Further Studies of the Relation of the Maxillary First Permanent Molars to the Face In Class I and Class II Malocclusions[1]

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The basis for classification of malocclusion has been questioned ever since Delabarre (1819) advanced his classification, which was quite similar to that later advanced by Angle. The following men have advanced classifications of their own: Carabelli (1842), Welcker (1862), Iszlai (1891) and Edward H. Angle (1899). The Angle classification was almost universally accepted shortly after it was introduced, but questions arose concerning the validity of the maxillary first permanent molar as a stable point. Angle (1905), in his paper "The Upper First Molar as a Basis of Diagnosis in Orthodontia", sought to defend his theory, but the controversy still persisted. This led to attempts to relate the teeth to a more stable base, such as the cranium,

Paul W. Simon (1924) attempted to employ points outside of the denture as a basis for classification and selected for this purpose three different planes in the head. These planes were, the median plane, the Frankfort horizontal plane and the orbital plane, which lie at right angles to each other. This was the first time that diagnosis had been based on points outside of the denture.

On the basis of his findings, Simon formulated the "orbital-canine law," which is based on his assumption that in most cases of normal occlusion the orbital plane passes through the cusp of the maxillary canine. If the orbital plane passes posterior to the cusp of the maxillary canine, the upper denture was assumed to be forward of normal, and if it passed anterior to the cusp of the maxillary canine the upper denture was assumed to be posterior to normal.

Broadbent (1927), Oppenheim (1928) and Hellman (1930) disproved Simon's orbital-canine law by making craniometric measurements on skulls with normal occlusion and showed that no such stable relationship existed.

The author, in a previous paper made a study of the position of the upper first permanent molar in Class I and Class II malocclusions. The position was determined by the angle nasion-sella turcica — upper first permanent molar, N-S-$\underline{6}$, as shown in Figure I.

One of the conclusions of this work was that "The upper first permanent molar assumes the same definite relation to the face and cranium in Class I and Class II malocclusions. These teeth can therefore be used as a basis for classification in Class I and Class II cases according to the Angle classification."

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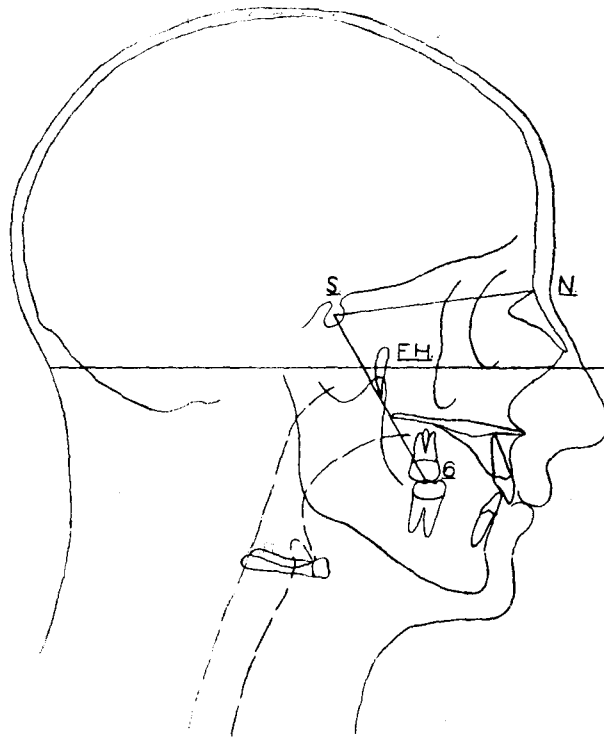
FIG. 1. Tracing of cephalometric roentgenogram showing anatomical points forming the angle N-S-6.

The findings were as shown in Table I.

Classification	Class I		Class II	
			Division I	Division II
Number of cases	67		36	21
Arithmetic mean	67.95°	±.35	68.46° ±.53	67.86° ±.64
Standard deviation	2.87	±.25	3.15 ±.37	2.96 ±.48

