Disharmony In Tooth Size And Its Relation To The Analysis And Treatment Of Malocclusion*

WAYNE A. BOLTON, D.D.S., M.S.D.
*Seattle, Washington***

INTRODUCTION

One of the basic fundamentals with which the orthodontist has to deal in reconstructing the denture is tooth size, specifically, the mesiodistal width of the teeth. Surprisingly few investigations have been conducted on this phase of orthodontics, as evidenced by the scarcity of literature related to the subject. The primary purpose of this study was to analyze a group of excellent occlusions and determine whether or not mathematical ratios could be set up between total lengths of dental arches, as well as between segments of dental arches. It was hoped that a method of evaluating tooth size would be found which would be an aid in diagnosis and treatment planning of orthodontic cases and also help in determining the functional and esthetic outcome of the case.

One of the first investigators to become interested in the subject of tooth size was G. V. Black[3], who in the late nineteenth century measured large numbers of human teeth. From these measurements he set up tables of mean figures which are still important references today.

More recently, quantitative studies have been made dealing with this phase of the orthodontic problem by several different investigators. Ballard[1] in 1944 studied asymmetry in tooth size; he measured the teeth on five hundred sets of casts and compared the mesiodistal diameter of each tooth with the corresponding tooth in the opposite side of the dental arch. Ninety per cent of the sample demonstrated a right-left discrepancy in mesiodistal width amounting to 0.25 millimeters or more. He advocated the judicious stripping of proximal surfaces, primarily in the anterior segments, when a lack of balance existed.

Neff[5], using two hundred cases, measured in millimeters the mesiodistal diameters of both the maxillary and the mandibular anterior teeth. He then arrived at an "anterior coefficient" by dividing the mandibular sum into the maxillary sum. The range was 1.17 to 1.41. No mean figures were given. Neff then attempted to relate the "anterior coefficient" to the degree of overbite. The overbite was determined on a percentage basis by measuring the amount of coverage of the lower central incisors by the upper incisors. End to end relation would be 0% and complete coverage 100%. By measuring normal occlusions which showed a 20% overbite, it was determined that the "anterior coefficient" for this figure was 1.20-1.22. A 20% overbite was considered to be ideal.

Ballard and Wylie[2] provided a method of computing the total mesiodistal width of the unerupted mandibular canine and premolars. This procedure was devised to be used in conjunction with Nance's[4] method of mixed dentition case analysis, in which the meas-

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** Clinical Assistant in Orthodontics, School of Dentistry, University of Washington.

urements of these three teeth, the canine and premolars, are taken from intraoral radiographs. A graph was formulated from which the mesiodistal width of the mandibular canine and premolars could be predicted after the total mesiodistal width of the mandibular incisors had been determined. It was attempted in the present investigation to compare the statistical findings of the two studies.

Wheeler[7] has published in his dental anatomy text tooth dimensions which have been devised in order that teeth may be carved and articulated in as nearly an ideal manner as possible. His figures were compared with the present study in order to see if they correlated. Figures published by The Dentists Supply Company of New York were also compared in the same manner. Their figures were based upon mathematically determined relationships and are thus a good comparative guide to evaluate how closely nature approaches a mathematical formula.

Material and Methods

The measurements used in this study were taken from fifty-five cases where excellent occlusions existed. The casts were carefully selected from a large number of excellent occlusions, most of which had been treated orthodontically (non-extraction). Of the fifty-five in the sample, forty-four were treated cases and eleven were untreated. Selections were made with extreme care, the cases being drawn from ten different private practices as well as from the Department of Orthodontics, School of Dentistry, University of Washington.

Three-inch needle-pointed dividers were used to determine the greatest mesiodistal diameter of all the teeth on each cast, excepting second and third molars. The dimensions to the nearest one-quarter millimeter were taken from a finely calibrated millimeter ruler and recorded. The following measurements were made on each set of casts:

1. The mesiodistal widths of twelve maxillary teeth, the right first permanent molar through the left first permanent molar, were totaled and compared with the sum derived by the same procedure carried out on the mandibular twelve teeth. These measurements are shown as X and X' in Figure 1. The ratio between the two is the percentage relationship of mandibular arch length to maxillary arch length which we have called the "overall ratio."

$$\frac{\text{Sum mandibular ``12''}}{\text{Sum maxillary ``12''}} \times 100 = \text{overall ratio}$$

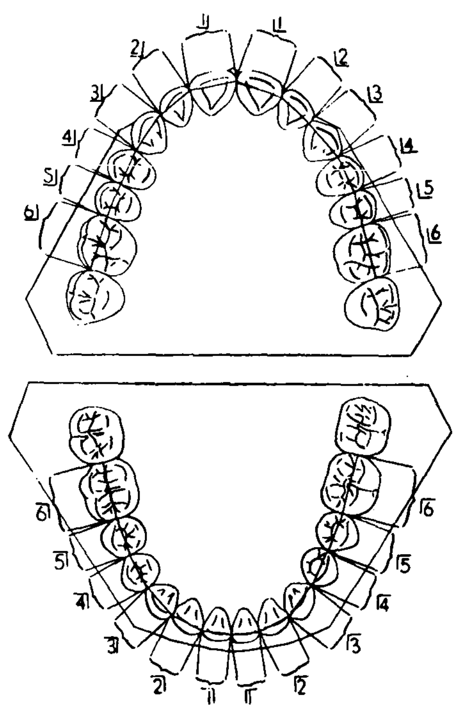

Fig. 1 X is the sum of mesiodistal diameters of max. teeth 654321 | 123456
X' is the sum of mesiodistal diameters of mand. teeth 654321 | 123456
Y is the sum of mesiodistal diameters of max. teeth 321 | 123
Y' is the sum of mesiodistal diameters of mand. teeth 321 | 123

2. The same method was used in setting up a ratio between the maxillary and the mandibular anterior teeth. Those measurements are shown as Y and Y' in Figure 1. The ratio between the two is the percentage relationship of mandibular anterior width to maxillary anterior width, and this is referred to as the "anterior ratio."

$$\frac{\text{Sum mandibular ``6'' x 100}}{\text{Sum maxillary ``6''}} = \text{anterior ratio}$$

3. The buccal segments were divided into units in an attempt to analyze the cuspal interdigitation and possibly localize tooth size discrepancy. It is felt that the findings lack clinical significance; therefore, the buccal measurements are being omitted from this paper.

4. *The degree of overbite* was computed on a percentage basis. The amount of coverage of the mandibular central incisor by the maxillary central incisor was compared with the total length of the lower incisor. This gives an accurate picture of the overbite situation regardless of the tooth length.

5. *Overjet* was measured as the distance from the labial surface of the mandibular central incisor to the junction of the incisal and lingual surfaces of the maxillary central incisor. A finely calibrated millimeter ruler was used. The horizontal level selected for the measurements was the incisal edge of the maxillary central.

6. *The angles of the maxillary and mandibular incisors to the occlusal plane were measured.* This was determined by measuring the angles formed by the labial surfaces of the incisors with the base of the cast which was trimmed parallel to the occlusal plane.

7. *Incisor length* or the incisogingival height of the maxillary and mandibular central incisors was recorded.

8. *Cusp height* was measured with a specially designed divider which allowed measurement from the cusp tip to the depth of the central sulcus midway mesiodistally.

