with very little variance.

Figure 1 is a tracing of an occlusal normal. The arc shown here is drawn with center at nasion and radius nasion to upper molar point. This is a quick and graphic method of determining the relative orientation of the dental points to nasion. Please note the position of the incisal edge of the lower incisor to this arc. Assuming the usual near equality of the lengths nasion to upper molar point and nasion to

TABLE I

| | OCCLUSION | N | Measurement | Mean | S. D. |
|----------------------------|-----------|-----|-------------|---------|--------|
| Zingser 1949 | CI I | 25 | N-U1 | 80.36mm | 6.27mm |
| | | | N-U6 | 79.68mm | 6.56mm |
| | CI II-I | 51 | N-U1 | 80.24mm | 5.87mm |
| | | | N-U6 | 79.86mm | 5.77mm |
| Prakash & Margolis 1952 | MIXED | 120 | N-U1 | 86.3 mm | 6.1 mm |
| | | | N-U6 | 85.1 mm | 5.2 mm |

Read before the Northwest Component of the Angle Society at Seattle on February 10, 1963.

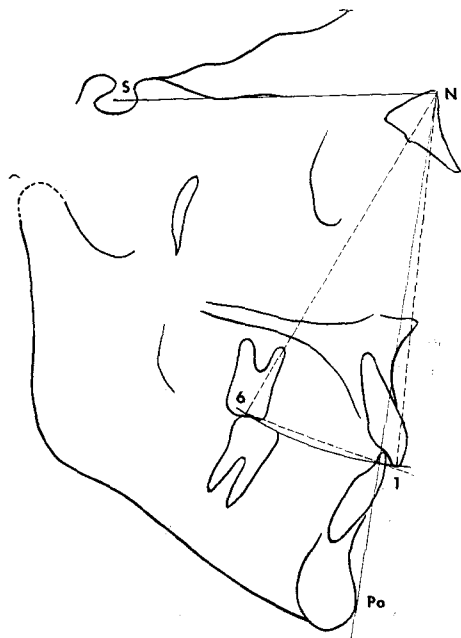


Fig. 1

upper incisor point, the degree of inter-ception of the lower incisor by the arc is a measure of overbite. In such an overbite assessment the position of the upper incisor point to the arc must also be noted, since, as we shall see, clinically significant deviations from normal exist in this respect.

Table II shows in condensed form the results of two further studies.^{3,4} In these the degree of equality of lengths of the molar and incisor-to-nasion projections were determined at the individual level by subtracting the molar-nasion length from the incisor-nasion length in each case. This is ex-

TABLE II

| | OCCUSION | N | Mean | S. D. |
|----------------|----------|----|--------|--------|
| Zingesser 1951 | CI I | 25 | 0.76mm | 1.93mm |
| | CI II-4 | 51 | 0.33mm | 2.09mm |
| Zingesser 1960 | Normal | 42 | 0.83mm | 1.12mm |

N-U1 minus N-U6

actly what one does geometrically by constructing the nasion-molar arc and noting the position of the upper incisor point to this arc. When the upper incisor point falls below the arc, nasion to upper incisor point length minus nasion to upper molar point length is positive by the amount of the distance that the incisor point falls below the arc. The difference, nasion to upper incisor point length minus nasion to upper molar point length, is negative when the upper incisor falls above the arc.

Please note that this rigid proportionality prevails within the Class II, Division 1 group as well as among Class I cases and occlusal normals. With this in mind it seems logical to assume that the proportionality changes very little with treatment, that is, with the correction of the Class II to a more normal occlusion.

CASES OF LIMITED GROWTH

Such, indeed, is the case despite a shortening of the arc segment with space closure. There is a maintenance of the proportionality if it was within normal limits prior to treatment. And as we shall shortly see, there is a normalization of this relationship in those cases that were initially abnormal in this respect. Note the degree of overbite before and after treatment shown in the tracings in Figure 2, and the correlation between overbite correction and the relative positions of the lower incisal edge to the nasion-molar arc.

