A Cephalometric Evaluation Of Class II, Division 2*

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INTRODUCTION

Twenty-four years ago the Eastern Component presented before this society a paper entitled *"A Clinical Study of Cases of Malocclusion in Class II, Division 2."*[6] This paper was a clinical evaluation of the problems associated with this type of malocclusion and the thoughts which were prevalent at that time concerning its etiology and treatment. The current endeavor was undertaken to determine whether the advances and changes which have been made in the last twenty five years have materially altered our thinking and procedures associated with this situation.

Twenty-five years ago cephalometric roentgenography was in its infancy and the information presented at that time was based upon models, facial photographs, and some anthropometric measurements. The advent of cephalometrics has changed our thinking in some phases of orthodontics and has given factual credence to some of our other thoughts. This portion of the Class II, Division 2 symposium is not to be considered as a research project but rather as a grouping of thoughts on the morphology of the Class II, Division 2 problem from a radiographic standpoint. This has been done in an effort to further clinical diagnosis and aid in the planning of treatment.

The first sentence of the 1933 report states, "In reviewing the literature in an effort to find data concerning this type of malocclusion one is struck by the relatively small amount available."[6] This statement remains just as true today as it was then. In the field of cephalometrics there have been some forty types of analyses promulgated, and today most papers in the field of clinical orthodontics give at least a token acknowledgement to the lateral head radiograph. The specific references to Class II, Division 2 are, however, strikingly sparse. In most references to differences in morphology there is mention of the Class I type face, the Class II type face, and the Class III type face, there being no differentiation of the divisions of Class II.

A few investigators have made references to certain morphologic differences in the two divisions of this class. Baldridge[3] in 1941 made a study of the relationship of the upper first permanent molar to cranial landmarks. His work showed that the molar assumes the same definite relation to the face and cranium in Class I and Class II malocclusions. He pointed out that the base bone of the mandible in Class II, Division 2 cases is in the correct anteroposterior relation to the face and cranium, but it may be longer in its overall anteroposterior length. Continuing his study in 1950[4] he related the upper first permanent molar to Frankfort horizontal plane and again these angular measurements showed that there was no difference between Class I and Class II cases. In this study he made a linear measurement of the position of the maxillary first permanent molar in relation to point A. The vari-

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ations found here were in the younger age groups and were thought to be a result of the mixed dentition. Adams[1] has pointed out that there is no difference in the absolute dimensions of the mandible in Class II malocclusions in relation to Class I malocclusions. Elman[7] showed that the lower first permanent molar bears the same definite relationship to the morphology of the mandible in both Class I and Class II malocclusions. In a study of the total facial pattern Renfroe[8] differentiated between Class I, Class II, Division 1, and Class II, Division 2. His conclusions were that there was no lack of development of the mandible in either division of Class II, and that Class II was characterized by a posterior position of the mandible. Renfroe's conclusions concerning the posterior position of the dental arch in Class II, Division 2 and its more forward chin point such as seen in Class I, were due to the fact that the Class II, Division 2 had a more square type face with a mandibular border that was more nearly horizontal and slightly longer than the Class I and the Class II, Division 1 mandible.

In 1954 Swann[9] presented another aspect of Class II, Division 2 in which he stated that the problem was one of developmental growth of the maxilla and the eruption of the maxillary teeth. He stated that this type of malocclusion was not primarily a skeletal dysplasia as is Class II, Division 1. His working hypothesis, based somewhat on the work of Elsasser and Wiley and also that of Howes, suggested that the upper second permanent molar developed ahead of tuberosity development and, in turn, caused a forward tipping of the maxillary buccal segments, which subsequently caused the abnormal arrangement of anterior teeth.

In the same year Blair[5] presented a detailed study on the morphology of Class I and Class II. He concluded that a high degree of variability of facial skeletal pattern can be seen within each class of malocclusion and that there were only minor differences between the mean skeletal patterns of Class I and Class II, Division 1 malocclusions. The mean skeletal pattern of Class II, Division 2, however, differed in a more acute gonial angle, a decreased effective length of the mandible, and a more forward position of the anterior outlines of both mandible and maxilla. His comments on the theory of "Compensatory Variation" give much food for thought.

Methods and Materials

In this study the primary criterion for case selection was the clinical diagnosis of Class II, Division 2 by a member of the Eastern Component of the Angle Society. This meant that it must conform to the classic description by Angle in the mind of the clinical orthodontist. The members of the Eastern Component selected such cases from their files and, where available, submitted lateral head radiographs. These radiographs were sorted, and only the prospective radiographs showing permanent dentition were used. The final group consisted of fifteen cases, five male and ten female. Tracings were made using acceptable standardized anatomic landmarks. Since these radiographs were obtained by various types of head holding devices, machine landmarks were avoided whenever possible. Again, because of the differences in mechanical devices some variation of head position would seem to be present. Accordingly, midsagittal reference points were used wherever possible. When bilateral structures were used, distances between images were halved. Since this was a clinical evaluation and not a compilation of statistical standards, measurements, while performed

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with normal accuracy, were made only to the closest degree or millimeter.