Statistical Analysis

The data were judged statistically and the following are the abbreviations and formulae of the statistical methods used:

S.E.M.—Standard error of the mean. This test predicts the degree of variation to be expected in the mean if the experiment were repeated on other similar samples.

S.D.—Standard deviation. This is the constant which measures in absolute terms the degree of scatter or dispersion about the mean.

C.V.—Coefficient of variation. The coefficient of variation relates the standard deviation to the mean by expressing the standard deviation as a percentage of the mean. In order for the standard deviation to be statistically significant in relation to the mean, the coefficient of variation percentage should be small.

C.C.—Coefficient of correlation. This test gives a method of correlating two measurements from the same sample.

Findings

The ratio

$$\frac{\text{Sum mandibular ``12'' x 100}}{\text{Sum Maxillary ``12''}}$$

was developed for each individual of the sample, and the following resulted:

Range	87.5-94.8
Mean	91.3
S.D.	1.91
S.E.M.	.26
C.V.	2.09%

TABLE 1

Similar data were compiled in analyzing the anterior ratio of each individual, this ratio being

$$\frac{\text{Sum mandibular ``6'' x 100.}}{\text{Sum maxillary ``6''}}$$

Range	74.5-80.4
Mean	77.2
S.D.	1.65
S.E.M.	.22
C.V.	2.14%

TABLE 2

In order to compare our data with that published by Neff, the problem was set up in reverse fashion:

$$\frac{\text{Sum maxillary ``6''}}{\text{Sum mandibular ``6''}} = \text{``anterior coefficient''}$$

	Author	*Neff*
Range	1.24-1.34	1.17-1.41
Mean	1.29	Not given, but the
S.D.	.027	ideal was deter-
S.E.M.	.0036	mined to be 1.20-
C.V.	2.09%	1.22.

TABLE 3

The coefficient of correlation between the overall ratio and the anterior ratio was +0.5, which is statistically significant.

Table 4 gives the information concerning percentage of overbite.

Range	11.8-53.9
Mean	31.3%
S.D.	10.2
S.E.M.	1.37
C.V.	32.6

TABLE 4

In order to determine if overbite is related to tooth size, a coefficient of correlation "r" was run between the anterior ratio and the per cent of overbite.

r = (Treated Cases)	+.053
r = (Untreated Cases)	—.094

The mean overjet was computed to be 0.74 mm.

Angles of the maxillary and the mandibular central incisor labial surfaces to the occlusal plane were taken in order to record the axial inclination of the crowns of these teeth to each other. The mean was 177 degrees.

Both the maxillary and the mandibular centrals were measured from the incisal edge to the gingival margin. A coefficient of correlation between the two measurements was calculated and found to be +0.76. Since this is a high correlation, either of the centrals may be used in calculating the coefficient of correlation between incisor length and degree of overbite. The mandibular central was selected and the coefficient of correlation was +0.39.

Cusp height is not constant throughout the denture of a given individual. The height of the cusps of the premolars was invariably greater than that of the molars. In recording the data an average between the height in the two areas was taken. The coefficient of correlation between percentage of overbite and cusp height was calculated.

Mean — 1.9 mm.

r = (Treated cases)	+0.29
r = (Untreated cases)	+0.28

Table 5 shows the relationships that existed between the premolars.

	Teeth Compared	Mean	r
1.	Max. First Premolar	7.04	
	Mand. First Premolar	7.15	0.96
2.	Max. Second Premolar	6.84	
	Mand. Second Premolar	7.27	0.50
3.	Max. First Premolar	7.04	
	Mand. Second Premolar	7.27	0.57
4.	Max. Second Premolar	6.84	
	Mand. First Premolar	7.15	0.61

TABLE 5

The coefficient of correlation between the sum of mesiodistal widths of the four mandibular incisors and the sum of the canine, first and second premolars arrived at by Ballard and Wylie was +0.64. The result in this study was +0.65.

Discussion

It was felt that a more satisfactory and significant discussion of the findings could be offered if the presentation were to be developed around actual cases that had been collected for the study. Figure 2 depicts an untreated excellent occlusion. This is the dentition of a fourteen-year old girl. There were no restorations or carious lesions. Measurements and ratios recorded from this ideal occlusion were compared with means derived from the complete sample of fifty-five cases. The comparisons are summarized in Table 6.

A statistical analysis of both the overall ratio, Figure 1, measurements X and X′, and the anterior ratio, Figure 1, measurement Y and Y′, indicated a small degree of variation in the individual measurements about the mean. In the overall ratio (Table 1) a standard deviation of 1.91 for a mean of 91.3 ± 0.26 is very small as verified by the correspondingly small coefficient of variation, 2.09%. The same pattern held true also for the anterior ratio (Table 2). For a mean of 77.2 ± 0.22, the standard deviation of 1.65 is significantly small as again indicated by the coefficient of variation, 2.14%. Both ratios derived from the case in Figure 2 compare very favorably with the mean figures, as demonstrated in Table 6.

The anterior ratio was reversed so that it could be seen if the resultant findings were in agreement with those published by Neff (Table 3). This is not a legitimate comparison because no mean figures were published in his study; but it was stated that for a 20% overbite, the "ideal anterior coefficient" should be 1.20-1.22. Dr. Neff also makes the approximation that for a coefficient of 1.30, which most nearly corresponds to our mean of 1.29, the overbite should be 35%. The mean overbite derived for this sample was 31.3%.

The +0.5 coefficient of correlation between the anterior ratio and the overall ratio is not a particularly high one, but still it must be considered significant. This indicates that as the anterior ratio increases, the overall ratio also increases in a fairly proportionate manner.

An attempt was made to analyze the overbite problem from several different aspects. It was noted that there was a considerable range in the degree of overbite in this normal sample as demonstrated in Table 4. It then seemed desirable to relate the overbite percentage to the three following factors: the anterior ratio, the length of the central incisors, and the cusp height. In all cases the coefficients of correlation were very low; therefore, overbite did not vary at all proportionately with variations in any of the aforementioned factors.

	Untreated Excellent Occlusion	*Mean*
Overall Ratio	91.11	91.3
Anterior Ratio	77.6	77.2
Overbite	31.2	31.3
Overjet	0.5 mm.	0.74 mm.
Incisor Angle	175.5°	177°
Cusp Height	2.0 mm.	1.9 mm

TABLE 6

A comparison of an untreated excellent occlusion (Figure 2) with the mean figures derived from this study.