Now let us analyze the dental and facial changes responsible for the overbite correction in case number 610. This is an example of how the overbite is reduced in patients who experience little growth in the course of treatment. The tracings in C of Figure 3 were oriented with the palatal planes superimposed and the nasion-sella plane par-

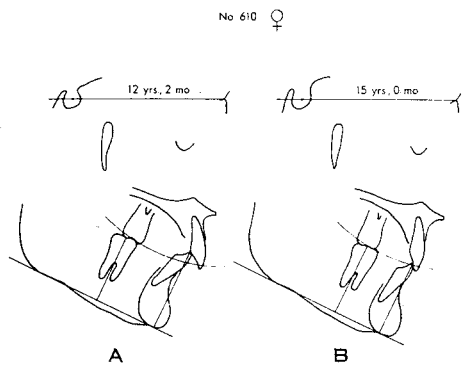


Fig. 2

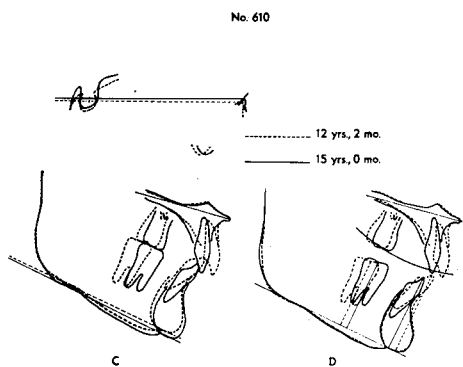


Fig. 3

allel to show to best advantage mandibular plane changes and vertical changes in the intermaxillary region, i.e., the region between palatal plane, the maxillary baseline; and mandibular plane, the mandibular baseline. The tracings in *D* of Figure 3 were oriented to show the nature of the specific tooth movements more clearly. The palatal and mandibular planes were superimposed and registered in the usual manner in this diagram.

In this example of minimal growth the mandibular plane angle has increased very slightly. The overbite was reduced within the confines of the largely pre-existing intermaxillary space by depression of the lower incisors through leveling. This response, as we

shall see, is *exceptional* and confined to such limited growth cases. In the process of space closure, leveling and Class II mechanics, the basic relationship of molar and incisor reference points to nasion remains almost unaltered.

THE INFLUENCE OF GROWTH

Superficially, the tracings diagrammed in Figures 4 and 5 resemble those of the previous case. In both the molar and incisor reference points remained nearly equidistant to nasion before and after treatment. The excessive overbites were corrected. However, the nature of the mechanism of overbite correction was entirely different in the two cases.

The type of response we see here

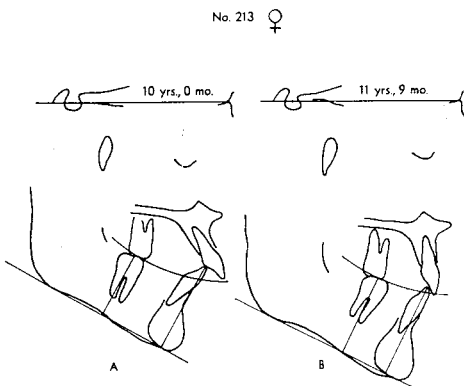


Fig. 4

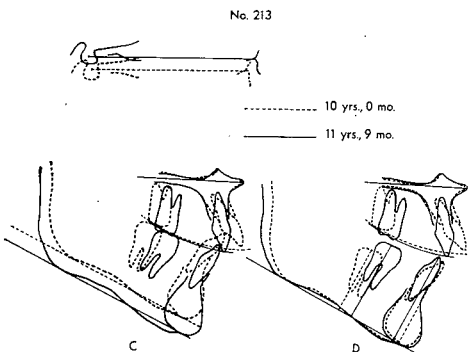


Fig. 5

is far more usual. The overbite correction was accomplished largely by elevation of the lower posterior segments with no depression of the lower incisors (Figure 5). In fact, the decreased inclination of both upper and lower incisors resulting from treatment that "uprighted" these teeth actually tended to increase the overbite. This tendency was negated by the marked mandibular vertical posterior dento-alveolar development. Maxillary posterior tooth movement also contributed slightly to the vertical development. Despite an appreciable vertical increase in the posterior dento-alveolar region, there has been no steepening of the mandibular plane angle. I assume that this was made possible by mandibular growth.

