Studies on the Relationship of the Lower Six-Year Molar to the Mandible*

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IN ORDER to more thoroughly understand and appreciate the abnormalities of growth and development in which we, as orthodontists, are vitally interested in the consideration and treatment of malocclusion, we must first attempt to understand the normal patterns followed during the process of growth and development. In this paper I will attempt to present a very small portion of that plan, namely—the normal relationship of the lower six-year molar to the mandible. Also I will try to present a comparison between these findings and those made from a study of this same relationship in the recognized abnormal growth and developmental condition known as Class II malocclusion (Angle).

This material was collected by taking corrected measurements from tracings of cephalometric headplates of two groups of children. In the first group, considered the control, a series of headplates of seventy-two different individuals from the Mooseheart Home for Children was made. The ages of the children in this group ranged from three to ten years, with forty-eight, or two-thirds of the group, above six years. The greatest majority had a Class I molar relation, a few were Class II, and two or three were Class III. The second group was a series of forty-two Class II cases selected at random from the clinical records of cases treated in the Orthodontia Clinic of the University of Illinois.

During the process of growth and development we know that the face, including the mandible, enlarges in three planes of space—length, height and width. Because a lateral cephalometric X-ray presents only two planes, these measurements indicate only the anterior-posterior and vertical changes.

As shown in the illustration of the mandible (Fig. 1), these measurements were taken from two base lines, one drawn tangent to the lower border of the mandible (A), and the other drawn tangent to the posterior border of the ramus (B). The vertical measurement (C) was taken from the distal contact point, or greatest distal crown convexity of the first permanent molar, to the base line at the lower border of the mandible and on a plane perpendicular to this base line. The anterior-posterior measurement (D) was taken from the same point on the tooth to the base line at the posterior border of the ramus, and on a plane parallel to the occlusal plane (E). Wherever double images were given on the headplate, indicating the right and left sides, a mean of the two images was used.

The first chart (Fig. 2) is a graphic representation of the measurements taken from tracings of the control or Mooseheart group. Each dot represents

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the combined vertical and horizontal measurements, in millimeters, of a separate case. Where identical measurements occurred in different individuals, the duplications are indicated by check marks.

The majority of all the points marked on this chart fall rather close to a straight oblique line. This group can be roughly divided into two sections, the first those cases under six years where the six-year molars have not yet come into occlusion, and the second those in which the first permanent molars are in occlusion.

The second section of cases where the molars are in occlusion comprises two-thirds of the seventy-two cases in the group. With but one exception these fall to the right of the 32 mm. line of the horizontal measurement.

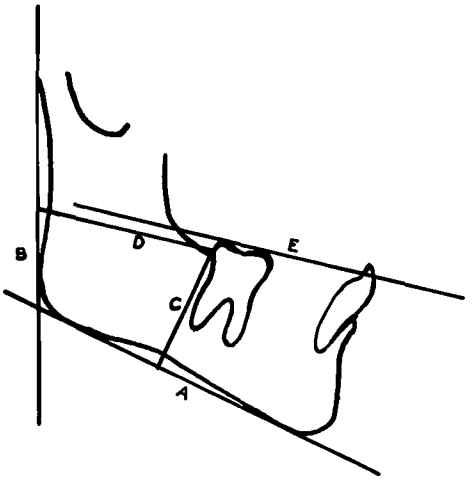


Fig. 1.—Base lines and planes of measurements used for determining the relationship of the six-year molar to the mandible in control and Class II cases.

This same group of forty-eight cases also falls, with but three exceptions, above the 22 mm. line of the vertical measurement. Below and to the left of this point where these two lines cross, the cases fall into general age groups in direct relation to their increase in dimensions. Thus most of the measurements of the three year cases are grouped together to the left of the 21 mm. line; most of the four year cases are between the 21 and 25 mm. lines; and the majority of the five year cases fall between the 25 and 30 mm. lines.