It has been stated, and was also suspected by the author, that a direct relationship between the anterior tooth ratio and degree of overbite would exist in any given case, i.e., as the numerical ratio increased or decreased, the degree of overbite would fluctuate in a proportionate manner. Previous findings which upheld the aforementioned theory could not be substantiated by a statistical evaluation of measurements compiled for this study, even when the untreated normals were handled as a separate group. With this group of untreated normals the problem of degree of overbite and its relations was repeated. The coefficients of correlation did not vary significantly when the two categories were compared. The sample was divided and the untreated

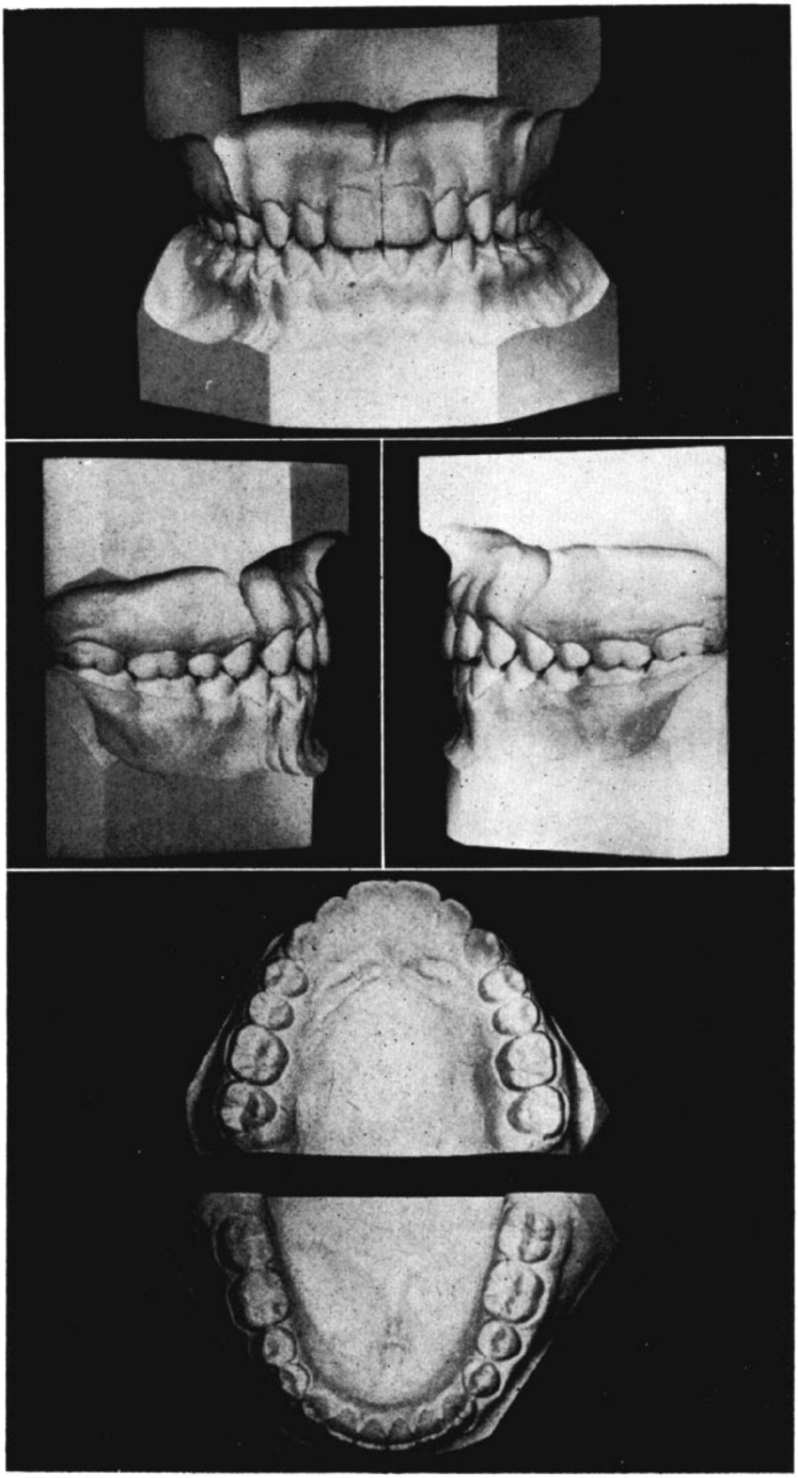

Fig. 2

component was related as a separate unit because it could be argued that the overbite which was probably altered in treatment had not in all of the cases had a chance to settle to its "normal" or state of balance with the other factors which influence occlusion. Since the coefficients were so similar, no difference was found between the two groups.

It is conceivable that the angle of the upper incisor to the lower incisor is an important factor in determining the amount of overbite in a given individual. This fact is suspected, but a satisfactory method of relating this angle to the occlusal plane could not be worked out and it remains an hypothesis. Perhaps a cephalometric study could solve this problem.

Table 5 was devised to see if any general conclusions could be drawn concerning the mean widths and variations in width of the premolars. From analyzing the figures on this chart, one could, in theory, state that from a size standpoint only, first premolars are the teeth of choice to be removed in extraction cases. Their means are the most closely related in that they are the two that most nearly correspond in mesiodistal diameter. The coefficient of correlation of +0.96 between mesiodistal widths of maxillary first premolars to mandibular first premolars is highly significant and indicates that if one first premolar is large, generally speaking, the other first premolar of the opposite arch will also be proportionately large. The next most desirable combination as far as mesiodistal width is concerned would be the maxillary first premolars and the mandibular second premolars. The least desirable relationship seems to go between the second premolars.

It must be emphasized again that these statements are made in theory only because the results tabulated herein were derived from the use of mean figures. Mean figures can only indicate a trend. Concrete statements concerning them should not be made, but since the coefficient of correlation test is not related to means, the high correlation between first premolar widths is very significant and cannot be disregarded. Nevertheless, one must always remember to look upon each patient as an individual and then proceed to use these findings as an aid in determining the actual condition existing.

The presentation of the two following cases which presented a marked disharmony in tooth size may help to show the clinical application of the ratios described previously.

Figure 3 depicts four views of a malocclusion in which the overall ratio and the anterior ratio were both considerably deviated from the means of this investigation. The overall ratio was 96.46 and the anterior ratio was 86.45. The fact that these figures are larger than their means indicates that the maxillary arch is too small for the existing mandibular arch. The buccal measurements were made and the resulting ratio found to be essentially one to one. From this it was suspected that the anterior segments were at fault. This suspicion was borne out by the setup in Figure 4. Interdigitation in the buccal segments was satisfactory, but in the anterior segment the best that could be achieved was an end to end relationship which, as shown in the photographs, would be very unsatisfactory.

By substituting in the anterior ratio formula,

$$\frac{\text{Sum mandibular ``6'' (X)}}{\text{Sum maxillary ``6'' (48)}} \times 100 = 77.2$$

X the unknown was found to be 37.05 mm. This is the mesiodistal dimension that the mandibular six anteriors should have ideally. Since this unit