Elsasser and Wylie, (1948) state in their summary that "Class II Division I males are larger than Class I males in overall maxillary length, but not in overall mandibular length; the maxillary first permanent molar is farther forward on the body of the maxilla, and the maxillary central and the anterior nasal spine are farther forward in relation to sella in Class II Division I males." Referring to their Table I "Mean values of dimensions measured," I will mention three of the dimensions listed: two were linear measurements and projected to Frankfort horizontal; 1. Ptm'-N-S' pterygomaxillary fissure to anterior nasal spine Class I males 52.28 ±0.45 Class II Division I males 55.53 ±0.52. 2. Ptm' 6 pterygomaxillary fissure to upper first permanent molar. Class I males 14.91 ±0.46 Class II Division I males 16.60 ±0.56. The third measurement was an angular measurement of the angle nasion to sella turcica to upper first permanent molar, N-S-6. Class I males 67.09° ±0.50, Class II Division I males 66.98° ±0.51. If the authors were referring to the upper first permanent molar being farther forward in relation to the pterygomaxillary fissure, I

will accept it. If, however, they were referring to the relation of the upper first permanent molar to the cranium I would differ with them as the difference in the mean of the angle N-S-6 is only 0.11 of a degree. Wylie (1947) stated the following: ''These studies, using angles and proportions, may profitably be studied in connection with the more recent work of Elsasser and Wylie who added certain cranial dimensions and worked primarily with linear values. They found, statistically speaking that in males the maxilla was definitely longer in Class II Division I than in Class I with the maxillary first permanent molar farther forward in relation to the cranium. Incidentally, the maxillary first permanent molar is situated *on the maxilla* in the same fashion in both classes; while it is somewhat farther forward in relation *to cranium* in Class II Division I, statistically speaking the molar is situated in the same fashion on the maxilla in both classes, since the maxilla is larger in that class, than in Class I.''

Bushra (1948) in his studies of forty individuals with excellent dental occlusions, found that ''In general the craniofacial angles and the angle nasion-sella turcica-maxillary first molar (N-S-6) showed the lowest variability.'' His findings on the angle N-S-6) were: arithmetic mean 66.3°, standard error of mean ±.53, range 58.6° - 72.3°, standard deviation 3.37 and coefficient of variation 5.08.

In the time intervening between 1940 and the present time the author has had occasion to examine a number of tracings of lateral cephalometric roentgenograms, and has observed that the line N-S varied in its relationship to the Frankfort horizontal.

To illustrate this variability, two instances might be cited from experience: one individual in which the line N-S was parallel to the Frankfort plane, and another in which N-S intersected Frankfort at 15°.

From the above observation it was decided to restudy the same roentgenograms used in the previous study, on the relation of the upper first permanent molar to the face and cranium in Class I and Class II malocclusions.

II. MATERIAL AND METHOD

The material upon which this study was made was taken from one hundred and one cephalometric roentgenograms in the files of the Orthodontia Department at the University of Illinois. These roentgenograms were those of patients with malocclusion; forty-eight were Class I, thirty-two were Class II Division 1, and twenty-one were Class II Division 2 cases. The roentgenograms were selected without regard to sex, age, or severity of deformity. Only those cases were used in which both upper first permanent molars were present. In addition, twenty-one cephalometric roentgenograms of normal growing individuals from the files of the Bolton Foundation of the Department of Anatomy of Western Reserve University were included. Seventeen were Class I and four were Class II Division 1 cases. All roentgenograms had been taken with the Broadbent-Bolton cephalometer according to Broadbent's technic. The initial lateral roentgenogram of each patient was traced and measured as it represented the case before treatment was instituted.

Lines were drawn from various points representing anatomical landmarks and these are illustrated in Figure 2.
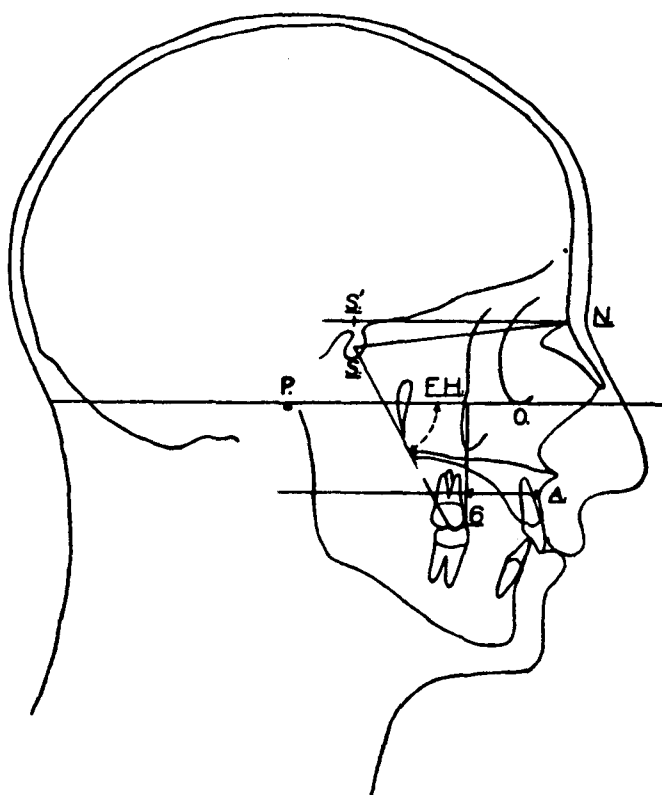
FIG. 2. Tracing of cephalometric roentgenogram showing anatomical points, lines and angle measured.

