

Malocclusion - Malady or Malformation?*

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THE AVERAGE orthodontist spends his first few years wondering where he is going to get some patients to treat, his remaining years wondering how he is going to retain those he has started, and all his years wondering why the whole thing ever came about. "How it all came about" is called etiology.

Generally speaking, the first explanations for malocclusion advanced were based on the straightforward reasoning that if a fellow called an orthodontist who can push teeth into positions where he wants them, perhaps they were pushed into their original positions in the first place. Thus we have several so-called etiological factors based on local pressures exerted either in waking or sleeping hours. Some orthodontists were content to accept these local factors as explanations for almost all cases, with the implication that the difficulty was the child's own doings, or if not his, then his mother's or the pediatrician's. Other orthodontists, however, faced the fact that some children might spend their formative years flat on their backs in bed without their hands ever straying north of the clavicle and still fail to attain that anatomical rarity, normal occlusion. Their orderly minds demanded that this, too, be explained.

It could hardly be claimed that valiant attempts have not been made to satisfy this demand; textbooks and a multiplicity of articles in the orthodontic literature have supplied a variety of theories as to the cause of malocclusion. If it was not always possible to present proof, usually cases could be submitted which might be considered as instances of the etiological agent under discussion. For many readers these were proof enough.

Not so long ago every case report included a statement seldom qualified by such signposts of doubt as "probably" or "perhaps" as to the etiology of the malocclusion. Today we are less certain, but there remains the underlying assumption that "nature" intends that all be well and that we are merely slack-witted for not having found out why she was thwarted. This, I am afraid, represents an attitude towards biology which was rejected long ago by most professional biologists, and we may reflect upon the role of two men in creating this attitude or philosophy towards the natural world about us.

Jean Jacques Rousseau lived in France in a period which would correspond to colonial days in America, and his influence upon the thinking of his fellow citizens was sufficiently strong that he may be considered one of the forces behind the French Revolution. He is the spiritual father of all those who blame a considerable proportion of a man's ailments upon

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the modern way of life: soft food, lack of use of the denture, and over-refined foodstuffs. One should not suppose that Rousseau was preoccupied with this sort of thing, for he was not; he was interested in moral degeneration rather than physical and he spoke of the "noble savage" with the same reverence that one finds in the dentist who has discovered that dental caries is related to cream puffs and soft drinks, and wants therefore to blame everything else evil upon the admitted artificialities of our life. Rousseau's standing as a scientist need not concern us, for he had none. Because, however, his attitude are mirrored in the orthodontic literature again and again we must appraise them for what they are worth; and when we do, we find they consist mostly of sentimentality. Now sentimentality is a good thing, so long as it has us remember wedding anniversaries and the like; but its place is in the home, and the man who seeks to let it guide him in the world of affairs is courting financial and professional bankruptcy.

Another thinker to whom the popular attitude owes spiritual allegiance is Herbert Spencer, whose life spanned the years of nineteenth century optimism. It was his privilege to participate in the formulation of the doctrine of evolution, and it was he who provided the phrase "the survival of the fittest." He preached the doctrine of progress and optimism; and we may trace indirectly to him the idea that research must always lead to a better way of doing things, a notion which strangely overlooks that fact that research may well discover that the job cannot be done at all. He believed that the course of evolution was not aimless, but on the contrary directed towards a goal which is better than that which existed before. He also believed in the now thoroughly discredited doctrine that characteristics acquired during one individual's life-time may be transmitted to his offspring, and he believed that function played a large part in determining form. Perhaps the most difficult view of all to swallow was his contention that man is the acme of the evolutionary process.