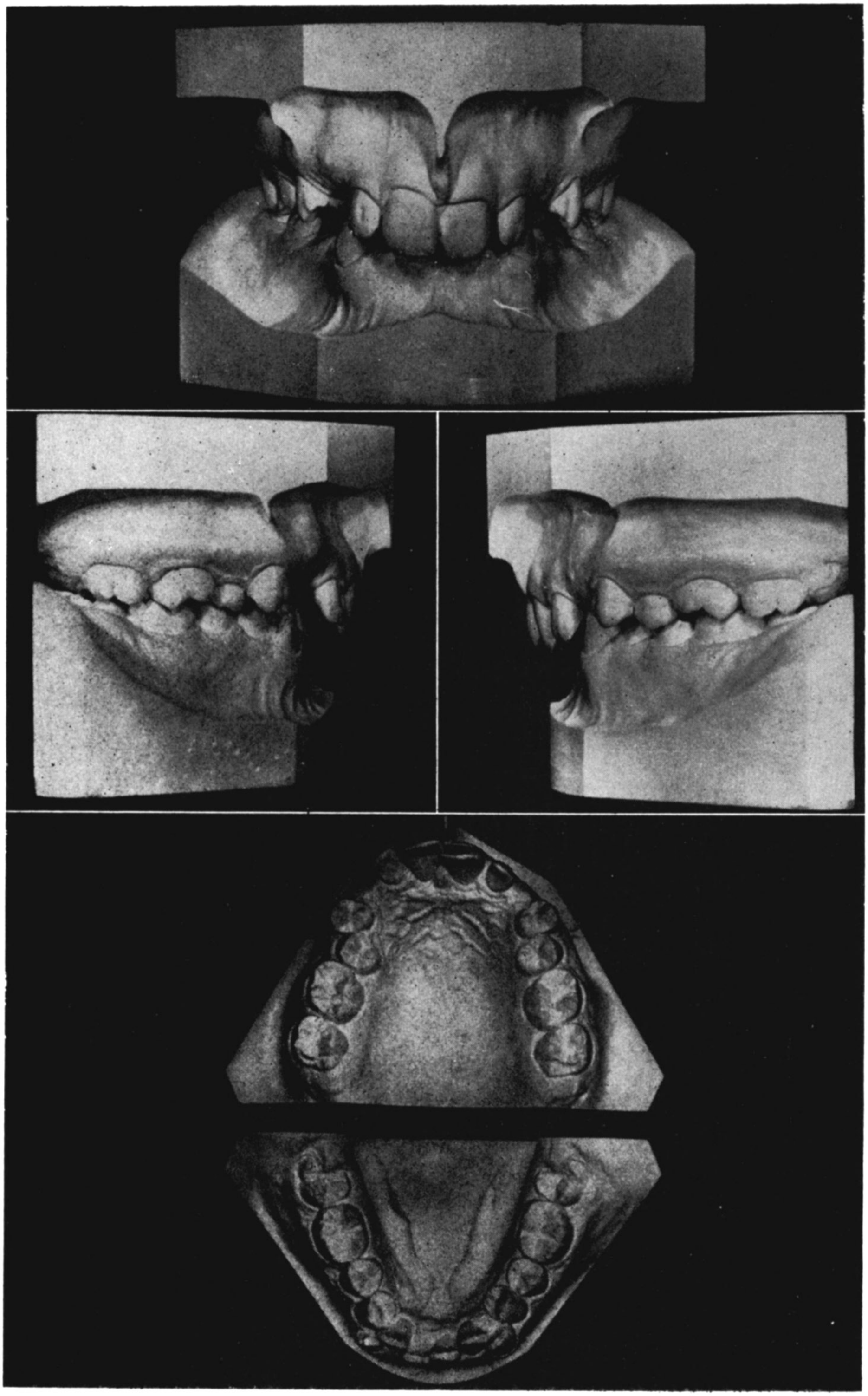

Fig. 3

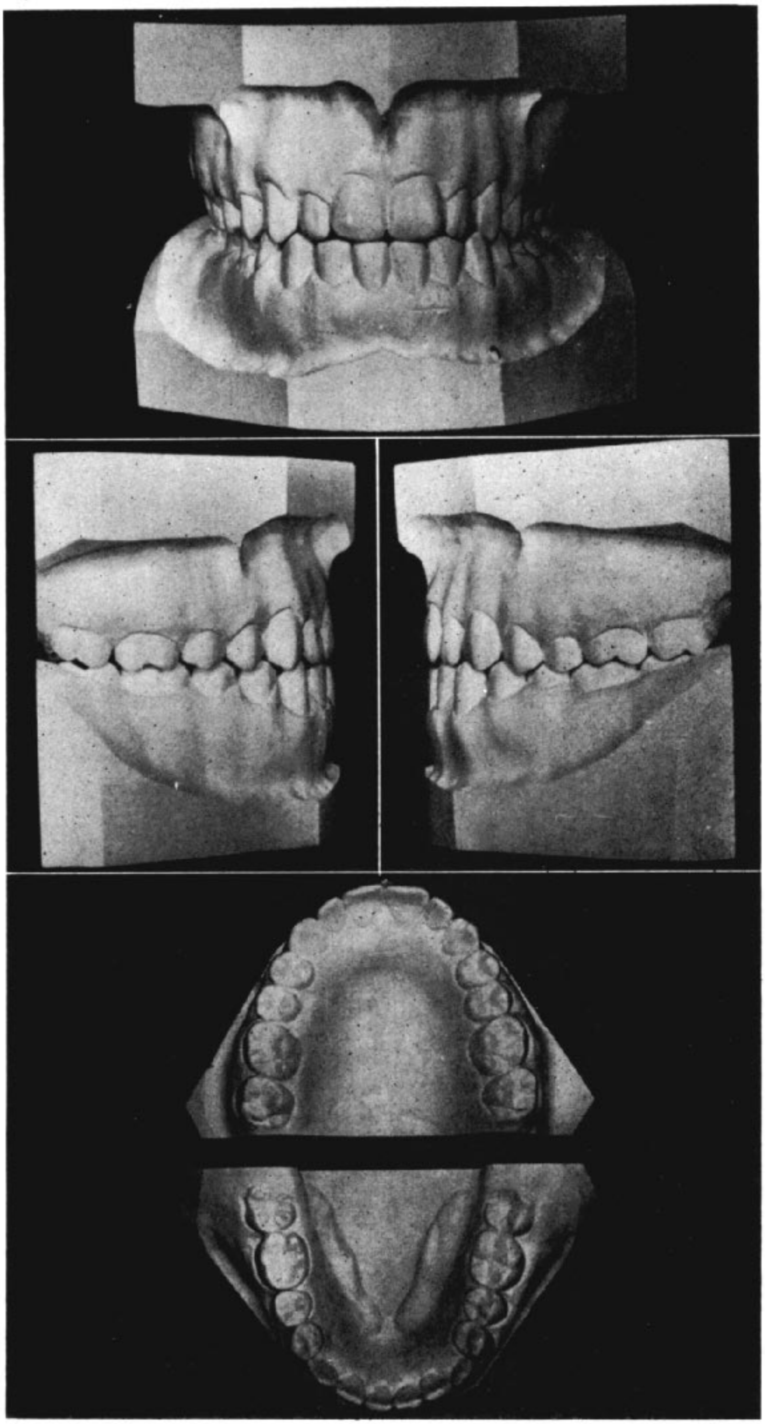

Fig. 4

actually measured 41.5 mm., it was noted that if a satisfactory anterior relationship were to be achieved, the mandibular segment should be reduced approximately 4.5 mm. By inserting this reduction in the overall formula also, the result was 92.0, within the range of normality, which indicated that the size discrepancy was confined to the anteriors.

The removal of 4.5 millimeters of tooth structure by stripping the four mandibular incisors and the mesial surface of the canines, was considered to be impractical.

The other alternative for reducing this dimension was the extraction of a central incisor whose mesiodistal width was 5.5 millimeters. The ratios were then reduced to 75.0 for the anterior and 91.03 for the overall. These readings are slightly below the mean, but the result is demonstrated by the setup in Figure 5. If the mandibular anterior segment were left intact, the final esthetic result would be far from desirable because extreme maxillary anterior spacing would be inevitable, that is, if the buccal segments were in a Class I molar relationship.

