

## SOME POINTS OF COMMON INTEREST TO THE RHINOLOGIST AND THE ORTHODONTIST.\*

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THE SUBJECT of palatal and maxillary deformity has been discussed *ad nauseam* in rhinological circles, and we have long recognized that there are a few cases in which the removal of adenoids fails to cure the patient of the mouth-breathing habit. Of these patients a small number remain mouth-breathers from sheer inertia of habit, but by far the greatest number do so because of the malocclusion of the teeth which results from a deformed palate. This fact, as I have said, has long been admitted by the rhinologist. But it is only of late years that we have begun to learn from the orthodontist that this hitherto impregnable rock of pathology can be remoulded nearer to a normal shape in such wise as to restore the power of breathing through the nose with the lips closed; an advance in therapeutics which, in this country [England] at least, is not yet so widely known as it ought to be either by medical men or by the laity. We have learned that the inability to close the mouth is due either to the protrusion of the upper central incisors from an abnormally long alveolar process, relative to the upper lip, or to malocclusion of the first permanent molars, or to both factors combined. And as these abnormalities are due in turn to narrowing of the bony palate and crowding of the teeth, my first remarks will be addressed to the theories which seek to explain the origin of the narrow palate. In the second place, I propose to direct your attention, as orthodontists, to some of the later nasal effects of the narrow palate. And, in the third place, I shall conclude with a glance at the question of treatment from the rhinologists point of view.

Firstly, with regard to the mechanism which produces narrowing of the palate. Nearly four years ago, in a paper read before the British Society for the Study of Orthodontia, I reviewed and criticized several of the theories then held to account for the abnormality. The first of the theories discussed was that the deformity of the palate is due to the compression exercised by the facial muscles and the soft tissues of the cheeks upon the alveolar process, as a result of which the broadening of the palate is hindered or prevented, while the premaxillary segment, along with the teeth it bears, pushes forward in the direction of least resistance.

The objections to this theory are, first, that the pressure exercised by the soft parts of the face upon the maxillæ must be extremely slight even in mouth-breathers, since for purposes of respiration the mouth opens but a very little way. And it is also worthy of note, that in the attitude of rest, when the muscular tension is at its lowest grade, the teeth of the lower jaw lie, not in contact with the teeth of the upper jaw, but separated from them by a distance of several millimeters. That is to say, that the position of

\*Read before the European Orthodontia Society, London, 1913.

lowest muscular stress and pressure is with the mouth slightly open. It must also be remembered that the open mouth is habitual in play.

On the other hand, the weight of these objections is reduced when we remember, with regard to the slightness of this pressure, that even the most delicate pressure if it is frequently repeated or, still more, if it is continuous, is capable of effecting great alterations in the shape and disposition of bone. Secondly, that the pull and drag are greater when the patient is asleep and snoring. Further in support of this theory we may cite the following circumstances.

I am sure it must often have struck you that the narrow palate, the projecting upper incisors, and the whole configuration of what I have termed the rodent face, represent the perpetuation and fixation in the bony skeleton of the facial attitude assumed by children who are suffering from nasal obstruction. An habitual attitude becomes stereotyped and fixed by an alteration in the shape of the bones. Indeed, after the faulty eruption of the teeth the habitual attitude is not only fixed but exaggerated and even caricatured; with this aspect of the subject we deal later.

In this respect, then, the narrow palate and the rodent face are deformities, the development of which recalls those osseous malformations of the trunk and limbs which are the result of the adoption and maintenance of improper attitudes.

We sometimes hear people speaking as if the bone of the maxillæ may be of a peculiar and exceptional type, liable to different pathological changes from those of other bones, and plastic and malleable in a manner not characteristic of osseous tissue elsewhere in the body. Such is not the case. Bone is everywhere plastic, and everywhere responds to alterations of strain, stress and tension.

The conformation of the bones of the skeleton is everywhere the resultant of three forces—gravity, the action of growth, and the action of the muscles.

A normal balance of these forces induces a normally-shaped bone. But deformity ensues if any one of the three forces is relatively weaker than the others, as in the case of flat-foot, knock-knee, etc. For example, it is the weakness and lack of balance in the muscular forces together with the relatively overpowerful action of gravity which compels the patient to adopt an exaggerated attitude of rest, and when this attitude is stereotyped in bony structure, then we get the permanent deformity. That is to say, the position favored and adopted by the muscles, ligaments and other soft structures, is copied after a time by the bones which alter their shape in order to do so.