The attitude referred to may be summarized as follows: some believe that "Nature" specifically intends that every child arrive at a state of physical perfection, particularly in the region of the face and jaws. Mind you, I do not assert that nature intends the opposite; I am simply saying that nature "intends" nothing at all, and never has. The attitude inherent in so many of our treatises on etiology lays stress almost exclusively upon post-natal events, and embodies the tacit assumption that every infant sets out at birth, like a little boy on the first day of school, with a clean slate and an even start with his confreres. The contrary idea that an individual may start out with a very low potential seems largely to be overlooked, for our literature shows that there are always efforts made to find the causes for things we do not like in events which occur in infancy and childhood: local factors, conditions of civilized living, and interruptions in growth. There is also the assumption that these dento-facial anomalies might be prevented had we discovered their causes.

It is apparent that we have borrowed two words from our medical brethren, "normal" and "etiology", without realizing that the connotations we give those words are quite different from those of the physician. Think a moment of the smallest man on the local football squad; picture his stature, and compare it with that of the largest member of the team.

Which one of the players is normal, or is either of them abnormal? The answer is obvious: both are normal, although one is considerably below average in stature, and the other much above. Yet if the smaller of the two were to have a blood sugar level as much below the average value as his stature is below average, he would be gravely ill; and a comparable departure from average would make a diabetic out of the big man. We see here the difference between morphology and metabolism: one deals with the shape of an individual and is characterized by a wider range of normal variations, while the other concerns the bio-chemical process of keeping alive. Almost entirely the orthodontist is an applied morphologist; he is confronted with variations in physical constitution, and he does what he can to modify them in a favorable direction. By and large, the physician deals with metabolism, and his rigid standards of normality work and are reasonable because limits of variability in metabolism are narrow when compared with those in morphology. We cannot create a set of our own standards to fit our problem and fashion them after his. If we are to understand the biologic basis of orthodontia, we must grasp the fundamental difference which we may facetiously state as follows: The difference between the *Shape You Are* and the *Shape You're In*.

Cephalometric studies show how the component parts of the face may vary in size, and how the effect of one disharmonious area may be cancelled out by another variation in some other part of the face, or more unfortunately, how two extremes may reinforce one another to make an unusually severe cranio-facial pattern and one difficult to treat. It is probable that every face, however "normal" it may seem even to the skilled observer, has one or more features about it which, when subjected to measurement, would seem not to belong with other dimensions obtained in the same individual. These random variations give individual character to human faces, and the most ardent advocates of rigid standards of sameness in facial "normality" would perhaps be sorely disappointed if they could see their criteria universally applied.

If latitude in morphological variation must be allowed, what of "etiology"? It is fruitless to talk of the etiologic factors involved in the difference in stature just cited, and no one expects that it be explained, for we complacently accept 20% variation in stature. Yet when we observe variation in the dento-facial area, we demand that it be explained; and at one time it was commonly said that no orthodontist should start treatment until he had definitely determined the etiology. The term "etiology" usually implies that the cause is discoverable in conditions arising after birth, yet if the basis of malocclusion is present at birth, to talk of etiology in this ordinary sense is pointless, and "preventive orthodontics" is a mirage.

What are the facts? Orthodontia is morphology, and morphology consists of relationships. Let us consider other relationships in the human body, and see how often perfect balance is achieved.

Sheldon¹ has provided a logical classification of body-types whereby we may describe constitutional differences in numerical terms. Part of his classification deals with dysplasia, which is the illogical inclusion of parts not well matched up with the rest of the body. That is, in a person predominantly long and lean there might be a part of the body given,

strangely enough, to soft roundness. It is very significant that Sheldon found more dysplasia in the head and neck areas than in any others which he studied.

Fairly well known are the interesting experiments of Stockard² and the really startling offspring which he produced by crossing diverse types of dogs. A less publicized aspect of his study deserves some consideration. You will remember that he started out with the aristocrats of dogdom, animals whose ancestry was unsullied, and next to whom the average human is a genealogical upstart. Before bringing about the canine misalliances for which the experiment is known, he made a careful study of measurements of skulls of pure-bred dogs. He found that even in dogs selectively bred for perfect physical types there was no particular harmony in the component parts of the underlying bony structure. No one would be surprised if he found such disharmony in the cross-bred dogs, but these skulls were taken from show-ring candidates, comparable with the boys and girls who win the annual 4-H prize at the county fairs.