The malocclusion in Figure 6 demonstrated a somewhat different type of disharmony, being a case in which the discrepancy in size was not confined to one segment, but involved a complete dental arch. The ratio readings for this individual were 82.8 for the overall, and 70.3 for the anterior, which indicates that the maxillary arch is too large for the existing mandibular arch. The setup in Figure 7 bears this out. With the first molars placed in a Class I relationship, it is obvious that a marked discrepancy in tooth size exists between the two arches. Not only is there a marked maxillary anterior overjet, but the disharmony also extends to the buccal segments, making it impossible to obtain proper canine and premolar interdigitation.

By substituting in the overall formula,

$$\frac{\text{Sum mandibular ``12'' (87)}}{\text{Sum maxillary ``12'' (X)}} \times 100 = 91.3$$

X was found to be 95.3. This is 9.7 mm. smaller than 105 mm., the actual measurement recorded; therefore, the maxillary arch is excessive by 9.7 mm. Then by substituting in the anterior ratio,

$$\frac{\text{Sum mandibular ``6'' (36)}}{\text{Sum maxillary ``6'' (X)}} \times 100 = 77.2$$

(Mean), and solving, we find that X is 46.7 mm. By subtracting 46.7 from the 52.0 that existed, it is seen that the maxillary anterior segment is excessive by 5.3 mm. This leaves 4.4 mm. of the overall excess to be confined to the buccal regions.

A setup of this case (Figure 8) was made by removing 5 mm. of tooth structure from the maxillary anterior segment by the stripping of the following teeth: the mesial and distal surfaces of the four incisors, and the mesial surface of the canines. Extraction was considered to be necessary in the maxillary arch so second premolars were removed and the first molars were brought forward into a Class II molar relationship. This allowed satisfactory intercuspation in the buccal segments, which previously had not been possible.

Of clinical significance is the fact that the analysis can be so quickly and easily carried out. From a set of casts the various tooth measurements on each dental arch are punched along straight lines drawn upon a card. The dimensions can then be determined from the use of a finely calibrated millimeter ruler. The ratios are then set up and the results compared to the means published here. If a marked deviation occurs, a diagnostic setup can verify and give the exact picture of the conditions that exist which will affect the plan of treatment. It is felt