1. S-N from the center of sella turcica to nasion.

2. S-6 from the center of sella turcica to the point representing the buccal groove of the maxillary first permanent molar.

3. FH (Frankfort horizontal): a horizontal plane running through the right and left cephalometric porion and the left orbitale.

4. FH-6 a perpendicular from the Frankfort horizontal, tangent to, the mesial surface of the upper first permanent molar.

5. A-6 Parallel to the Frankfort horizontal from point A-subspinale: the deepest midline point on the premaxilla between the anterior nasal spine and prosthion, to line FH-6.

6. N-S' from naison parallel to the Frankfort horizontal to S' a projection of sella turcica perpendicular to Frankfort horizontal.

In the first study, the upper first permanent molar was studied in its relationship with the line N-S, which is used to represent the anterior floor of the cranium, thus it was being related to the cranium. In this study it was decided to relate the upper first permanent molar to the Frankfort horizontal or Frankfort plane, which is formed by connecting the two cephalometric porions with the left orbitale. Porion is located in the temporal bone which forms part of the base of the cranium. Left orbitale is located on the maxillary bone and is therefore located on a facial bone.

Thus in relating the upper first permanent molar to the Frankfort horizontal, we are relating it to both the cranium and face. The linear distance from the mesial surface of the upper first permanent molar to point A or subspinale in the midline on the anterior surface of the maxilla was also studied.

The anterior, inferior angle formed by the intersection of the lines S-6 and FH as illustrated in Figure 4 was measured to within half of a degree and will be referred to as angle S-6 to FH, in this paper.

The following linear measurement was measured to within half of a millimeter: The distance from point A to the line FH-6, which is the perpendicular projection of the mesial surface of the upper first permanent molar, to the Frankfort horizontal.

In the first study of these patients, they were grouped according to their classification as Class I, Class II Division 1 and Class II Division 2. In this study divide the Class I group was divided into two groups as follows: 1. Class I, U. of I., from the files of the University of Illinois. 2. Class I, Bolton, from the files of the Bolton Foundation of the Department of Anatomy of Western Reserve University. The reason for dividing Class I was to see if the findings would vary due to the difference in the age of the individuals who were being studied. The twenty-one normal, growing individuals from the Bolton Foundation represented a group with a restricted age range from seven years to eight years and two months. Included in this group were seventeen Class I, and four Class II Division 1 malocclusions. Since there were only four Class II Division 1 they were included in the group for that classification. In the Class I group from the files of the University of Illinois, the age range was from eight to twenty-one years of age. Eighty-five percent were in the age range from eleven to sixteen years of age.

Since Class I was divided into two groups in this study, it was decided to make the same division in the first study and see if it would make a difference in the findings. The result obtained for the arithmetic mean of the angle N-S-6 was as follows:

1. Class I, U. of I. 68.35°

2. Class I, Bolton 66.65°

Thus, there is a difference of 1.70°.

III. FINDINGS

The angle S-6 to FH yielded the measurement shown in Table II.

Classification	Class I		Class II	
	U. of I.	Bolton	Division I	Division II
Number of Cases	48	17	36	21
Arithmetic mean	62.03 ±.56	61.71 ±.94	60.94 ±.58	60.60 ±.61
Standard Deviation	3.86 ±.39	3.88 ±.66	3.55 ±.41	2.78 ±.43

Note in this table that the arithmetic mean and the standard error of the mean are, for all practical purposes, the same in all four groups. The greatest difference in the arithmetic mean is only 1.43 degrees, which can probably be accounted for on a basis of chance. This occurred between the Class I, U. of I. and the Class II Division 2 groups.

The linear measurement from point A parallel to Frankfort horizontal, to the mesial surface of the upper first permanent molar yielded the measurements given in Table III.