A large amount of suprapalatal growth is evident in *C* of Figure 5. Previous longitudinal studies indicate that the difference in lengths, nasion to upper incisor point and nasion to upper molar point or the absolute position of the upper incisor point with reference to the nasion-molar arc, does not change with growth in the short span usually involved in treating such cases.⁴ Therefore, we can logically assume that the changes we see are manipulative and not obscured by growth.

The upper incisor point to nasion-molar arc relationship in case number 213 changes slightly. The upper incisor point, which had previously fallen slightly above the arc, now falls slightly below. This is a direct consequence of orthodontic manipulation in leveling, Class II mechanics, space closure, and uprighting.

Case number 174 is another example of a usual response to overbite correction (Figures 6, 7). The elevation of the mandibular posterior dento-alveolar segments was the most important contributing factor acting to decrease the

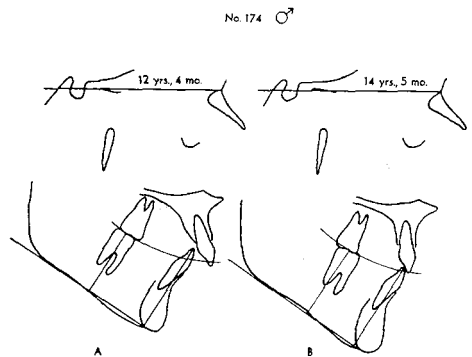


Fig. 6

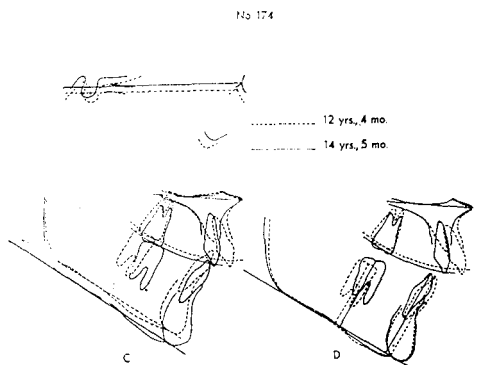


Fig. 7

overbite; maxillary posterior vertical tooth movement contributed less and the mandibular incisors were not depressed. In this case an incisal spur was used on the cervical gear. This tended to depress the upper incisors slightly as they were uprighted. This effect is clearly shown in tracings *A* and *B* of Figure 6. Note the appreciable amount of suprapalatal growth that has occurred in the course of treatment (*C* of Figure 7). As in the previous case this growth does not obscure the accuracy with which the nasion-molar arc serves to measure the changes in the relative vertical position of the upper incisor as the incisal spur does its work.