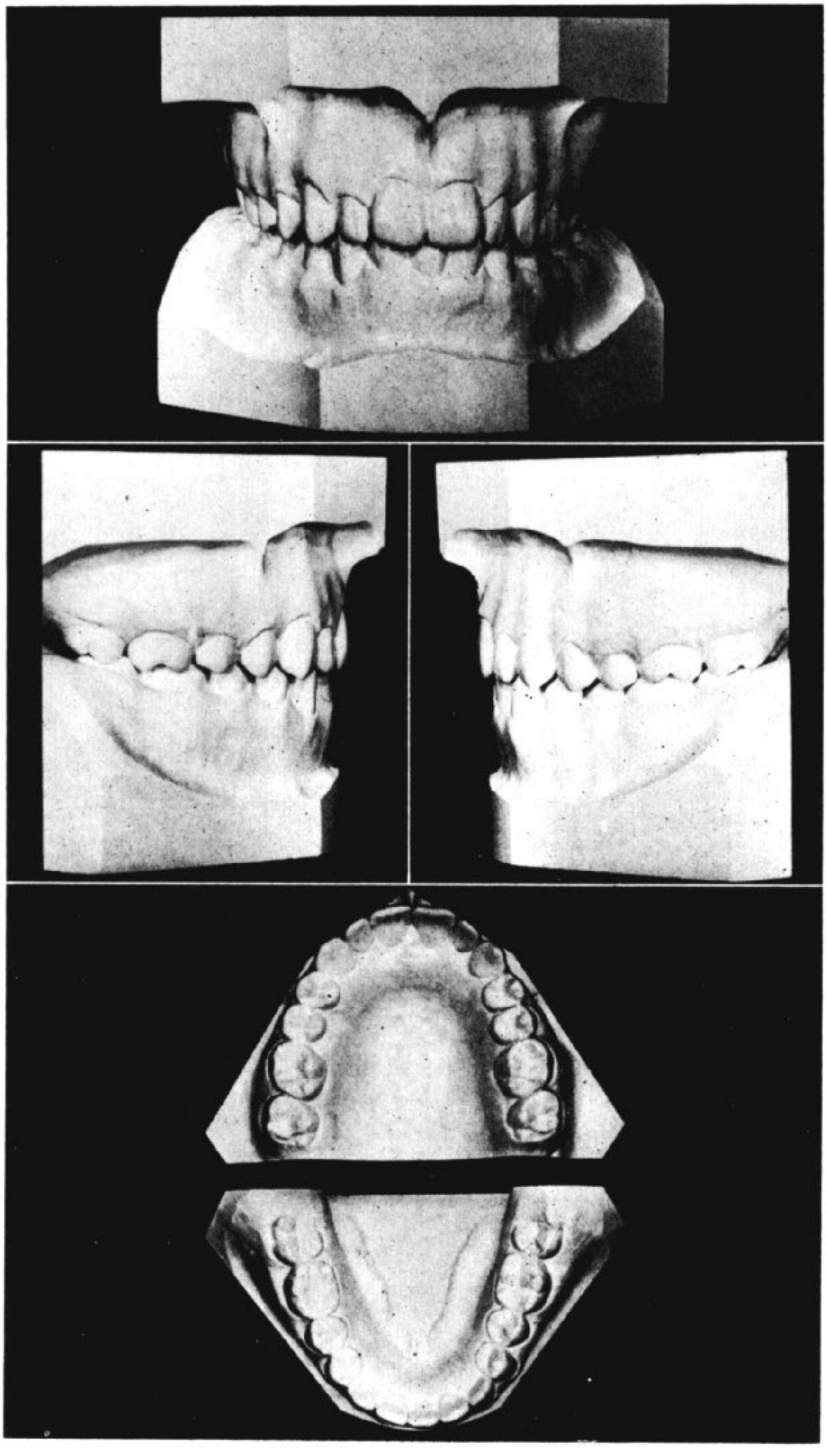

Fig. 5

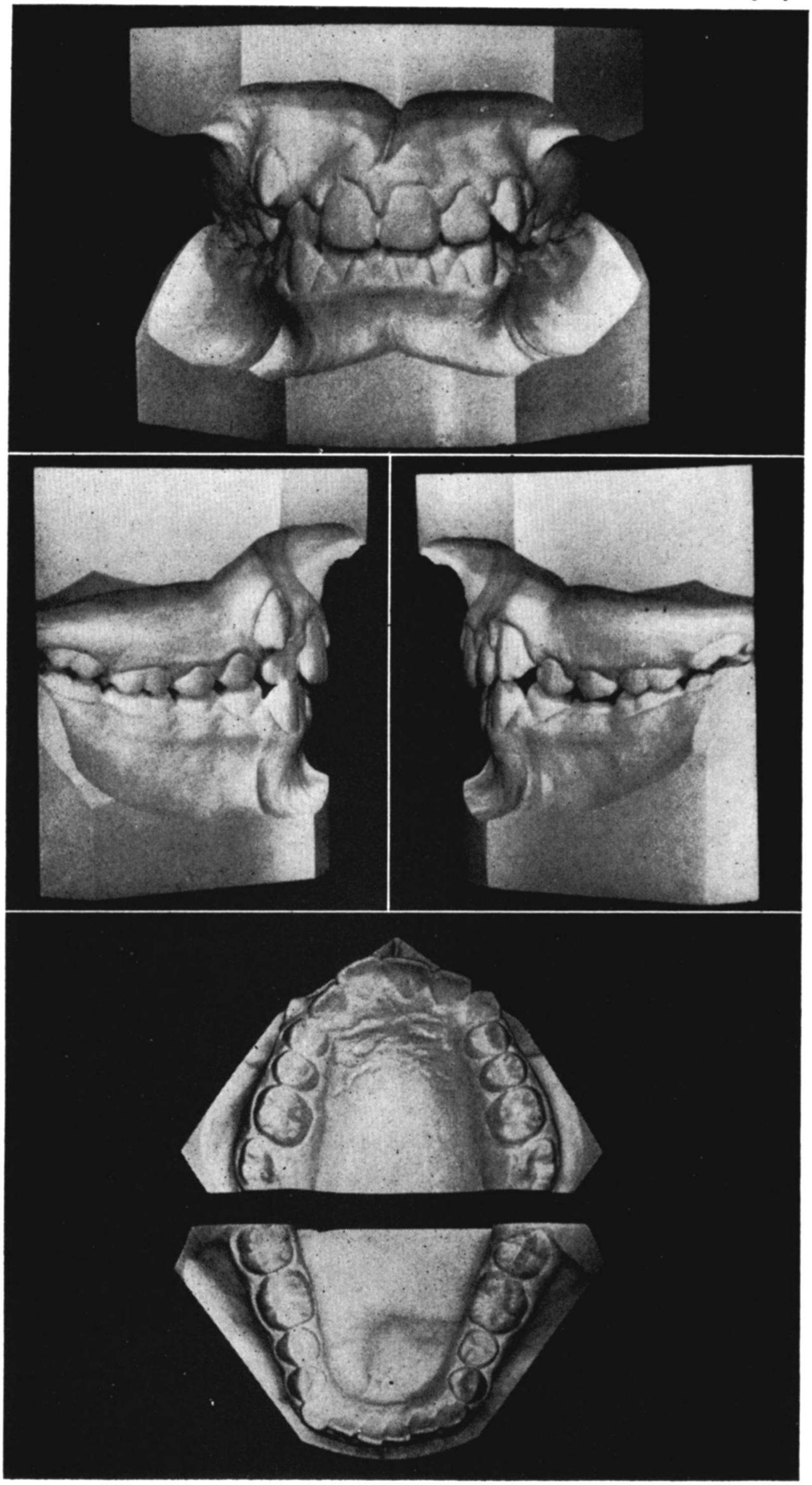

Fig. 6

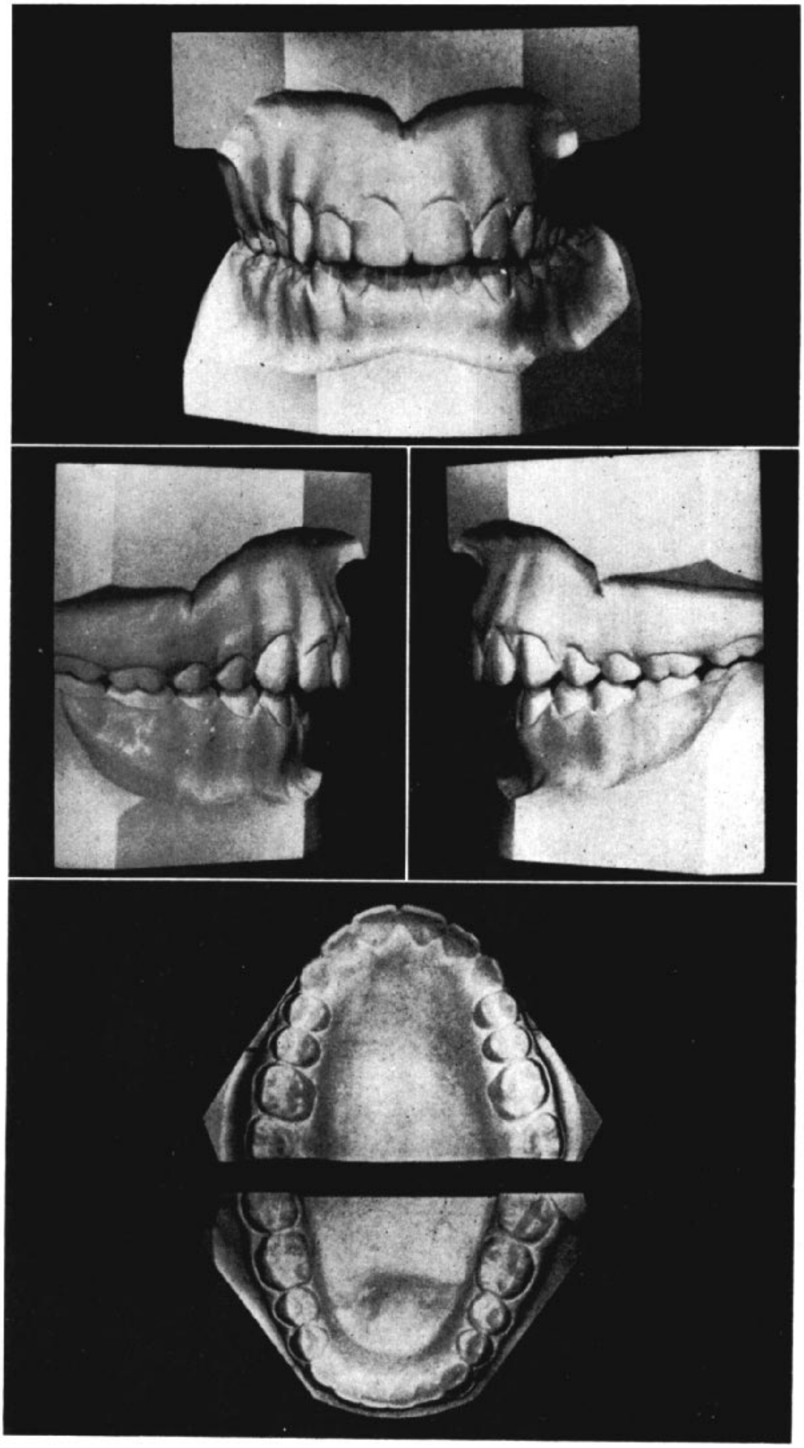

Fig. 7

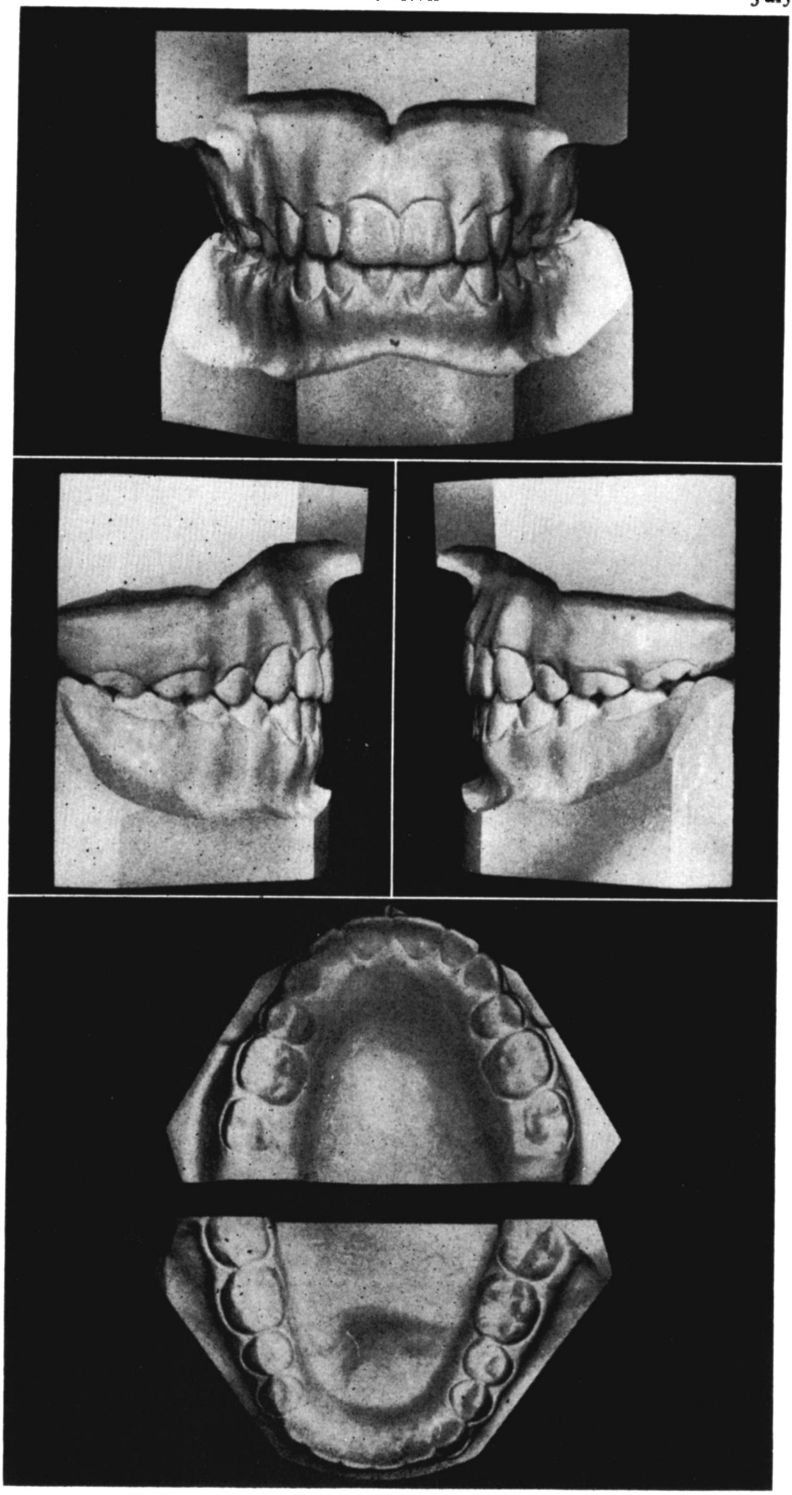

Fig. 8

Analysis of Tooth Size Discrepancies

OVERALL RATIO

Sum mandibular "12"____________mm. / Sum maxillary "12"____________mm. = ________ X 100 = ____________% Overall ratio

Mean 91.3 = 0.26
S.D. (σ) 1.91
Range 87.5 - 94.8

Max. "12"	Mand. "12"	Max. "12"	Mand. "12"	Max. "12"	Mand. "12"
85	77.6	94	85.8	103	94.0
86	78.5	95	86.7	104	95.0
87	79.4	96	87.6	105	95.9
88	80.3	97	88.6	106	96.8
89	81.3	98	89.5	107	97.8
90	82.1	99	90.4	108	98.6
91	83.1	100	91.3	109	99.5
92	84.0	101	92.2	110	100.4
93	84.9	102	93.1		

PATIENT ANALYSIS

If the overall ratio exceeds 91.3 the discrepancy is in excessive mandibular arch length. In above chart locate the patient's maxillary "12" measurement and opposite it is the correct mandibular measurement. The difference between the actual and correct mandibular measurement is the amount of excessive mandibular arch length.

____________ - ____________ = ____________
actual mand. "12" correct mand. "12" excess mand. "12"

If overall ratio is less than 91.3:

____________ - ____________ = ____________
actual max. "12" correct max. "12" excess max. "12"

ANTERIOR RATIO

Sum mandibular "6"____________mm. / Sum maxillary "6"____________mm. = ________ X 100 = ____________% Anterior ratio

Mean 77.2 = 0.22
S.D. (σ) 1.65
Range 74.5 - 80.4

Max. "6"	Mand. "6"	Max. "6"	Mand. "6"	Max. "6"	Mand. "6"
40.0	30.9	45.5	35.1	50.5	39.0
40.5	31.3	46.0	35.5	51.0	39.4
41.0	31.7	46.5	35.9	51.5	39.8
41.5	32.0	47.0	36.3	52.0	40.1
42.0	32.4	47.5	36.7	52.5	40.5
42.5	32.8	48.0	37.1	53.0	40.9
43.0	33.2	48.5	37.4	53.5	41.3
43.5	33.6	49.0	37.8	54.0	41.7
44.0	34.0	49.5	38.2	54.5	42.1
44.5	34.4	50.0	38.6	55.0	42.5
45.0	34.7				

PATIENT ANALYSIS

If anterior ratio exceeds 77.2:

____________ - ____________ = ____________
actual mand. "6" correct mand. "6" excess mand. "6"

If anterior ratio is less than 77.2:

____________ - ____________ = ____________
actual max. "6" correct max. "6" excess max. "6"

Fig. 9