Hellman³ worked with no less than a group of normal occlusions, and found even in them that one dimension of facial breadth could be well above a group average, while another close by could be considerably less than average. In short, facial dimensions behave quite independently of one another, and almost anything within limits may be matched up with anything else.

Wylie's study of siblings and their parents showed that one could not, knowing the proportions of one part of the face, predict even roughly the proportions of some part adjacent.⁴

A fact not generally known is that J. Leon Williams⁵ rejected in no uncertain terms the belief that tooth form and face form are harmoniously integrated with one another in humans. Perversely enough, the dental supply houses have chosen to convey exactly the opposite idea in connection with Williams' name. Other examples could be cited, but these will undoubtedly suffice to establish that there is lack of harmony between the various facial parts. A skeptic will note, however, that the possibility has not been eliminated that these discrepancies arose because of post-natal misadventures. This objection is not too difficult to dispose of, and I should like now to bring before you some very well established facts and to point out the interpretations to be drawn from them and show how they compel us to revise older beliefs.

Fact number 1. *The morphogenetic pattern of the human face is laid down at birth and thereafter does not change.* The point to be drawn from this work by Brodie⁶ is that we are compelled to re-evaluate critically some of the time-honored concepts of the etiology of malocclusion. No longer can we entertain the notion that some misadventure befalling the child during his growing years produced the disharmony in facial pattern which provides the real basis for the malocclusion. We are obliged to find new explanations for all cranio-facial anomalies which are essentially disproportions between facial parts. They are legion, and specifically involve Class II, Class III, closed bites, and many open bites. No exception is the deplorable facial pattern in which the Frankfort-mandibular-Plane-Angle is relatively large. These are not growth discrepancies, if we define

growth as increases in size taking place after birth. It must be clear that if the facial proportions are, at the end of the journey which we call growth, the same as they were at the beginning of that troublesome trip, then unfortunate consequences which befall the individual along the way could only modify the size of the face by diminishing its rate of growth without alteration of proportion. This constancy of facial pattern is known to apply as much to abnormal facial types as it does to the normal. Such positive knowledge has made it possible for us to reject many of the supposed etiological factors we adhered to, not only the far-fetched but some logically sounding ones as well.*

Fact number 2. *Malocclusion is primarily a morphological problem, and it demands that the orthodontist create the most harmonious set of relationships possible out of conditions which were originally disharmonious.* In elaborating this point, I like the term previously introduced, "dysplasia". Let us consider the relationships which the orthodontist must bring into harmony, and the possible dysplasias.

A. The relationship of the teeth of one arch, maxillary or mandibular, to one another.

Taken one arch at a time, dysplasias are not so obvious; measurements have shown⁷ that the teeth of one side do not match their mates of the opposite side in mesiodistal width, and that real symmetry is found in less than ten per cent of patients. This is perhaps not a practical problem when one arch alone is considered, except in cases where maxillary laterals are missing or grossly unequal in size, but unfortunately we cannot take one arch at a time if we are to look at it practically.

B. The relationship between the teeth of one arch and those of the other.

These discrepancies in mesiodistal width which we acknowledged above rise up to plague us when we take both arches in occlusion; we seek to get the sort of interdigitation which has inspired the comparison of dental occlusion to a set of gears, and we find the gears mismated. An obvious mismating is any case in which mandibular second premolars are congenitally absent, but the less obvious ones are to be reckoned with, and in my opinion provide a partial explanation of relapse. Once members of the profession who have studied occlusion in detailed fashion again statistics could be cited to show dysplasia between maxillary and mandibular dental arches, but I prefer the evidence produced by Nature creates a set of dental parts which were, like Man and Wife, made in Heaven to go with one another, let him dissect the tooth from models and set them up as in a prosthetic set-up. He will soon learn that he has a different situation from the one in which he buys a set of porcelain teeth at the supply house, all molded to drop into working harmony with one another. Granted that he may get a good Centric; let him then mount the case on an articulator and "go through the bites".