The increase in the mandibular plane angle was very slight. In this case like

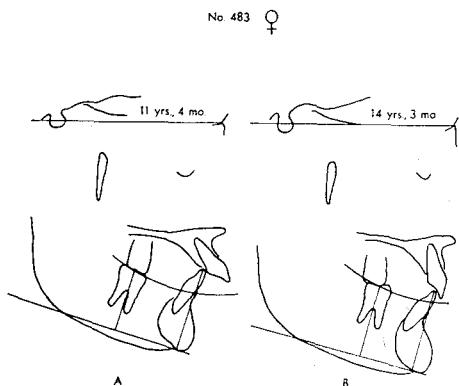


Fig. 8

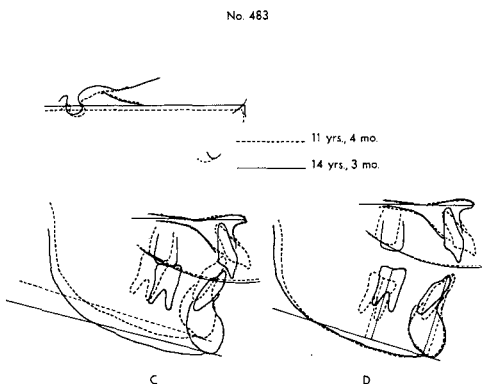


Fig. 9

the preceding, the relatively constant mandibular plane angle, prevailing despite marked vertical posterior dento-alveolar development, is indicative of much vertical mandibular growth.

PROPORTIONALITY DISCREPANCY

In the previous cases the nasomaxillary proportionality, as expressed by the difference of length, nasion to upper incisor point minus nasion to upper molar point, was within normal limits and changed very little with treatment. Case number 483, Figures 8 and 9, shows what happens in the course of treatment when this proportionality is abnormal. In this case, the incisor point fell far above the nasion-

molar arc indicating a large negative proportionality discrepancy.

As a result of treatment there was a normalization of the nasomaxillary proportionality so that the discrepancy was less negative. This change was largely made possible by the vertical posterior dento-alveolar development, principally mandibular, and to a lesser extent maxillary. The vertical increase decreased the overbite and allowed the upper incisors to move freely to assume a more infraocclusal position. This was accomplished by leveling, Class II force, and axial uprighting concomitant with incisal retraction.

The mandibular plane angle seemed to decrease despite the large posterior vertical dento-alveolar development. This can be explained by assuming that mandibular growth was more than adequate for accommodating the increased intermaxillary space.

The proportionality is occasionally off on the positive side, that is with the incisor point falling abnormally below the nasion-molar arc. Leveling, sometimes supplemented by high-pull headgear or incisal-spur cervical gear and Class III mechanics, usually elicits good response. This is particularly true where growth is active. Cases of limited growth and those with negative proportionality discrepancies are most difficult to treat successfully.

FINDINGS

1. In the twenty-five case sample, the mandibular plane angular changes were minimal (Figure 10).

2. This was true despite a marked vertical increase in the posterior mandibular dento-alveolar region. The height in this region was measured as a vertical from lower molar point to the mandibular plane (Figures 2, 11).

3. The lower incisor height changes were not nearly as uniform as the molar height changes. The lower incisors tend-

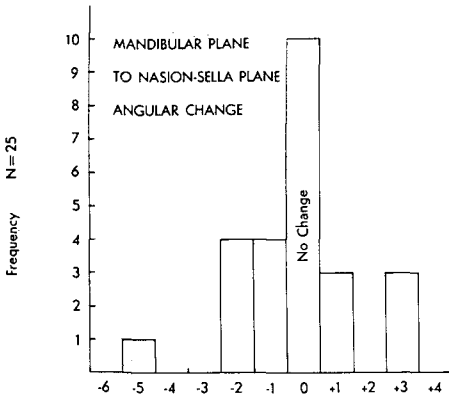


Fig. 10

ed to be depressed most often in cases where vertical mandibular growth was minimal (Figure 12).