that the ratio results can give one an insight as to how the setup should be approached, i.e., which teeth might most logically be extracted if such procedure is deemed necessary. It must also be pointed out that the need for the extraction of a tooth or teeth is not necessarily confined to the case where shortened arch length exists. Gross disharmonies in tooth size may indicate the removal of a dental unit or units even where there is adequate arch length. Conversely, tooth size discrepancies may be corrected by the placing of overcontoured restorations where indicated.

Figure 9 portrays a simple analysis sheet drawn up for use by the orthodontic practitioner. It has also been a part of the diagnostic procedure for every case treated in the orthodontic clinic of the University of Washington since 1953.

Mesiodistal diameter figures for all the teeth were taken from Wheeler's[6] text of dental anatomy. These dimensions were considered to be ideal for the carving and articulating of the teeth in making the perfect setup. In using his figures and computing the ratios, the results were found to be 91.4 for the overall and 77.8 for the anterior. This correlates closely with results derived from this study.

A comparison of widths of anterior segments of artificial teeth when set up (data published by the Dentists Supply Company of New York) showed that the mean of the anterior ratios for 61 moulds was 76.86.*

* These figures were based upon mathematically determined relationships.

During the search for excellent occlusions a striking example of a man-made discrepancy in tooth size was discovered. The occlusal views of the case, Figure 10 (above), demonstrate very well how the mesiodistal diameters of all the teeth comprising the maxillary buccal segments except the right first premolar have been increased by the overcontouring of restorations. Measuring casts made before and after operative dentistry and orthodontic treatment revealed that the left maxillary buccal segment (excluding second molars) had been increased in length by 2 millimeters and the right side by 1.25 millimeters. The corresponding mandibular segments had been increased in dimension also, but only a negligible amount, approximately 0.25 millimeters. Fewer restorations were present in the mandibular denture.