*This is as good a point as any to indicate that I neither discard nor take lightly the many obvious environmental factors such as habits which lead to malocclusion. They are, however, superimposed upon the basic facial pattern of the child's face; and without a good facial pattern, good occlusion and facial balance and occlusion cannot be achieved, even in the complete absence of habits, etc., etc.

C. The relationship between the mandibular bony base and the maxillary bony base.

Here we have the essential basis of Class II and Class III. Either base can be too large, too small, or middle-sized. What constitutes "too large" or "too small" depends mainly upon the size of the other, and the absolute size of one base or the other has little significance except when considered in terms of the other. The devilish part of this concept — relating one base to the other — is that it is influenced by other relationships: the accommodation Class III, which has made possible so many successful case reports of this class of malocclusion, is an example of the relationship between maxillary and mandibular teeth governing the relationship between maxillary and mandibular bases. On the other hand, Thompson⁹ has shown that teeth can deflect a mandible into Class II occlusion, when the true relationship between bases is Class I.

D. The relationship between the mandibular dental arch and the mandibular base, and the relationship between the maxillary arch and the maxillary base.

This is a hotly debated issue, and one which will never be settled with agreement all around, involving as it does esthetic judgments which are purely subjective.

This listing can be concluded by mentioning the relationship between the facial profile and all the other factors enumerated above. It would seem that in the face, almost anything can be paired off with anything else. It is as if the face were made on an assembly line, with bins full of component parts from which the total face is assembled. The parts in each box, unlike those in the assembly line in Detroit, are not of the same size, and no one knows just what is going to be paired off with some other part, nor how well they go together. We know that these random-sized parts get into the boxes; what we are not sure of is who put them there. An increasing number of us are inclining to the belief that the chromosomes did.

What then, is malocclusion? A view which has not been considered seriously enough, and one which has an abundance of evidence in its favor, is that the majority of our problems arise through the chance combination of component parts of the face in such a way that a truly harmonious relationship between them is the exception rather than the rule. The mechanical interdigitation of human teeth is sufficiently complex that disproportion between parts which support the teeth is immediately made evident by derangement of this mechanical relationship. Although such dysplasia occurs in other parts of the body, it goes unnoticed because no complex set of gears is thrown out of kilter by that dysplasia.

Let us think a little more about those gears. They are not very good gears, for as said before, the teeth of one side are not equal in size to those of the other, and the mesiodistal widths of the lower incisors are correlated with the widths of the cuspids and bicuspid to about the same extent that height and weight are correlated in adult males.¹⁰ We would rightfully expect more than that from an apprentice machinist. We have often been called upon to admire the dental "gears" of the animals. Why is it that malocclusion is less frequently encountered in the allegedly lower animals? Would this not offer a serious objection to my earlier contention that facial dysplasias occur, for instance, in dogs? That objection is not

too difficult to dispose of. In the first place, Class II and Class III malocclusions do occur in dogs — and I cannot resist pointing out that when they do occur, the role of inheritance is not difficult to demonstrate. What about Class I malocclusions? The most perfunctory study of comparative dental anatomy shows that Class I is almost exclusively a human problem, because in matters of arch length — and all Class I malocclusions are problems in arch lengths — the standards of normal occlusion in man are unique. In every other species there are spaces distributed normally throughout the arches. Although the cheek teeth of herbivores are virtually solid blocks, there is a generous gap between them and the anterior segment. In the dog, there is a space between every two teeth. These spaces serve as adjustment areas into which teeth may shift, thereby obscuring discrepancies between supporting bases. Under such conditions it is safe to say that discrepancies between tooth mass and supporting bases will seldom be encountered. Our standards for normal occlusion in man, on the other hand, demand that there be no rotations or other manifestations of deficiency in arch lengths, and no spaces nor even loose contacts to allow for variation in the other direction.