Findings

Upon visual examination of these radiographs the subjective opinion developed that all of the cases were quite similar. The superposing of the tracings of headplates showed that certain variations existed. Initially, a composite tracing of the mandible using Broadbent's registration point for superposing showed that the general proportions of the mandible appeared to be similar. But the variation in gross size and special position made for a conglomeration of lines. Accordingly, the maximum and minimum variation both in anteroposterior position and inclination of the mandibular border are shown in Fig. 1. In an effort to ascertain the relative position of the maxilla and mandible in relation to cranium, the tracings were superimposed on the line NS with the points N coinciding. The variation of points A and B are shown in Fig. 2. Again, a similarity was seen but this similarity is influenced by gross size and spatial relationships of parts. Because considerable variation seemed to be evident from the visual examination of these composites, a line diagram was made from each tracing which would be sufficient to develop the measurements for four basic analyses. Figure 3 represents a typical diagram with the measurements of the four analyses which were used. To make the situation more graphic each case was recorded on the Vorhies-Adams polygon of the Downs' analysis. Again the variations of the individual cases seemed great enough to warrant making a composite polygon to show the maximum variations of these fifteen cases in comparison with the polygon of the Downs' normals. This is shown in Fig. 4. This composite polygon shows graphically

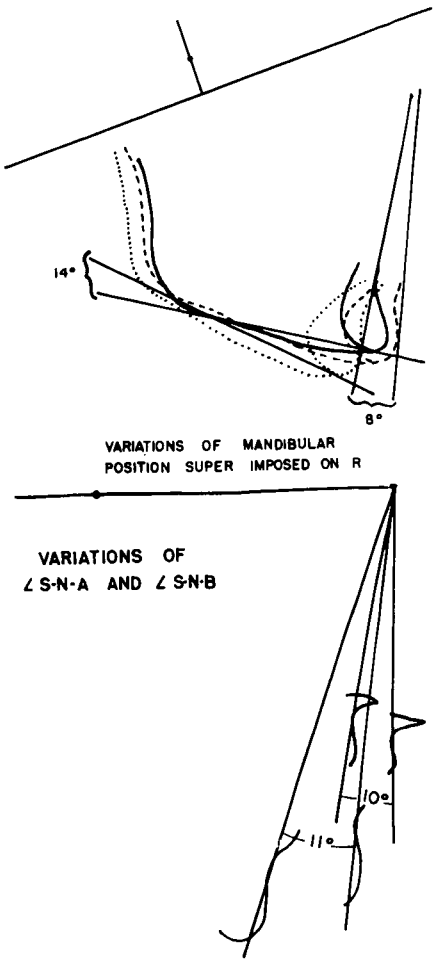

Fig. 1 Above, Fig. 2 Below.

certain variations which were expected. With one exception the variations were not particularly great. That exception, of course, is the relationship of the axial inclination of the upper incisor to the lower incisor. Since this was the most startling variation, this measurement was used as a base with which to compare other measurements in an effort to find some correlation that might be significant. Most comparisons showed no correlation, but some, while not showing any correlation, pointed out certain interesting variations.

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WYLIE - ANT. POST DYSPLASIA

	ORTHO	PROG
GF TO S		
S TO PTM		1
PTM TO ANS	6	
PTM TO G	1	
MAND. LENGTH		3
TOT.	7	4
DIFF.	-3	

WYLIE-JOHNSON-VERT. DYSP.

CONDYLAR ∠	= 124
LOWER BORDER MAND	= 65
RAMUS HEIGHT	= 57
CONDYLE TO FH	= 0
UPPER FACE HEIGHT	= 55
TOTAL FACE HEIGHT	= 121
U.F.H. / T.F.H. x 100	= 45.4

DOWNS ANALYSIS

FAC. ∠	= 82
∠ CONVEX	= 8
AB TO FAC.PL.	= -14
MAND. PL.	= 30
Y AXIS	= 65
CANT. OF OCC.	= 13
∠ L TO Ī	= 139
∠ Ī TO OCC.	= 22
∠ Ī TO MAND.	= +5
L TO APo (MM)	= 3 MM

NORTHWESTERN ANALYSIS

1. S-N-A	= 81
2. S-N-B	= 75
3. DIFF.	= 6
4. N-S TO Go - Gn	= 35
5. ∠ N-A-Po (CONVEX)	= 8
6. L TO N-S	= 91
7. ∠ L TO Ī	= 139
8. ∠ Ī TO Go - Gn	= 95
9. ∠ Ī TO OCC. PL.	= 68
10. L TO FAC PL (MM)	= 5 MM
11. ∠ L TO FH	= 95