The effect of overcontoured restorations on occlusal relationship is best illustrated by the left lateral view shown in Figure 10 (below). The molars are in a good Class I relationship, but it is clearly demonstrated that the canine and premolar pattern of occlusion is faulty, this portion of the maxillary buccal segment being anteriorly placed in relation to the mandibular segment. This is a good illustration of how an overzealous dentist can alter tooth size to the extent that shortened arch length is the result.

Summary and Conclusions

Fifty-five excellent occlusion cases were selected and various measurements were made on the casts. These included a determination of the mesiodistal diameters of all the individual teeth, certain buccal segment measurements, as well as the degree of overbite and overjet, the angle of the maxillary central incisor to the mandibular central incisor, central incisor lengths, and cusp height. From statistical analyses of the data, the following conclusions were made:

1. The tooth size data were compared to that published by both Black and Ballard and the results of all were found to be closely related.
2. When the twelve maxillary teeth were compared with the twelve mandibular teeth in a ratio as

$$\frac{\text{Sum mandibular ``12''}}{\text{Sum maxillary ``12''}} \times 100 =$$

overall ratio, a statistically significant mean, standard deviation, and coefficient of variation were found to exist. They were 91.3 ± 0.26, 1.91, and 2.09% respectively.
3. In comparing the six maxillary anterior teeth to the six mandibular anterior teeth in a similar ratio as in 1 above,

$$\frac{\text{Sum mandibular ``6''}}{\text{Sum maxillary ``6''}} \times 100 = \text{anterior ratio}$$

equally significant findings were obtained. For a mean of 77.2 ± 0.22, the standard deviation was 1.65 with a coefficient of variation of 2.14%.

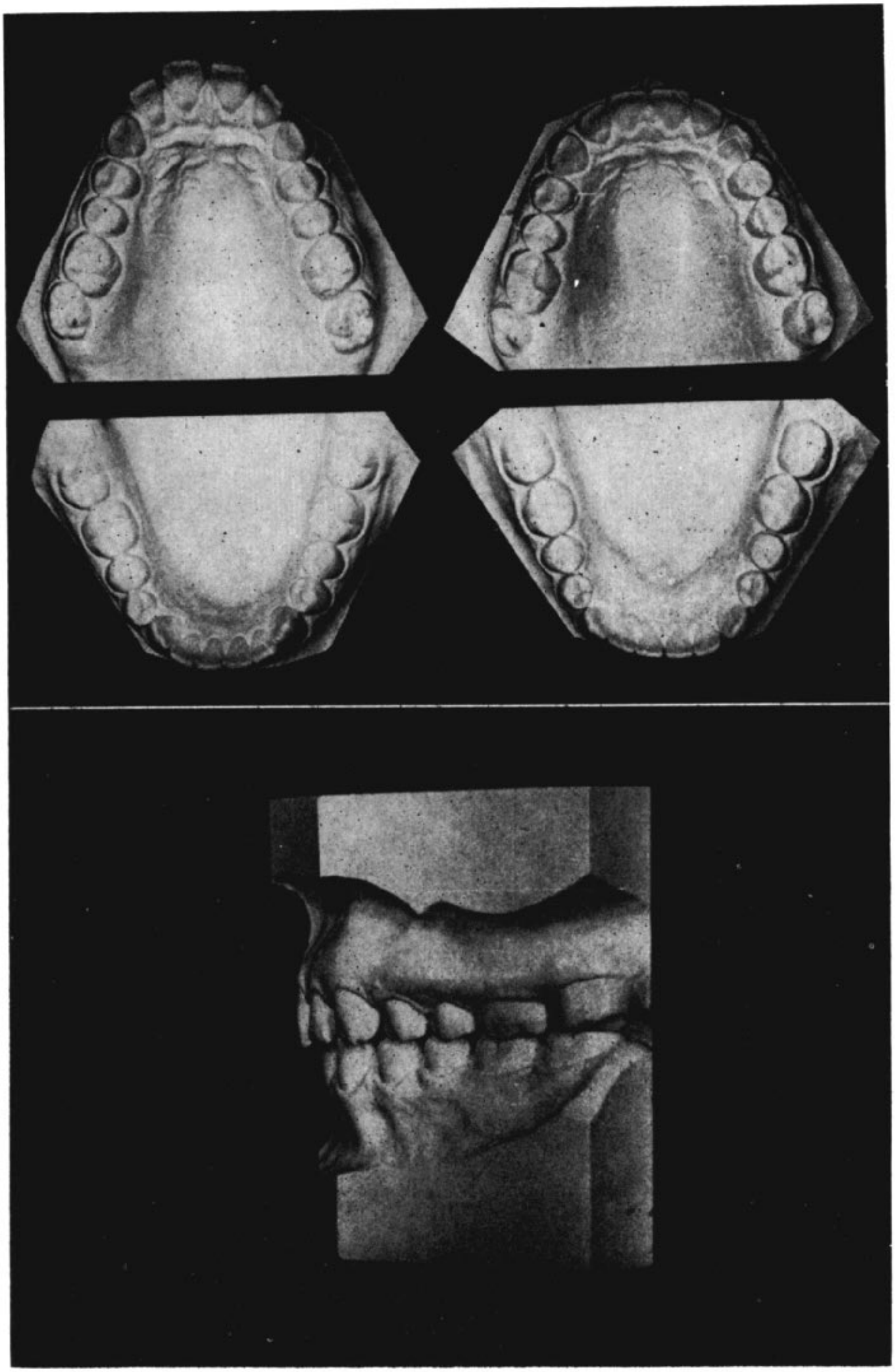

Fig. 10

4. The maxillary and mandibular buccal segments can be divided so as to give units which can be compared one with another. This procedure can be an aid in localizing tooth size disharmonies which would alter the occlusal relationships desired from orthodontic treatment.
5. The degree of overbite had a wide range of variability within this sample of excellent occlusions. The mean was 31.3% with a range of 11.8% to 53.9%. The standard deviation was 10.2 with a coefficient of variation of 32.6.
6. A significant coefficient of correlation could not be found when the degree of overbite was related to incisor length.
7. A significant coefficient of correlation could not be found when the degree of overbite was related to tooth size, via the anterior ratio.
8. Overbite was related to cusp height by the coefficient of correlation. A +0.28 indicated a very poor correlation between these two.
9. Premolar relationships were studied by analyzing the means of the mesiodistal diameters along with coefficients of correlation. The study emphasized the need for considering premolar sizes on an individual basis before the final decision is made in extraction cases.
10. A practical example of the disharmony in occlusal relationships that can be caused by increasing tooth width with over-contoured restorations has been shown.
11. The statistical evaluation given by Ballard and Wylie in the study on mixed dentition case analysis was repeated in this investigation with very similar results.
12. The clinical implication of the ratios devised has been demonstrated. It is felt that they can be one of the tools used in orthodontic diagnosis, but in the final analysis should be considered as a preliminary step to the diagnostic setup. The importance of the diagnostic setup should not be overlooked. However, the necessity for it can be determined by applying the ratios described in this study.

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