The second chart (Fig. 3) shows the measurements taken from the Class II group. Each cross mark represents a single case and the circles represent identical measurements taken from different individuals. These marks also have a tendency to lie along a straight oblique line. The lower six-year molar of the Class II cases apparently follows the same trend as far as the relationship between these measurements and the mandible is concerned, as did the same tooth in the control cases. I might explain here that the apparent bunching of some of the measurements is due to the predominance of individuals in certain age groups. The majority of the Class II cases used for these measurements fell in the twelve to sixteen year group where the predominance of crosses can be seen. The highest and next highest marks on

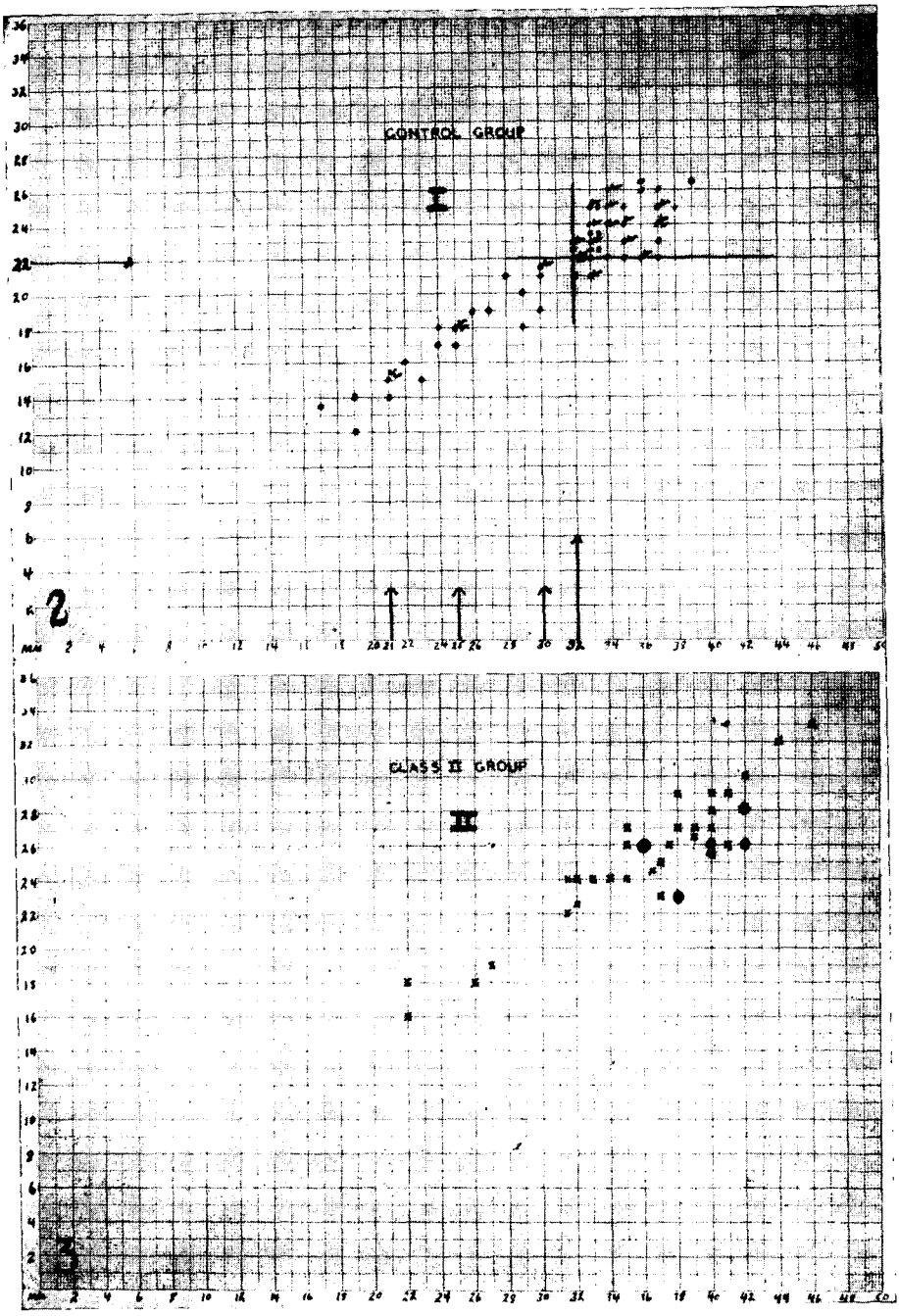


Fig. 2.—A graphic illustration of the linear measurements, in millimeters, taken from cephalometric headplates of seventy-two control cases. The check marks indicate duplicate measurements.

Fig. 3.—A graphic illustration of the linear measurements, in millimeters, taken from cephalometric headplates of forty-two Class II (Angle) cases. The circles indicate duplicate measurements.

