

RACE, GROWTH, AND OCCLUSION

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IT IS with considerable hesitancy and a rather marked feeling of insecurity that I embark on a discussion of so large a subject as race, growth, and occlusion. Particularly so when I realize that a synopsis written prior to the formulation of material for this essay suggested a great deal more by way of content than I am able to provide.

It is significant to note, at this point, that in the general field of human biology, whether it be medicine, dentistry, or some other discipline, the trend of thought is toward the understanding of biologic process and interrelationship rather than toward isolating simple reactions of cause and effect. And, although this attitude greatly complicates the work of the student of human biology, it is productive of more critically evaluated results, in other words, more painful perhaps, but certainly more desirable.

Dr. Hellman is one who has repeatedly, and often none too gently, emphasized the need for a fuller understanding of the biology of occlusion as contrasted to the widespread application of orthodontic stresses and strains to morphologic categories. I quote from an article written by Dr. Hellman in 1933, "One of the most incomprehensible attitudes in orthodontia is the indifference toward the need of understanding more thoroughly the relationship of mechanical skill to the fundamental problems of malocclusion of the teeth." In 1936 Dr. Hellman listed the three needs of orthodontics in the following order: (1) an understanding of the process of development, (2) an understanding of fundamental biologic processes, and (3) mechanical skill. These two citations illustrate an attitude that is becoming prevalent in the orthodontic profession.

Professor Hooton of Harvard University has been particularly interested in the development of researches that will give a fuller understanding of human biology. In an address given before a group of physicians and later published in *Science* magazine he outlined a number of researches which he believed to be basic to an understanding of the problems of medicine and dentistry. Here he took the medical and dental professions rather seriously to task by stating that physicians and dentists in general work backward from the grave and, on the whole, are little concerned with the phenomena of life until they have become definitely abnormal.

With this brief introduction let me proceed directly into some items that have come to my attention which may have significance in contributing to a further understanding of the problems relating to occlusion.

The potential influence of race and race mixture in occlusion came to my attention rather incidentally. During the process of collecting data for the

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anthropology of native and American born Armenians* I was persuaded by Dr. George R. Moore of the Orthodontic Department of the University of Michigan Dental School to include a few observations on the dentition and associated structures. Consequently a record was taken which included the following items: number of permanent teeth erupted, number of caries and fillings, number of extractions, amount of tooth wear, degree of crowding or spacing of the anterior teeth, and type of occlusion. In recording occlusion Angle's classification was followed.

Due to the fact that I was—and still am—inadequately trained to make other than the more gross observations, I was very careful to record all occlusions as normal unless the malrelations were of an unquestionable magnitude. There is little doubt that by following this procedure I probably omitted a sizable percentage of malocclusions, as I have noticed that my grading as compared to that of an orthodontist gives a considerably higher percentage of normal occlusions.

Detailed statistical analysis of the above material in conjunction with the anthropologic data revealed a number of facts which I believe to be of value to the profession of orthodontics. I shall omit a discussion of the statistical methodology used in the analysis of this material and present to you the findings.

1. There is no evidence that Armenian children have a different eruption rate of the permanent teeth than north European and American children.

2. The incidence of dental caries is 31 per cent higher in American born Armenians than it is in Armenian born Armenians. This is in spite of the fact that the latter averaged 19 years older than the former. This indicates that dental caries can be ascribed to nonracial and nonhereditary factors in this case.

3. The amount of tooth wear is considerably heavier in the Armenian born than it is in the American born Armenians. This is partly due to the greater age of the former and partly to a generally more severe diet of the Armenian born.

4. There are no essential differences in the percentages of occlusal anomalies between the native and the American born Armenians that can be ascribed to environmental conditions.

5. Malocclusions are definitely limited (8.03 per cent) in relatively homogeneous Armenoid populations.† The dental arches are absolutely large with ovoid shapes predominating. Crowding in any region is practically absent and spacings are not marked. Individual anomalies are found largely in conjunction with mutilation as a result of extraction. (Evidence of dental care other than extraction is generally lacking.)

6. Malocclusions rise to high percentages when Nordic or Mediterranean racial elements are added to the Armenoid type. These malocclusions, I believe, are to be ascribed to hereditary factors and not to other causes.

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†The term Armenoid is used here in the descriptive sense only. From the racial point of view the Armenoid type is a hybrid with two racial sources, the Iranian plateau and the Alpine stocks.