It is the same with the jaws, in the first instance at all events—although, of course, the role played by gravity in the production of their deformities is one of no importance. It is impossible to doubt that the pull of the cheeks and soft parts, when the mouth is open, does not play some part in the production of the narrow palate. Their action is however very delicate and is probably only passive; because, as orthodontists have shown us, if the forces making for normal expansion in the jaws are reenforced, then the resistance of these soft parts count for nothing. As it is, however, in these cases, if they are left to nature all the forces acting on the jaws unite and harmonize,

not to mould the jaws to the normal shape but to aggravate and to perpetuate an already existing deformity.

There is another and a more serious objection to the presumption of the action of the soft parts, and to it I refer below.

The second theory which I debated in my former paper was that which refers to the normal shape of the adult superior maxilla and to the preponderating influence of the tongue. This organ, which normally occupies the vault of the palate and by its long continued pressure moulds that arch, is withdrawn from the palate when the mouth is used for breathing. The expanding force being thus withdrawn, the jaws remain narrow. In support of this theory may be cited the fact that in certain slow-growing tumors of the mouth and in the condition known as macroglossia, extraordinary enlargement and widening of the palatal and mandibular arches frequently appears.

Both with regard to this theory and to the previous one, there is one circumstance which constitutes a most serious difficulty in the way of our accepting either of them alone, or both of them together for that matter, as the invariable cause of narrowing of the palate. This circumstance is that the Gothic palate is sometimes found in people in whom mouth-breathing seems never to have been present. It is true that only a very small proportion of cases give such a history. It is also true that to rely, as we must, upon the patients own personal recollections in order to establish the presence or absence of early mouth-breathing, is to lay oneself open to be deceived. Thus there is quite a good *priori* objection to admitting the existence of such a circumstance as the narrow palate in people who have always breathed normally. At the same time the evidence in its favor is, I believe, so strong that a theory which has to ignore or deny the existence of this fact is so much the weaker, in my opinion.

Now, the existence of this fact (if fact it be) proves that for the production of the narrow palate some cause other than the compressive action of the soft parts, and other than the expanding action of the tongue, and other than both of these actions taken together, must at times be present. Is there a third explanation which will account for the narrowing of the palate? I believe that there is, and this explanation is that, namely, which ascribes the deformity not so much to improper respiration as to an absence or deficiency of normal mastication. Moreover, as I hope to show, it is possible to assign to this factor a predominating position in the group of causative factors and to see it in operation both in nose-breathers and in mouth-breathers. As this factor of mastication appears to be of much importance I will allude to it at some length.

The theory may be enunciated as follows: The development of the maxillæ and palate is conditioned in response to pressure stimuli of strain and stress imparted to the bone by the teeth in the act of mastication.

In general terms we speak of two types of maxillæ, the broad and the narrow, the broad being the normal.

In the healthy individual, efficient mastication during the period of the milk teeth leads to an arrangement of the teeth of the upper jaw relative to those of the lower, in such wise, as Noyes, quoting Angle, says, that "the buc-

cal cusps of the lower teeth are locked between the cusps of the upper so that in the lateral grinding movements the buccal slopes of the uppers exert a powerful influence in widening and rounding the arch." In other words, the pressure of the lower teeth tends to force the upper teeth in an outward direction, and in response to this stimulus, the upper jaw and palate broaden out. The theory may be more clearly expressed thus: the width of the jaws depends upon and is proportionate to the amount of mastication.

Response on the part of bone to stimuli of this nature is common, as Arbuthnot Lane has pointed out, in the other bones of the skeleton. Indeed, so frequently is this response, that the writer lays down several rules or laws which may be thus summarized: that pressure and strain produce changes in the form and function of joints, and even that they produce new joints. Further, he goes on to say "the normal form of the skeleton and the soft parts depend upon a normal combination of attitudes of activity with attitudes of rest," preponderance of either one of these resulting in deformity. Lane describes and depicts many examples illustrating these generalizations—great and curious alterations in the structure and disposition of bones and joints, which, by the way, were formerly regarded as evidence of disease (e. g., the changes which take place in the elbow joint of a coal-trimmer resulting from his occupation, etc.).