4. The nasomaxillary proportionality changes were measured as changes in the linear difference, nasion to upper incisor point minus nasion to upper molar point. In general, extreme variance from the usual near equality of these lengths tended to be normalized (Figure 13). This is more clearly seen when one plots the changes that occur in those cases with prior to treatment (a) positive and zero values, and (b)

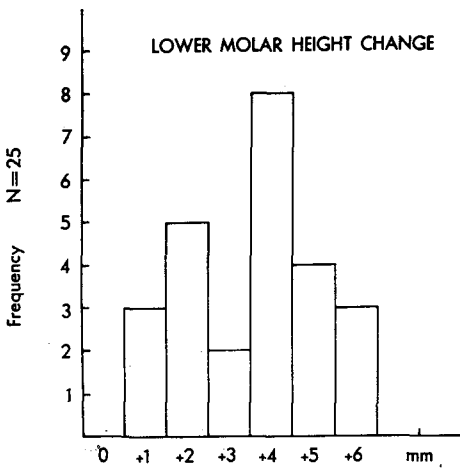


Fig. 11

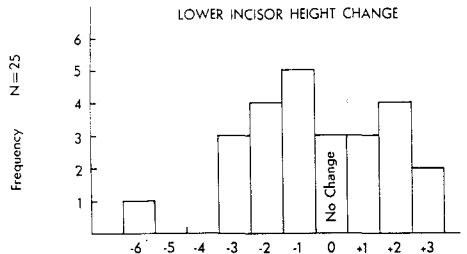


Fig. 12

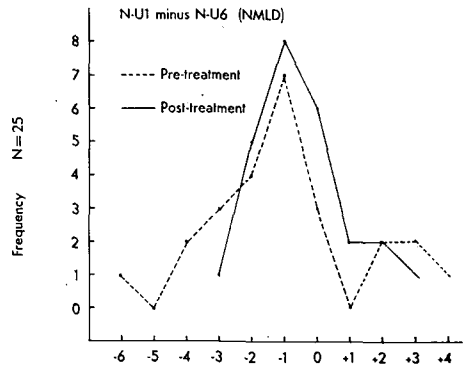


Fig. 13

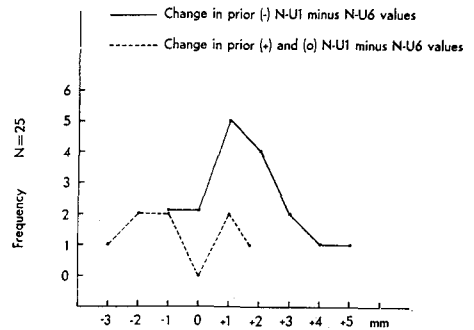


Fig. 14

negative values. The normalization process then becomes very evident (Figure 14).

SUMMARY AND CONCLUSION

In summary, twenty-five edgewise treated, Class II, Division 1 bicuspid extraction cases were cephalometrically analyzed in an attempt to determine the nature of the vertical response to

Class II therapy. The following conclusions were reached:

1. The majority of case responses were characterized by a marked posterior mandibular dento-alveolar vertical development. This, together with some vertical maxillary dento-alveolar development, was the principal element in overbite correction.

2. Mandibular plane to cranial base angular changes were minimal. This indicates that the appreciable posterior dento-alveolar vertical development was accompanied by a commensurate vertical mandibular growth.

3. In cases of limited vertical growth, fortunately far less frequent, the nature of the overbite correction was quite different. The overbite correction in these difficult cases was largely accomplished by incisal depression mostly involving the mandibular incisors.

4. Since the specific tooth movements required to bring about overbite correction depend largely upon the degree of vertical mandibular growth that accompanies treatment, predictions of probable response must be tempered by considerations of age, sex and the many variables that regulate and affect growth.

5. The basic nasomaxillary proportionality, whose expression is the near equality of the projections nasion to upper incisor point and nasion to upper molar point, has been found to prevail with little variance. Previous studies have shown this to be true among such diverse groups as occlusal normals, Class I, and Class II, Division I malocclusions. The present study indicates that the proportionality changes little with Class II treatment and such changes as do occur are in the direction of normalization.

6. These findings have led to the conclusion that the nasion-molar arc

is an excellent means of analyzing the overbite problem. It is based upon a widespread anatomical dentofacial characteristic of very small variance, which permits assessment of the nature and severity of the overbite disturbance in terms of the relative positions of the incisors and the molar occlusal contact region.

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