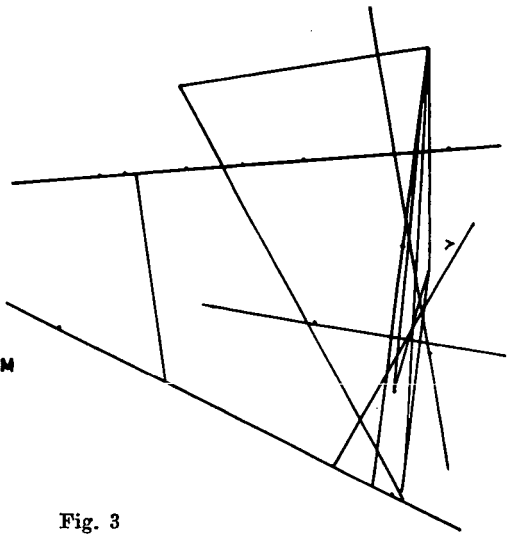

Fig. 3

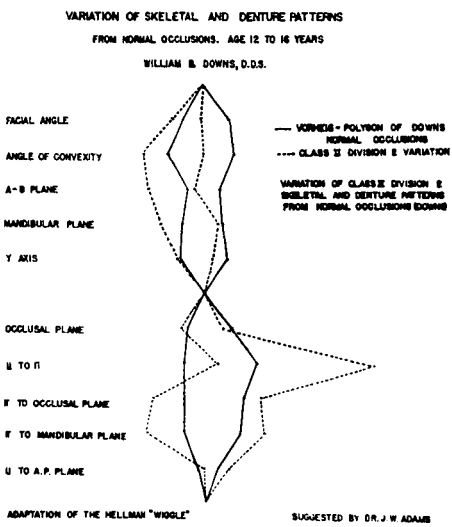

Fig. 4

Since the angular measurements of the incisors are in the anterior portion of the face, a scattergram was made of their relationships to NAP, the angle of convexity. This scattergram shows no correlation (Fig. 5), but it is significant that all but one of the cases showed a marked increase of the angle of convexity over the so-called average normal. The interincisor angle was then compared with the angle which the upper central incisor made to the line NS. This scattergram (Fig. 6) shows a reasonable correlation. Again, the angle which the upper incisor made to the line NS is considerably smaller than the average normal. Figure 7 shows a similar correlation between the inter-

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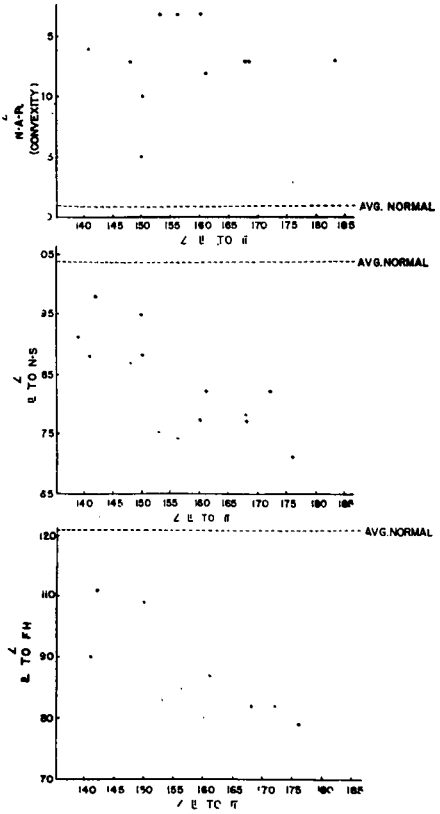

Fig. 5 Above, Fig. 6 Middle, Fig. 7 Below.

incisor angle and the angle of the upper central incisor to Frankfort horizontal plane. In this case the correlation would appear to be somewhat closer. Since these correlations occurred with a relationship between the upper incisor and cranial bases, a similar scattergram was made with the angular inclination of the lower incisor to the mandibular plane (Fig. 8). Again, we see a correlation of these two factors, six of the cases showing a more procumbent incisor angle than the average normal and nine cases being in a more lingual version.