If this occurs in the adult bone how much more likely is it liable to occur in the comparatively soft, growing bones?

Thus we arrive at the conclusion that the chief, if not the only cause of the normal shape of the jaws, is the alternation of the exercise of normal mastication with periods of rest. And, that with insufficient mastication, the attitude of rest being preponderantly affected, as we have already seen, the jaw fails to broaden and its bulk is cramped and distorted. If it were possible for the attitude of use or exercise to be exaggerated the result would be a jaw which was abnormally broad—but I am not aware whether this has ever been observed.

The detailed effect of the narrow jaw upon the second dentition is, to quote Noyes again, that "the disto-buccal cusps of the upper teeth 'lock' between the buccal cusps of the lower, throwing the entire mandible half the width of the molar distal to its normal position," which not "only disturbs the relation of each permanent tooth as it erupts, but entirely changes the distribution of the functional forces upon the bone."

As a consequence of the malocclusion of the first permanent molars, the forces of mastication are impressed upon the upper jaw in such a direction that the lower molars tend to force the upper teeth in an inward direction, and in this way the previous tendency to the formation of a narrow palate is strengthened and intensified.

There are thus two stages in the production of the Gothic palate. First, insufficient mastication and the habitual assumption of the attitude of rest leads to a somewhat narrow palate; secondly, the vicious eruption of the first permanent molar perpetuates, intensifies and finally fixes the error in development. It is to be noted that while insufficient mastication is the primary morbid factor, it is only operative during the first stage. In the second stage, after the eruption of the molars if their malocclusion is not corrected,

the more efficient the mastication is, the greater must be the resulting deformity.

But, as we have just said, the first cause of the malformation lies in insufficient mastication prior to the eruption of the permanent molars, that is, before the eighth year. This is a truth which is not yet popularly prevalent.

Let us see how the view of the question fits in with the facts as we know them.

We shall, first of all, consider the production of the narrow palate in people who are mouth-breathers, and secondly, we shall consider the production of the narrow palate in people who have never been mouth-breathers.

We turn, first of all, to the mouth-breathers.

With regard to adenoids and their place in the etiology of mouth-breathing, the following may be taken as facts. Practically speaking, before the eighth year, adenoids are the only cause of mouth-breathing, the deformity of the palate and the consequent septal deviations do not exist so early as this. In some adenoid children mouth-breathing is habitual, even in early life. I have known in a child at the breast, the act of suckling seriously incommoded by the presence of adenoids. (By the way, another fact not too widely appreciated is that in the new-born infant, quiet respiration is not possible save through the nose. If the nose is held or obstructed, the child in breathing through the mouth also cries; and I have know of an infant's bodily strength dangerously weakened by loss of sleep resulting in this way from nasal obstructions.)

In some adenoid children, mouth-breathing is habitual and constant; in others and I believe the larger number, the mouth-breathing is not continuous. It is only occasional, and depends upon the presence or absence of swelling of the adenoid tissue. This in turn depends upon the presence or absence of catarrh, or other infection. As time goes on, however, we must remember that the mouth-breathing tends to become habitual.

We have already shown that it is in mouth-breathers that the influence of the tongue and of the soft parts of the face must operate most effectively, nevertheless those factors of themselves would fail to account for the occurrence of the narrow palate. Their action, if present at all, must be slight, if not altogether negligible.

But does mouth-breathing encourage insufficient mastication? Does it impede mastication? There can be no doubt that it does. Watch an adenoid patient at his meals. During mastication, if the nasal obstruction is partial, he has to stop chewing now and again to supplement the insufficient nasal respiration by a breath through the mouth; or, if the nasal obstruction is considerable, the poor child has to do his breathing through his mouth all the time he is masticating. In either case prolonged comfortable mastication is discouraged, and the food is bitten, champed and bolted. It is possible to bite and breathe through the mouth, but it is difficult to grind and to breathe through the mouth, because the necessary movements of the tongue are then in abeyance. Thus the old rule in polite nurseries—"Chew with your lips closed"—is physiologically sound, only many children are unable to obey that rule. And in them the sum total of pressure stimuli

received by the growing bone is, in the mass, enormously reduced. The attitude of rest is, so to speak, habitual, and deformity ensues.