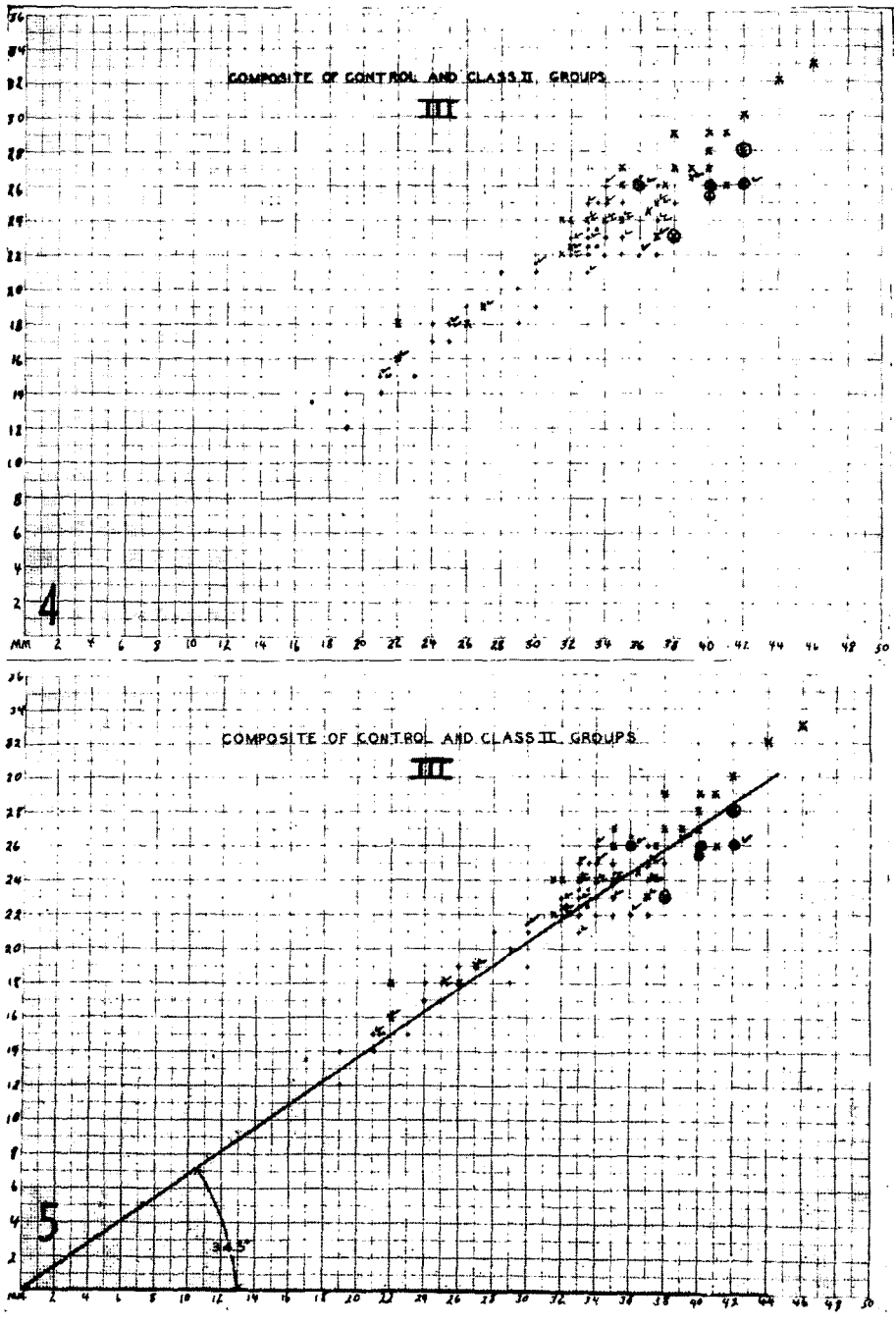


Fig. 4.—A composite illustration of the measurements of the control and Class II cases.
- ● A measurement from a control case
- V A duplicate measurement from another control case
- × A measurement from a Class II case
- ○ A duplicate measurement from another Class II case

Fig. 5.—A line drawn from the zero point through the mass of the charted measurements forms an angle of 34.5° with the lower base line.

this chart indicate measurements from a twenty-six and a twenty-one year case, respectively.

In order to compare the findings of the control and Class II groups a composite chart was made (Fig. 4). The dots and checks represent the control group measurements, while the crosses and circles indicate the Class II cases. It is apparent from this chart that there is no marked difference between the measurements of the control and Class II cases as to their general direction and scatter. The measurements of the older Class II cases apparently result in an extension of the trend of the dots, as seen in the control cases alone.