In order to clarify points 5 and 6, I shall give a brief outline of the procedure followed. I was interested in noting what effect blond admixture in Armenians had in the anthropometric measurements and indices. All persons showing blue, green, or gray in their eyes were sorted out and compared with the remainder who were entirely brown eyed. Detailed analyses of these sorts revealed that we can assign the blond traits to the Nordic race; other sortings were used to remove Mediterranean racial elements. It is significant to note that every bodily measurement and index was changed, the majority of them to a statistically valid degree. Of more importance to the orthodontist is that fact that malocclusions were in excess of 50 per cent in the Nordic-Armenoid and Mediterranean-Armenoid groups and only 8 per cent in the Armenoid group. In addition the above groups showed an excess of 27 per cent in cranial and facial asymmetries over the Armenoids. These percentage differences are of an unquestionable magnitude. Table I gives a general idea of the head and face measurements of the two parent groups and of the mixed group.

TABLE I

	NORDIC	NORDIC-ARMENOID	ARMENOID
Head length	199.47	187.20	182.90
Head breadth	152.11	157.64	158.86
Frontal minimum	106.02	108.36	107.68
Bizygomatic diameter	138.80	142.93	144.45
Bigonial diameter	107.22	109.01	110.07
Face height	123.05	129.00	128.10
Upper face height	67.80	79.75	76.60

Head length and bizygomatic diameter are intermediate to the two parent stocks. Head breadth, and bigonial diameter more closely approximate the measurements of the Armenoid. Frontal minimum diameter, face height and upper face height show heterosis and are in excess of both parent stocks. As indicated by the table, the most marked change is in the upper facial length. The malocclusions, for the most part, are Class II, Division 1 Angle. In this case it seems that the malocclusions have arisen largely as a result of maxillary overgrowth as a result of heterosis.

The same type of differences obtained in the mixtures involving Armenoid with Mediterranean. Here the mandible did not change as much, and the disproportions are, in general, much more marked. A number of studies on race mixture have indicated that disproportionate facial changes are common, particularly in the facial lengths. Nansen (*Armenia and the Near East*, p. 237), for example, states, "The chin is generally weak with the profile receding in a line from the upper lip downward." He is undoubtedly referring to a type that is mixed Nordic-Armenoid as my data from the same regions show. Von Luschan (*Peoples of Western Asia*) describes another type of "weak-chinned" Armenians. Here I believe the type is largely a mixture of Mediterranean and Armenoid. Other data, collected by Dr. Moore and myself, and as yet only superficially analyzed, indicate that hybrids of parents that show widely divergent head and face types, have markedly higher percentages of malocclusions than do those whose parents are similar in head and face form.

At any rate the general nature of what evidence I can gather is, that in the crossing of divergent races many irregularities and disproportions are likely to be produced of which malocclusions are part.

GROWTH

Up to this point I have emphasized the hereditary nature of a few facial and dental factors associated with the hybridization of different racial groups. I have also indicated the necessity for further study in individual inheritance. For a few minutes I should like to deal with another aspect of biologic process, namely, growth, or development from birth to maturity. It hardly seems necessary to point to the vast importance of growth as a phenomenon that immediately concerns every orthodontist. A considerable portion of orthodontic work is done upon the organism when it is in a period of rapid change.

Many workers have shown that different parts of the body grow at different rates and that accelerations and retardations of various parts occur at different times. Consequently disharmonies and asymmetries are frequently coincident with a fully normal biologic process. The dentofacial complex is one of the regions particularly susceptible to variable growth rates of its several parts. In addition it is highly functional and rather easily changed by external modifying forces. Evidently then an understanding of the nature of change due to growth and its modifying factors should be vitally important to the profession.

A great deal of work has been done on growth, and the literature on the subject is extensive. But extensive as the published material is, it is still very difficult to find satisfactory accounts of the nature of the developmental process. Many studies involving large samples have been made, and norms have been computed to show the average growth trends in a large number of circumstances. Other statistical constants, such as the standard deviation and the coefficient of variability, have been computed to show the general nature of the population under consideration. Regression constants have been utilized to show intensiveness of associational items. In short, the science of biometrics has brought to bear a great many techniques to enable us to appreciate more fully the meaning contained in mass data. All this information is very helpful and has greatly increased the scope of knowledge in most branches of biology. Useful as biometrics may be as a tool, it cannot compensate for omissions in the material with which it works. The shortcomings of mass averages, measures of dispersion and associations are glaringly evident in the field of growth; the data are accumulating which indicate that mass statistics tend to obscure rather than to clarify the problems of growth. The reason is rather obvious; cross-section constants, such as the mean, the standard deviation, and the coefficient of variability, condense individual variates to points. The connecting of these points at different age levels gives norms which are supposed to represent the process of growth. Lest my discussion become too obscure let me illustrate my point: suppose that we found the stature of a child ten years of age to be 55" and we wanted to know what this meant in terms of growth. We could refer to height tables and note whether the child was on the norm, or above, or below. We could compare him with the average population and

