Asymmetry in Tooth Size: A Factor in the Etiology, Diagnosis and Treatment of Malocclusion

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INTRODUCTION

IF FREQUENT REPETITION in the orthodontic literature—in places too numerous to cite individually—may be taken as an indication of the thoughts of orthodontists generally, practitioners prevalently believe that the dental apparatus of man is potentially a perfect machine, harmonious in all its parts, needing only a skillful rearrangement by the orthodontist to render it functionally and esthetically perfect. This point of view is sound in its larger aspects, since the fact is demonstrated by every orthodontic case which is carried successfully to the end of active treatment, but when analyzed in minute detail it is manifestly deficient.

The inclined planes of the opposing dental arches have often been compared with a system of gears, a mechanical principle in which harmony between component parts is the first essential. When a carefuly machined set of gears runs at high speed there exists a state of "balance" which is far from static. The dental apparatus, although the articulating surfaces meet in a different fashion, also achieves this dynamic balance when all parts are harmonious in size and form; to the orthodontist the most gratifying realization of balance in the denture is a treated case which remains unaltered for a long period after the removal of retaining appliances.

Such permanent stability is infrequent, and clinical experience leads one to inquire whether some cases do not violate the first requisite of balance among component parts. If it can be shown that this prevails more often than has been realized in the past, therapeutic measures should be advanced to establish a harmony which was not attained by natural means, where the deviation is so great as to be beyond correction such a situation should be recognized in prognosticating success in treatment.

METHODS AND MATERIAL

In order to make a quantitative attack on the problem, measurements were made of 500 sets of models, drawn from three different private practices and from the Division of Orthodontics, College of Dentistry, University of California. All models were made from plaster of Paris impressions. Fine-pointed dividers were used to determine the greatest mesiodistal diameter of each permanent tooth on the models; the dimensions in millimeters were taken from a finely calibrated millimeter rule and recorded in the data. No deciduous teeth were measured. The greatest mesiodistal diameter of each tooth was compared with that for the tooth of the opposite side, and discrepancies were catalogued as follows:

a. Discrepancies between teeth of opposite sides of one-half millimeter or larger.
b. Discrepancies between teeth of opposite sides as large as one-quarter millimeter but less than one-half millimeter.

Discrepancies less than one-quarter millimeter were disregarded, since they might be attributed to errors of measurement, and in any case would not be clinically significant.

Mean mesiodistal diameters, ranges, and standard deviations were calculated on all teeth to provide an indication of tooth size and variation. These values are compared with ranges and means published by Black (Table I).

TABLE I.—MEASUREMENTS OF INDIVIDUAL TEETH

	Author's Data				Black's Data	
	Range	Mean	σ	C.V.*	Range	Mean
UPPER TEETH						
Central Incisor	5.5-11.0	8.91	0.65	7.30%	8.0-10.0	9.0
Lateral Incisor	3.5- 9.5	7.08	0.64	9.04%	5.0- 7.0	6.4
Cuspid	6.0-11.0	8.00	0.60	7.50%	7.0- 9.0	7.6
First Bicuspid	6.0- 9.5	7.27	0.50	6.88%	7.0- 8.0	7.2
Second Bicuspid	5.5-10.5	7.14	0.60	8.40%	6.0- 8.0	6.8
First Molar	8.5-13.0	10.98	0.68	6.17%	9.0-12.0	10.7
LOWER TEETH						
Central Incisor	4.5-10.0	5.67	0.48	8.46%	5.0- 6.0	5.4
Lateral Incisor	5.0- 8.5	6.28	0.48	7.63%	5.0- 6.5	5.9
Cuspid	5.5- 9.0	7.12	0.55	7.58%	5.0- 9.0	6.9
First Bicuspid	5.5- 9.0	7.36	0.52	7.06%	6.0- 8.0	6.9
Second Bicuspid	5.5-11.5	7.50	0.63	8.40%	6.5- 8.0	7.1
First Molar	7.0-13.0	11.17	0.68	6.09%	12.0-11.0	11.2

* Coefficient of variation.

Individuals which showed right-left discrepancy in mesiodistal diameters of certain teeth were further studied to discover cases which showed no discrepancy with respect to total segment length in spite of left-right discrepancies of teeth within the segment.