Figure 9 shows the lack of correlation between the interincisor angle and the angular difference between the angles SNA and SNB. Although there is no correlation between these factors, it is again interesting to note that all of the cases showed a markedly greater angular difference between the points A and B than the average normal. Figure 10 shows the plotting of the interincisor angle against the mandibular plane as projected from the cranial base NS. While we again see no correlation, we see that six of the fifteen cases had a mandibular plane angle greater than that seen in the normal and the remainder were markedly less. The same interincisor angle was plotted against the gonial angle and is shown in Fig. 11. Only one case showed a gonial angle of greater size than the average normal. The others were more acute, although twelve cases were grouped within ten degrees. The percentage of upper face height is shown in Fig. 12. An interesting factor is shown here in that all but one case has a percentage

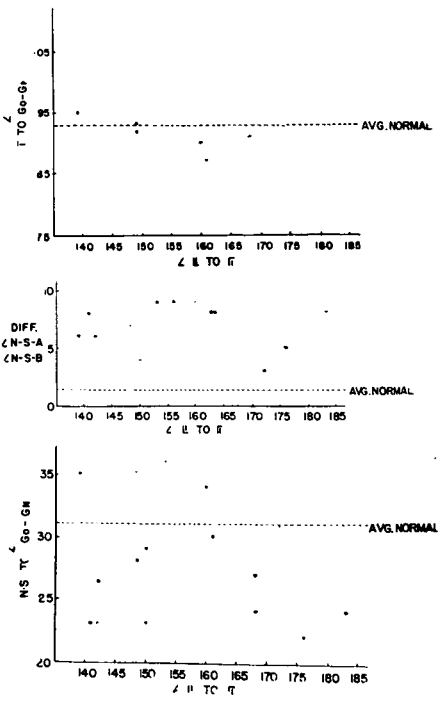

Fig. 8 Above, Fig. 9 Middle, Fig. 10 Below.

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upper face height greater than the average normal. Conversely, this would mean that the lower portion of the face was markedly less.

Discussion

This presentation is intended to set forth certain factors, determined from clinical material, as one would utilize the various procedures and norms set up by research studies. The graphic portrayal of the variations shown on the Vorhies-Adams polygon indicates that there is a tendency for the overall group to vary somewhat from the normal pattern, and yet any one of the individual cases might well show a close similarity to the normal pattern. The indication would be that there is considerable variation of the Class II, Division 2 skeletal pattern. The most striking variation, of course, is the upright position of the incisor teeth. In using this as a means of comparing other variables the only place where a correlation existed was in the relationship of the upper central incisor to its basic supporting structure and the lower incisor to the mandibular base line. This would tend to indicate that the inclination of the teeth is of a coronal tipping variety rather than a spatial variation due to skeletal dysplasia. This thought would be in agreement with those who believe that the skeletal pattern of Class II, Division 2 is similar to that of the Class I pattern. The larger angle of convexity would tend to support the belief that the maxillary basal bone is either larger or in a more anterior position. The greater difference between points A and B would tend to support Swann's thoughts on a more mesial shifting of the maxillary dentition. It also supports those who have found that the basal bone in the mandible is longer in this division and the mandibular dentition situated more posteriorly over its basal

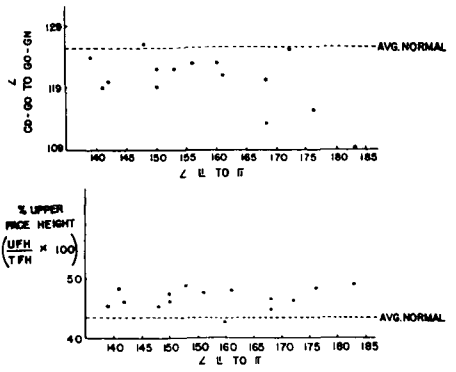

Fig. 11 Above, Fig. 12 Below.

bone. The flatter mandibular plane and the more acute gonial angle is in accordance with Renfroe's thinking as is the lack of lower facial height.

All of these cases were judged by members of this component as being true Class II, Division 2 cases and yet the morphologic variation which was found from the radiographic standpoint would tend to indicate that the clinical syndrome may be the result of different types of variables in different individuals producing the same end result. If this is true, then various avenues of thought may be formulated concerning the proper plan of treatment as it may apply to the individual case. The thought of considerable variation within the type as expressed by Blair would seem to be most acceptable here. Observation from the purely subjective clinical standpoint would tend to give some credence to the working hypothesis as set forth by Swann. The only new evidence set forth here would be the increase in lingual tipping of the anterior teeth. If this is accepted, then there must be some functional force causing this tipping. The subjective answer would accordingly be a matter of muscular balance and pressure. This though, of course, is not new. Fifty years ago the following quotation appeared in print, "In the harmonizing of

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the anterior part of the upper arch with that of the lower through lip pressure the malarrangement of the incisors varies considerably, which, not infrequently, however, assumes one of two different and more or less constant types."[2]

Conclusions

1. Class II, Division 2 malocclusion is not a specific stereotyped clinical syndrome.
2. This situation may arise as the result of compensatory variation, eruptive disharmony, or muscular pressure. It is probably a result of the combination of all of these factors.
3. Clinical treatment plans and prognosis should be based upon the specific variations within the individual.

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