Figure No. 5 is a graphic representation of the mean measurements, both horizontal and vertical, of the control and Class II groups. The mean vertical measurement for the control group was 21.56 mm. and the mean horizontal measurement of the same group was 31.24 mm. The point indicating these measurements is marked on the chart at C. The mean horizontal and vertical measurements for the Class II group was then found and marked on the chart at the junction of the 25.27 mm. line with the 36.90 mm. line. It was apparent at first glance that a line drawn from the Class II mark to the control mark and projected in this same plane straight down the chart, would pass very close to the zero point on the graph.

In order to determine whether a line drawn from the Class II mark to zero did pass through the control point, lines were drawn from zero to each of these charted mean points (Fig. 6). There was a slight difference between these two lines, but the difference was so small that it was obliterated by the width of the lines drawn on the chart. As closely as could be measured, the angle formed between the oblique line and the lower base line was 34.5°. The construction of this chart suggested the possibility of studying the relation of the control group to the Class II group by a comparison of these angles formed at zero.

From this point we turn back to the composite chart (Fig. 7). By first laying out this mean angle of 34.5°, we note that the oblique line formed passes through the center of the measurements charted. In order to determine the exact difference between the angle formed from the mean measurements of the Class II cases on the one hand, and that formed from the mean measurements of the control cases on the other, it was necessary to find the mean angles for each. This was accomplished by drawing a straight line from the zero point to each and every charted measurement. The angles formed between these lines and the lower base lines were tabulated. Identical measurements from different individuals were noted in the tables as identical angles. The mean angle for the control group of seventy-two cases was found to be 34.51°, while the mean angle for the forty-two Class II cases was 34.30°. This is a difference of only .21 of 1° or a little over .6 of 1% in variation between the two angles. This variation is so small that it makes the angles appear identical in the limited dimensions within which these measurements fall.

After determining the angle formed between each individual point and the base line, the combined groups were tabulated according to degrees without regard to classification (Fig. 8). As can be seen from this chart, the majority of the cases fall between the 33° and 36° lines. Exactly one-half of the