Secondly, we saw that one of the difficulties in the way of the other theories of causation, those of the pressure of the soft parts and of the tongue, is that the narrow palate may be found in persons who have never been mouth-breathers and have never had adenoids. Does our present theory account for these cases? Obviously it does. Insufficient mastication in early life, from whatever cause arising—whether due to mouth-breathing or not—will induce the deformity. And when we consider, as Dr. Sim Wallace has taught us, the prevalence of feeding young children upon messes which require little chewing, the wonder is that the narrow palate is not the rule in civilized communities.

Consequently it would seem that in this mastication theory we have an explanation which can account for all the facts as we know them and which leaves none of them awkwardly floating about to be ignored or forgotten.

Let us now summarize the conclusions we have come to regarding the genesis of the narrow palate.

1. Insufficient mastication during the period of the milk-teeth leads to slight relative narrowing of the palate.

2. As a result of this narrowing the first upper permanent molars erupt too near the middle line, and mesial to the position of their opponents, the first permanent lower molars.

3. The misdirected pressure upon the upper jaw induced by this malocclusion together with the consequent vicious eruption of the other permanent teeth, intensifies the narrowing of the palate, and the final ossification of the bone fixes it.

4. In mouth-breathers, the pressure of the soft parts of the face and the withdrawal of the tongue from the vault of the palate are probably also factors in the production of the narrow palate, but their influence is passive and subsidiary to that of insufficient mastication.

One of the effects of this argument is, of course, to enhance the importance of the first dentition period. During this period, the presence of adenoids, the excessive use of soft food, and everything which tends to discourage free mastication must be sought for and dealt with, *secundum artem*. Even thus early advice of the orthodontist must supplement the operation of the rhinologist.

I have an addition I should like to make to the foregoing account of the theories of deformity of the jaws. It does not amount however to anything more than a suggestion, but I give it for what it is worth.

In all the foregoing consideration the chief causes of the maxillo-palatal deformity are placed in the mouth. But, surely, the action of the nose is worthy of some consideration, and my suggestion is that in the absence of nasal breathing there is a lack of definite nerve stimuli which, possibly, in normal conditions favor the growth in width of the jaws and the expansion of the nasal chambers. This factor being absent or deficient in diminished nasal respiration, the skeleton of the nose will fail to broaden out.

Leaving now behind us the subject of the mechanism of production of the narrow palate, I wish to direct your attention to one or two consequences of the deformity—consequences which are not perhaps so fully appreciated as they deserve to be.

You are all familiar with the fact that the narrow palate is generally associated with a deviation of the nasal septum. This sequela, it is interesting to note, never appears before the age of seven. If a child under that age has a deviated septum the history will show that it is traumatic and not developmental in origin. You are also aware that in many of these patients, by the time they have reached adult life, the total transverse measurement of the nasal chamber is very much reduced. Even in the normal nose, I may remind you, the nasal chamber consists of an irregular series of slits, never very broad. So that even a trifling encroachment upon the free space in the nose, whether by septal deflection or spurs, or by reduction in its total transverse diameter, seriously reduces its capacity, and places an obstacle in the way of free nasal breathing.

The cases with a reduced transverse nasal measurement are those in which operations are disappointing. Adenoids may be removed, but the patient still breathes through his mouth. The septum may be straightened—he still breathes through his mouth. Narrow anterior nares, with flabby and inactive alæ, may be widened—he still breathes through his mouth. Even the teeth may be rectified, so that the lips can be easily closed, and yet he still continues to breathe through his mouth. The fact is that the bony skeleton of the nose is at fault, and that unless you can widen it, efficient nose-breathing is impossible. And in adult life, after the completion of ossification, it is difficult or impossible to change for the better this faulty conformation of the face.

Now, in these cases, as well as in the multitudes of patients in whom timely correction of septal deformity is not made, the patient's health is liable to decline; so much so, that we can go so far as to say that the narrow palate tends to shorten life. Everyone has heard of the ailments in early life which follow nasal obstruction—the flat chest, the tendency to bronchitis, to pulmonary disease, to ear disease, and so on. But we do not hear so often the effects which follow the narrow or otherwise obstructed nose in later life. It is to these later effects that I wish to refer.