The distribution of the cases showing discrepancies was also made with respect to the Angle classification.

FINDINGS

That such discrepancies between teeth of opposite sides of the same dental arch are well nigh universal is demonstrated by the fact that 448 out of the 500 cases measured (90%) showed left-right discrepancy in one or more pairs of teeth (Table II). 408 of these cases showed a difference of 0.5 millimeters or more between left and right teeth. The remaining 40 cases had discrepancies greater than 0.25 millimeters but less than 0.5 millimeters.

The maxillary teeth most frequently involved were the lateral incisors and the first molars; of the mandibular teeth, the cuspids and first bicuspids.

In 448 cases with discrepancies, there were only 72 single arches which

TABLE II.—ASYMMETRY OF MESIODISTAL WIDTH IN HUMAN TEETH

	No. of teeth measured	No. cases with discrepancy	Percentage	Discrepancy 0.25-0.50 mm.	Percentage	Discrepancy of 0.50 mm. or more	Percentage
			Maxillary Teeth				
Central Incisor	999	123	12.3%	28	2.8%	95	9.5%
Lateral Incisor	972	178	18.3%	39	4.0%	139	14.3%
Cuspid	868	109	12.5%	30	3.4%	79	9.1%
First Bicuspid	914	112	12.2%	31	3.3%	81	8.8%
Second Bicuspid	871	114	13.0%	28	3.2%	86	9.8%
First Molar	988	144	14.5%	24	2.4%	120	12.1%
			Mandibular Teeth				
Central Incisor	988	100	10.1%	21	2.2%	79	7.9%
Lateral Incisor	989	117	11.8%	35	3.5%	82	8.3%
Cuspid	912	129	14.1%	25	2.7%	104	11.4%
First Bicuspid	906	154	16.9%	46	5.0%	108	11.9%
Second Bicuspid	836	97	11.6%	24	2.8%	73	8.7%
First Molar	972	129	13.2%	28	2.8%	101	10.3%

showed balance between lateral segments in spite of individual discrepancies.

The distribution according to the Angle Classification was as follows:

Class I 139 cases
Class II 104 cases
Class III 19 cases

DISCUSSION

In any structure, natural or contrived, in which component parts interdigitate in such a definite manner as do the teeth, and where the articulating surfaces are so formed that settling into positions of stability is enhanced, discrepancies of the magnitude of 0.5 millimeters cannot be ignored. It is shown here that conditions prejudicial to perfect balance of the denture are found in nine patients out of ten, and in the majority of this group the discrepancy is 0.5 millimeters or more. This means that if ideal contact point relationships are established in both arches and a highly satisfactory arch to arch relationship is achieved on one side, the other side may be thrown out by discrepancies in tooth size. Final stability can be attained only through alteration of inclined plane relationships from those considered ideal, or adjustment in arch length through rotations and slipped contacts. It is not unlikely that these changes which frequently occur when treated cases are released from retention do so because of lack of harmony in tooth material from the outset.

It should not be concluded from this demonstration of disharmony that the orthodontist should forthwith conclude that relapse is inevitable.

The judicious stripping of proximal surfaces has been practiced by orthodontists in the past, and should continue to be good practice. Where lack of harmony in tooth material lies primarily in the anterior segments, more latitude is provided in correcting lack of balance by stripping than in the buccal segments, where inclined plane relationships impose definite limitations. It should be remembered that in the mandibular anterior segment there are ten proximal surfaces which may be stripped to compensate for maxillary incisors which are deficient mesiodistally. Linn[1] has reported successful handling of tooth mass discrepancy by stripping, even citing instances of stripping to harmonize tooth size before placement of bands at the outset of treatment.

Summary

1. Careful measurement of plaster models of 500 orthodontic patients shows that in 90% of the sample there is a discrepancy in mesiodistal diameter between teeth of the left and the right side, amounting to 0.25 millimeter or more.
2. Means and standard deviations are given and compared with means published by Black.
3. Implications of this lack of harmony relation to etiology, diagnosis and treatment of malocclusion are discussed.

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Reference

1. Linn, J. A. Paper on harmony in tooth size as a factor in orthodontic treatment, read before Pacific Coast Society of Orthodontists, Southern Component, Los Angeles, March 27, 1943.