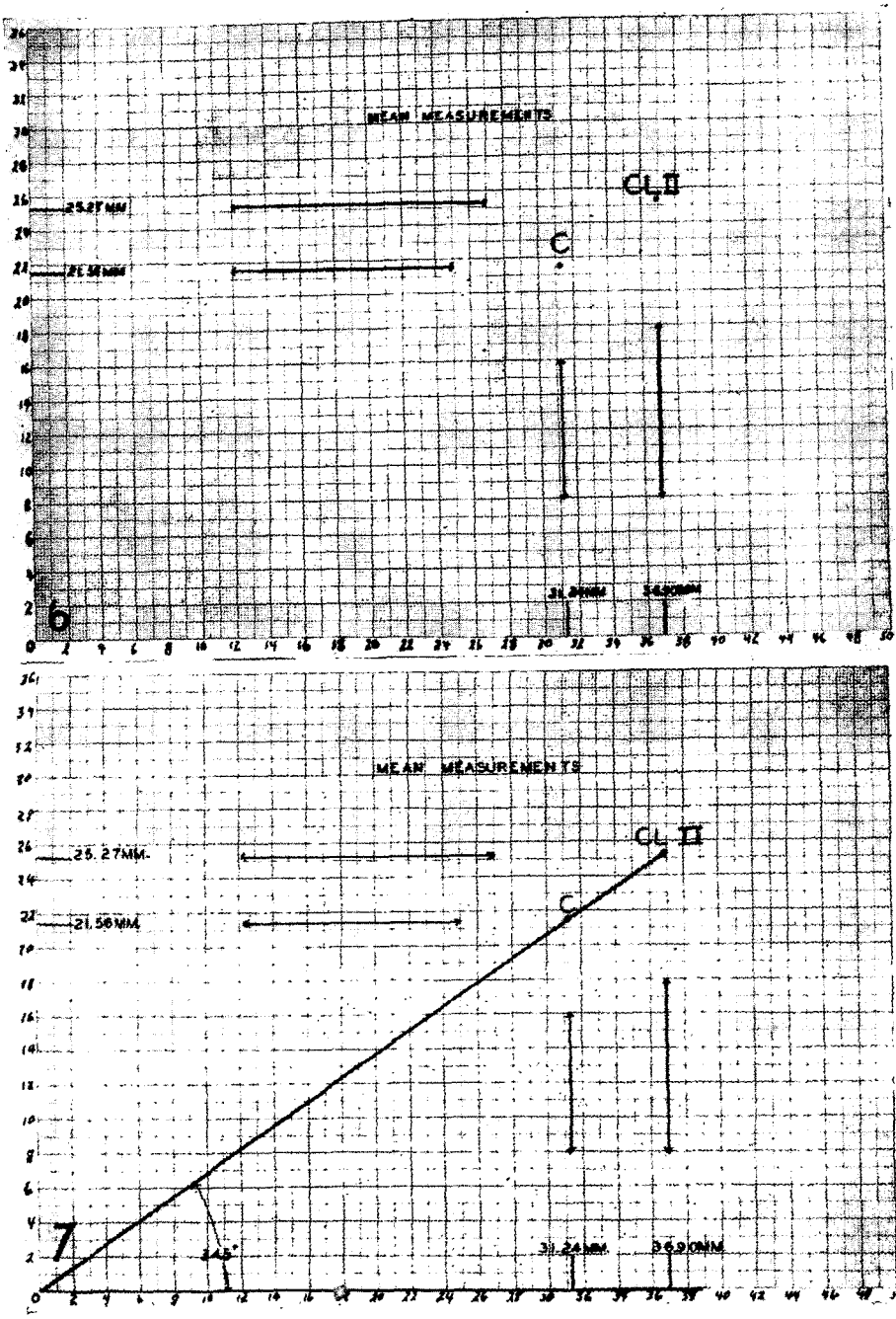
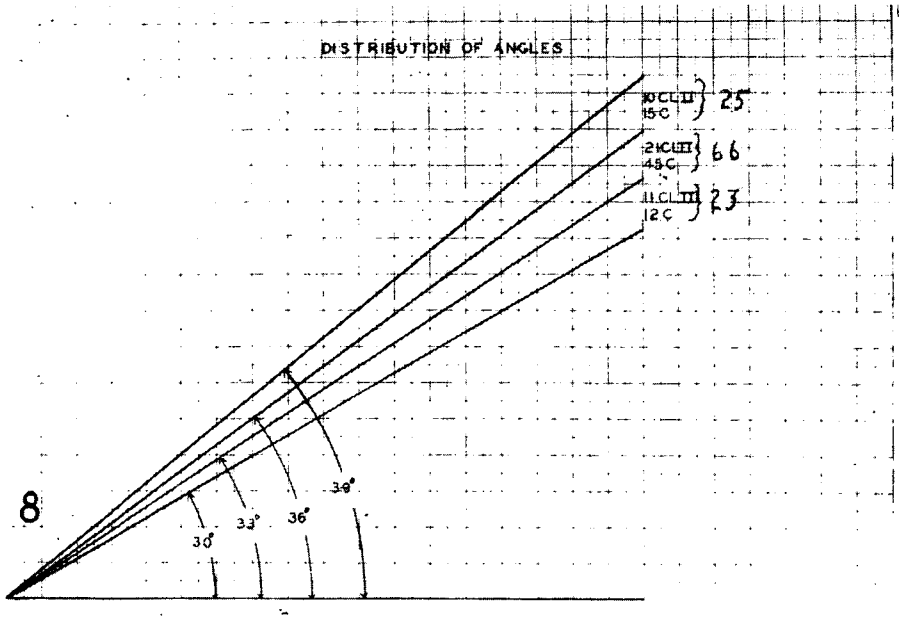


Fig. 6.—A chart showing the means of the measurements taken from both the control and Class II cases.

C—control cases

Cl II—Class II cases

Fig. 7.—Lines drawn from zero to C and to Cl II are practically identical and again form an angle of 34.5° with the lower base line.