say he was short, medium, or tall as compared to other children ten years of age. What we could not say is what this means in terms of growth. We do not know the rate of growth, the present status as part of a growth phenomenon, or the future probabilities as an adult.

I shall not take any more time to discuss this proposition further. The point I am trying to bring out is that in order to understand continuity one must have records of continuity.

Many factors affect growth. Heredity is probably the most important. Data are accumulating to show that the maximum achievement of an organism is dictated by hereditary equipment and to indicate that even under stress there is a definite attempt on the part of the organism to achieve this maximum. This may account, in part, for the failure of certain malocclusions to respond to treatment, or if they have responded temporarily to revert to their original condition. At least one prominent anthropologist has gone so far as to say that *all malocclusions are hereditary*; there are many others who are inclined to agree with him. I cannot support his contention. An examination of 500 underprivileged and for the most part undernourished children this last summer showed not only a marked retardation in average growth, both mental and physical, but also a much higher incidence of malocclusion and dental caries than did a well-nourished group from approximately the same racial stock. I am of the opinion that many of the malrelations were due to habits, such as thumb-sucking, which had been continued over a long period of time. I would also suggest that many of the malocclusions observed were ascribable to inter-relationships between poor nutrition, retarded growth, and habit, rather than to inheritance. At any rate treatment in many of the cases would have involved dietetics and psychology as well as orthodontics.

The evaluation of status of growth is essential. Here it is necessary to use a number of techniques. The measuring of growth with a chronological yardstick is conducive to many gross inaccuracies. Growth rates of individuals vary considerably; some accomplish maturity more rapidly than others. Hereditary backgrounds and external modifying forces are different and mature individual A is different than mature individual B. For workers dealing with growth it is much more important to know how the individual has developed and how far he is going to develop than it is to know how much time has elapsed since parturition, or where he stands with reference to an average. Let me give some examples of this: one can predict the score on a mental examination more accurately by knowing the number of erupted permanent teeth than he can by knowing the date of birth of a child. The reason is clear; the former measures status of maturity and the latter elapsed time. Another interesting demonstration of this same point—on a group of reading tests administered to children of approximately the same chronological age those having the low scores were also the ones who had fewer permanent teeth erupted, lower statures, smaller weights, and retarded carpal ossification.

Orthodontic procedure then should utilize a number of techniques to ascertain rate of growth and status of development rather than to depend upon chronological age.

In concluding let me briefly summarize the points that I have brought up in this brief and general discussion of race growth and occlusion.

1. Relatively homogeneous racial stocks tend to have a low incidence of malocclusion.

2. The crossing of races with widely divergent face and head types tends to result in disharmonies and asymmetries and a higher incidence of occlusal anomalies.

3. If the proposition is true for races, it should hold for individuals, since racial heredity is but a statistical generalization of individual heredity.

4. Hereditary factors place the limits that the organism will achieve, and even under adverse conditions there is a definite attempt on the part of the organism to achieve this hereditary maximum.

5. Extra germ plasmic factors as nutrition, injury, and habits can and very frequently do prevent the organism from achieving that status it would were it not for these external forces.

6. Severe or long-lasting forces can produce permanent defects. These defects will not be transmitted but will seriously affect the individual.

7. Growth is a biologic process and during the process of maturation there are many disharmonies due to unequal growth rates of different parts.

8. Growth as a process must be studied from continuous records. Cross-sectional sampling methods tend to obscure rather than to clarify the nature of growth phenomena.

9. Growth should be measured as a percentage-maturity accomplishment rather than as a regular chronological phenomenon.

10. A more complete and a more accurate understanding of human heredity, individual and racial, and of growth is basic to orthodontics or to any other profession dealing with children.

Finally let me say that the conclusions presented in this paper are tentative. The data upon which they are based are very limited in many places. I present them at this time as problems for consideration and discussion; not as authoritative laws.