It must be evident from this that the standards for normal occlusion in man are higher than they are for any other form, and therefore that much more difficult to realize. In the matter of arch length, the limits of normal variation are exactly zero. I hope no one will interpret this as a plea for relaxing these standards; I yield to no one in my enthusiasm for the most idealistic standards in orthodontic treatment. Occasionally it is demonstrated that it can be done, and I hope we will keep on driving ourselves until we can realize our most ambitious hopes in every patient.

Orthodontia requires sober reflection upon the limitations imposed upon even the best among us, and at the same time demands that we do the best we can within those limitations. As architects of the human face we should give up the vain search for what "nature" intended and face the fact that nature has no intentions at all. Let us instead study more thoroughly and define more clearly what we intend to do with the facial pattern. I believe that this trend is already under way among clinical orthodontists, with the showing of treated results in greater number and with a reduction of emphasis on one or two hand-picked cases. Treatment planning, sometimes called diagnosis, will increase in effectiveness as orthodontists build treatment planning more around their concept of what they think treatment can accomplish and less around what they fancy was originally the cause of the malocclusion.

Those individuals fortunate enough to have facilities for laboratory research should describe fairly exhaustively the nature, location and extent of these variations wherever routine clinical records cannot supply that information. They should furthermore coordinate these studies with investigations of the results of clinical treatment to discover, if possible, whether one mode of treatment serves any better than others in the treatment of particular disharmonious combinations. A more fundamental sort of investigation should take us into the study of embryology, since this science deals with the period when such disharmonies obviously arise.*

*It should be remembered that Brodie's demonstration of the behavior of facial pattern, while it discredits some older concepts of the etiology of malocclusion, does not leave us with nothing but inheritance to consider. Unfavorable facial pattern of non-genetic origin may be well established in intra-uterine life.

Furthermore, the terribly complex subject of human inheritance should receive further study by people thoroughly familiar with the dento-facial area. An important step in that direction will be taken when orthodontists admit that inheritance is a factor in the problems with which they deal. There is a reluctance on the part of some orthodontists to face the fact that inheritance has any part in the picture, because they feel that such an admission means that nothing can be done about our problem. On the other hand, there is a tendency on the part of others to seize upon inheritance as an alibi for failure. These two attitudes are essentially the same, and both should be dismissed emphatically. There is no reason whatever to believe that inherited conditions cannot be modified permanently and effectively through therapy; in fact, there is abundant evidence to the contrary.

Orthodontia should be approached in a biological frame of reference, but the search should be made not as a search for a pancea but as one for a clear understanding and description of the problems with which we deal.

The title of this paper was put in the form of a question: Is malocclusion malady or malformation? I have sought to show you that orthodontists have been prone to think of malocclusion as a malady, a sickness, with a specific etiological background for each of the ramifications of malocclusion. I believe this to be a misconception, and one which should be challenged.

To tell the truth, I do not like much better the second alternative given in the title — the implication that malocclusion is really a malformation. It comes closer, because it implies morphological deviation from the average, rather than metabolic departure from normal, but in my opinion it still misses the truth. I see malocclusion as disproportion between facial parts — parts which in themselves may be within the limits of normal variation, but which are disproportionate when combined with other facial structures and lead therefore to a disproportionate whole. A common disproportion which is presently recognized, not to say debated hotly, is the disproportion between tooth mass and bony support. Because this is not the only disproportion with which we deal, we cannot expect extraction to solve all the orthodontic problems.

I submit for your consideration, then, a proposition that is not breathtaking in its originality, but one which has received little consideration in the past. The hypothesis is that nature has combined the parts of the face in a random fashion, with little regard for how well they go together, and that the efforts of orthodontists will be better rewarded if they are directed towards working out the best clinical procedures for dealing with accepted disproportions than if they are expended on speculation as to why disproportion is encountered in the face of man, when in truth infinite variety is a fundamental fact of nature.

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