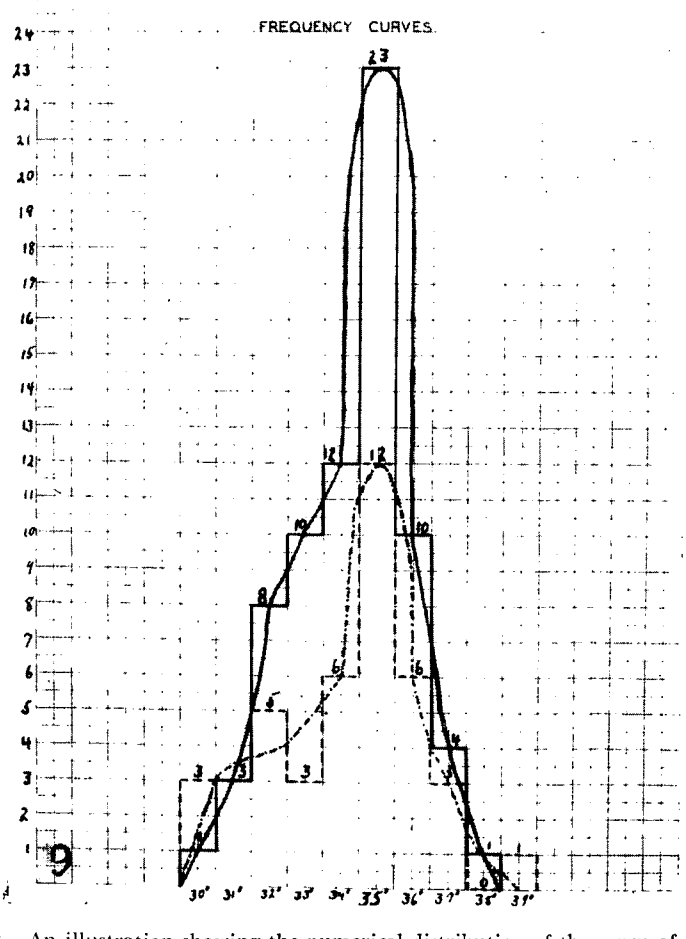


Fig. 8.—An illustration showing the numerical distribution of the range of the formed angles from 30° to 39°. Note majority of angles between 33° and 36°.

Fig. 9.—A frequency polygon showing the numerical distribution of the cases for each

Class II group and almost two-thirds of the control group are in this division. This shows a strong central tendency around 35°.

In order to more clearly examine the tendency toward centralization around this angle, a frequency polygon was constructed (Fig. 9). The solid lines indicate the control cases and the dotted lines the Class II group. At the base of the chart are listed the degrees corresponding to the spread of the angles, from 30° to 39°. Each step of the chart shows the comparative height and number of cases within the corresponding angles. The curves were formed by connecting the midpoints of the steps in their proper sequence. From this chart the impression is gained that there is an even stronger trend toward centralization than was indicated by the preceding graphs. The centralization of the angles of the Class II cases at the 35° pillar is again identical with the control cases. The curves of the control and Class II cases both skew toward the left with a comparatively similar dip in the curves on the right.

In concluding this study of the angles formed, it was found that the standard deviation for the control group was .94 of 1° and the standard deviation for the Class II group was 1.22°. The difference between these two standard deviations would probably have been less if the number of Class II cases available for this study was equal to the number of control cases used.

One condition which is apparent in considering the relation of the measurements to age is that there seems to be a closer relation between the physiological age of these various cases (in direct relation to these measurements) than between the chronological ages. This is indicated by the very close relationship between the vertical and horizontal measurements, irrespective of age, which results in an almost straight line on the chart. It was thought that this relation between the two dimensions could be expressed in the form of a ratio.

The ratio was determined by comparing the total sum of all the horizontal measurements of each group with the corresponding vertical measurements. This resulted in the following formulas:

Control group:

$$\frac{\Sigma H}{\Sigma V} = \frac{1.449}{1} \text{ or approximately } \frac{3}{2}$$

Class II group:

$$\frac{\Sigma H}{\Sigma V} = \frac{1.459}{1} \text{ or approximately } \frac{3}{2}$$

This ratio indicates that the vertical measurement is equivalent to approximately two-thirds of the horizontal measurement in any of the individual cases measured, irrespective of age, whether of the control group or of the Class II group.

The angle formed between the vertical and horizontal planes at the distal contact point of the six-year molar (Fig. 1, planes C and D), was measured and tabulated for each case. An analysis of this table revealed a variation of approximately 12° between the angles of the different cases measured. With this in mind we can make the statement that the mean of the horizontal and vertical lines forming this angle maintain a ratio of 3 to 2 al-

though the angle formed between these two lines varies in the individual case.

An analysis of the results as indicated by these charts leads me to conclude that the lower six-year molars of the cases studied bear, in at least two planes of space, a definite relation to the mandible. Furthermore, this constant relationship prevails not only prior to but after the molar has come into occlusion. This relationship appears identical in both the control and Class II cases included in this study.

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