Man's great enemies in middle age are arteriosclerosis and the diseases which are grouped under the heading of "catarrh." With the former we have at present nothing to do, but with the later, much.

The narrow palate and face—"the rodent face"—is, as we have just seen, often associated with the narrow nose, and with the deflected septum. Whether as a consequence of disuse, as some think, or as the effect of badly distributed atmospheric pressure causing turbinal engorgement, as others think, or as a result of interference with free ventilation and drainage of the nasal sinus system, as others again believe, and among whom I may be included, there can be no doubt that these patients are more prone to catarrhal infection than their more generously constructed neighbors. They are attacked by catarrhs more frequently, they suffer from them more severely and they harbor them longer for periods than do ordinary people. More-

over, the attacks come to merge into one another until the disease becomes chronic. From these infections spring several pathological changes which tend to shorten life.

In the first place, old people in whom bronchitis, asthma and emphysema have come on in middle life, very often owe their diseases primarily to the narrow palate and to the obstructed nose. Further, septal deflection and nasal narrowing are common predisposing causes of nasal sinus suppuration, especially of the ethmoidal cells. And as ethmoiditis is the great cause of nasal polypus, you have here another source of bad health and danger to life which owes its presence to the same deformity. Thus the evil effects of early disabilities and bad health stereotyped, in the deformed case of the jaws and face lasting a lifetime, may not send in their account until after many years have passed. But the account must nevertheless be met when the time comes.

Thus in your orthodontic work you are engaged in a great labor for the prevention of disease not only in childhood but also later in life, and your efforts, when successful, make for the prolongation of life.

Having now touched upon certain topics in etiology and symptomatology, I turn to the third and final item in my paper, to one or two points in therapeutics.

Obviously, the first step in the treatment of deformity of the jaws, actual or impending, is the removal of the cause. This cause is usually adenoids, but very rarely septal deformity in early life at all events. Moreover, the removal should be effected before the age of eight. One should not wait until the deformity has appeared before operating but should operate to prevent, as soon as sufficient evidence of nasal obstruction even if transitory or partial, is forthcoming. Now, there is another point I should like to make here, and that is that even after thorough removal and still more after imperfect removal, before the age of eight, recurrence is by no means improbable. After the age of eight recurrence diminishes in frequency in proportion to the age of the patient. This tendency to recurrence should not be blinked at or ignored, but should be looked for and if it occurs, treated by a second removal. Otherwise, your efforts to reform the palate will be seriously hampered. Moreover, as the symptoms of nasal obstruction in these cases are the same as those induced by the bony deformity and malocclusion, the adenoids may recur without attracting any attention. For that reason, patients under treatment should be periodically examined for adenoids, even though they have already been operated on once or oftener.

A word now upon the mechanical treatment of the Gothic palate. I do not pretend to expert knowledge of the methods in vogue, but I understand that two methods are practiced—first, the gradual, and more recently, the rapid method. Of the two I am quite sure that the gradual is more certain and reliable. I have had one or two patients in whom the rapid method has been tried—one case I showed a couple of years ago at the Laryngological Section of the Royal Society of Medicine—with some measure of success, but I am sure that in remoulding a deformed bone, if a permanent result is desired, the aid of time must be secured.

Finally, I should like to say that from the rhinologist's point of view,

for nontraumatic septal deformities in children between eight and fourteen years of age, not only do your efforts to widen the jaws tend to prevent or hinder the development of deviations and their effects, but in those early years, orthodontic treatment is, in my opinion, the safest treatment for the septal deformity itself, because operations on the septum before fourteen may by removing the growing septal cartilage inhibit the antero-posterior growth of the nasal septum and so engender a stunted external nose. It is true that the result of early operation has been doubted, but the evidence against the fear is not strong enough to free us from hesitation and misgiving when we are asked to operate on children's septums.

After fourteen, however, the septum if deflected should be operated and that for two reasons: first, deviations are then more extreme and are less amenable to the action of dental treatment upon the shape of the jaws, and secondly, because the deflection may, like adenoids, act by perpetuating obstruction at a time when you are laboring to overcome it.