TABLE III

Classification	Class I		Class II	
	U. of I.	Bolton	Division I	Division II
Number of Cases	48	17	36	21
Arithmetic mean	24.44　±.46	27.29　±.36	24.72　±.53	25.45　±.56
Standard Deviation	3.21　±.33	1.48　±.25	3.21　±.37	2.55　±.39

In Table III note that the arithmetic mean in the Class I, U. of I., Class II, Division 1, and Class II Division 2 groups is essentially the same, but that in Class I, Bolton the arithmetic mean is 2.85 or more millimeters larger than in the other three groups. Note also that the standard deviation and the standard error of the standard deviation in Class I, U. of I., Class II Division 1 and Class II Division 2 groups are for all practical purposes the same. The standard deviation and the standard error of the standard deviation is the smallest in the Class I, Bolton group and the amount of this difference combined with the largest arithmetic mean from the other three groups appears to be significant.

These findings on the linear measurement from the point A to the mesial surface of the upper first permanent molar seem to indicate that this distance in Class I, U. of I., Class II Division 1 and Class II Division 2 groups is essentially the same, and would indicate that between these two points the base bone of the maxilla mesio-distally was comparable, but that in the Class I, Bolton group composed of children in the age range of from seven years to eight years and two months, the finding of an increased distance appears to indicate that between these two points the base bone of the maxilla mesio-distally was greater when considered from the lateral aspect.

IV. DISCUSSION

A review of the literature revealed that a controversy existed regarding the anatomical landmarks being used as a basis for diagnosis of malocclusion. On one side were those who based their classifications on tooth relationships (Angle et al) and on the other side were those who based their classifications on dento-cranial relationships (Simon). The orbital-canine law as advanced by Simon, has been disproved by Broadbent, Oppenheim and Hellman, by making craniometric measurements on skulls with normal occlusion and showing that no such stable relationship existed.

In a previous study on the relation of the maxillary first permanent molar to the face and cranium in Class I and Class II malocclusions using the angle N-S-6 (nasion-sella turcica-upper first permanent molar), it was found that the same relationship existed between the upper first permanent molar and the face and cranium, at least from the lateral aspect.

In this study the relationship of the maxillary first permanent molar to the face and cranium in Class I and Class II malocclusions was considered from another aspect using the angle S-6 to FH, which would tend to confine the measurement mostly to the maxilla. The findings on the angle S-6 to FH seem to indicate that the upper first permanent molar in Class I and Class II malocclusions assumes the same relationship to the face and cranium, at least from the lateral aspect.

The linear measurement from point A to the mesial surface of the upper first permanent molar revealed a surprisingly consistent measurement

for the arithmetic mean in Class I, U. of I., Class II Division 1 and Class II Division 2 malocclusions, in the groups having approximately the same age range. This would seem to indicate that the mesiodistal length of the maxilla from point A to mesial of upper first permanent molar, at least from the lateral aspect, was comparable in these groups.

The finding of a larger linear measurement in the Class I, Bolton group from the point A to the mesial surface of the upper first permanent molar would seem to indicate that the mesio-distal length of the maxilla, between these two points, was larger, at least from the lateral aspect, than the corresponding area in older individuals.

This finding of a larger linear measurement from point A to the mesial surface of the upper first permanent molar in Class I, Bolton in the age range of from seven years to eight years two months, combined with the finding of a slightly smaller angle N-S-6 when the Class I group was divided in the first study, suggests that further studies should be undertaken to determine how, why and when these changes occur.

This study suggests that the individuals under study should be grouped according to age, in addition to the class of malocclusion which they present, when linear measurements are used. It also strongly suggests that it would be advantageous to group them according to facial type.

V. SUMMARY

This study, of lateral roentgenograms of one hundred and twenty-two individuals representing sixty-five Class I, thirty-six Class II Division 1 and twenty-one Class II Division 2 maloccluisons, was undertaken to further determine the position of the upper first permanent molar. The angle S-6 to FH and the linear measurement from point A to the mesial surface of the upper first permanent molar were measured.

The findings on the angular measurement of the angle S-6 to FH seem to indicate, at least in this sample, that the upper first permanent molar assumes the same relationship to the Frankfort horizontal, and thus to the face and cranium, in Class I and Class II malocclusions.

The findings on the linear measurement from point A to the mesial surface of the upper first permanent molar seem to indicate that a difference is found between different age groups and the larger measurement would be found in the younger age group. This would indicate that the base bone of the maxilla, at least from the lateral aspect, is greater between point A and the mesial surface of the upper first permanent molar in the age group having a mixed dentition.

The results of the findings, on the linear measurement from point A to the mesial surface of the upper first permanent molar in the different age groups suggest that the age factor, as well as the classification of the malocclusion, should be considered in future studies.

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