ON THE NATURE OF HIGH ARCHED
PALATE

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In the course of an investigation as to the evidence of vitamin D insufficiency among children one of the most constant and striking features was the frequency of the presence, in varying degrees and a variety of forms, of high arched palate. Most of the explanations of this phenomenon which have been put forward¹ assume the action of some forces which, in conjunction with softening of the bony tissues, press the hard palate upwards in the centre, whilst at the same time laterally compressing the alveolar arch. Certain observers (G. C. M. M'Gonigle, J. C. Brash²) have questioned the feasibility of these explanations. It is not difficult to see, when the general architecture and structure of the facial bones is considered, that a very much greater force would be necessary than could be derived from the neighbouring muscles. The feeble action of the buccinators, for example, would be more than antagonized by the action of the tongue, which tends to press the palatine arch outwards as well as pushing the roof upwards. Again, the type of deformity usually found in a very large series of cases did not correspond to that which would be expected as the result of forcible deformation of the palate. Direct inspection with a well-illuminated speculum failed to reveal any encroachment upon the nasal fossa, even in cases of extremely narrow highly arched roof; nor was there observed any cockling up or marked deviation of the septum nasi. Convincing evidence of lateral compression is likewise absent. If the lips are well retracted it will be seen that there is no real narrowing of the outer circumference of the alveolar arch, and that the teeth do not point inwards and downwards, as would be expected under the influence of inward pressure on the alveolar arch.

As a result of the examination of a series of children from birth up to the completion of the first dentition, and also of the children at school medical inspections, an alternative explanation suggested itself—namely, that there is actually no elevation of the palate, the apparent height of the roof being entirely due to abnormal downward elongation of the alveolar process, the narrowing being due to the inward expansion both of the alveolar and, to a varying extent, of the palatine processes. The number of children examined at school, extending into thousands, ensured that every variety of buccal cavity would be included in the investigation, which extended over a period of three years.

The normal course of development of the roof of the mouth appears to be somewhat as follows. At birth the roof of the mouth generally shows a slight degree of cupping, resembling somewhat a segment of a dinner plate. After a varying period—usually about one to three months—the anterior edge of the alveolar process becomes markedly enlarged in the centre, at a place corresponding to the two centres of ossification of the premaxilla and maxilla. This enlargement increases and spreads backwards, and, as dentition progresses, the descent of the teeth and the deepening of the alveolar arch result in the formation of a moderately high, rounded arch by the middle of the third year. At the commencement of the second dentition this condition appears normally somewhat accentuated, the alveolar arch now containing the twenty erupted deciduous, as well as the fourteen calcified crowns of the permanent set. The size and rate of growth

of the alveolar process is thus greater during the period of dentition, particularly in the vertical direction, than the lateral growth of the palate. During the second dentition, with the loss of the deciduous and the gradual descent of the permanent teeth, an approach is made to the adult type of flattened wide roof, with short, gently sloping sides, the growth of the palate being now relatively greater than that of the alveolar process (and arch).

This is roughly the normal course of events. In certain cases, however, the thickening of the premaxillary area is greatly exaggerated, forming a distinct swelling, marked off on either side from the rest of the maxillary edge by a U-shaped vertical groove. This hyperplasia may remain confined to the region of the incisor and canine teeth or may spread a varying distance along the alveolar arch, resulting in exaggeration of the normal vaulting. This becomes further accentuated during the second dentition, when thickening of the arch becomes a prominent feature, especially if the descent of the permanent teeth is obstructed by the retention of the stumps and fragments of the deciduous teeth (removal of these leading to marked diminution of the thickening). Thickening of the buccal surface of the palatine process is also frequently present in a marked degree.

The various types of deformed roof described in the literature of the subject depend chiefly upon variations in the relative degrees of downward elongation and thickening of the alveolar processes, and also upon the degrees of thickening of the palate bones. For example, when the arch is much thickened in front and tapers away behind we have the well-known Λ -shaped roof. Great hypertrophy of both palate and alveolar process brings about obliteration of the normal angle of the roof, and produces the saddle-shaped type of roof, the latter resembling the under surface of a saddle. With the progress of dentition the bony hyperplasia diminishes and deformity becomes less marked.

The bony hyperplasia differs in no way from the thickening of the cranial bones in rickets, and, like it, commences at the centres of ossification, is there more marked, and often remains limited to that region. Of the children investigated 80 per cent. showed unmistakable evidence of previous rickets, and the diet was notably poor in foods containing calciferol. The tendency for the deformities to become modified with age has also been noted, as is the case in rickets.

The conclusion drawn from the investigation is that there are two distinct varieties of high arch: (1) The *congenital*, which is a persistence of a certain stage of foetal development. In this type there is actual elevation of the floor of the nasal fossa, which slopes up and inwards to meet the nasal septum. (2) The *acquired* variety described above, in which there is no actual elevation of the roof of the mouth, the *apparent* elevation being due to hyperplasia of the alveolar and palatine processes, and is probably of a rickety nature. The two types may coexist.

As the acquired variety is very widespread, at any rate in this district—20 per cent. of "infants," 30 per cent. "immediates," and 15 per cent. of "leavers" among school children, showing *marked* deformity—it is only to be expected that it will be found associated with other conditions, such as adenoids, mouth-breathing, nasal obstruction, and mental deficiency, with which it appears to have no aetiological connexion.

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REFERENCES

- ¹ Choyce and Beattie: *System of Surgery*, first edition, vol. iii, pp. 156 and 200.
- ² Brash: *Aetiology of Malocclusion and Irregularities of the Teeth*.