THE PALATAL TUNNEL*

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'The tongue of the sucking child cleaveth to the roof of his mouth.' *Lamentations* 4, 4

All sucking children have a distinct anatomical groove along the roof of the mouth. All the more wonder, therefore, that it has never been described; at any rate I have not read of anyone who has drawn attention to it. It is not noted in the standard textbooks on anatomy, nor in some dental anatomy texts which I have consulted. It is not described in the standard works on paediatrics nor in popular books like those of Spock.

If attention can be drawn to the minute epithelial pearls, it is astonishing that the huge palatal tunnel should be overlooked. For many years I was under the impression that this anatomical feature was common knowledge, but when, some months ago, I made an effort to read what had been written on it, I could find no information whatever.

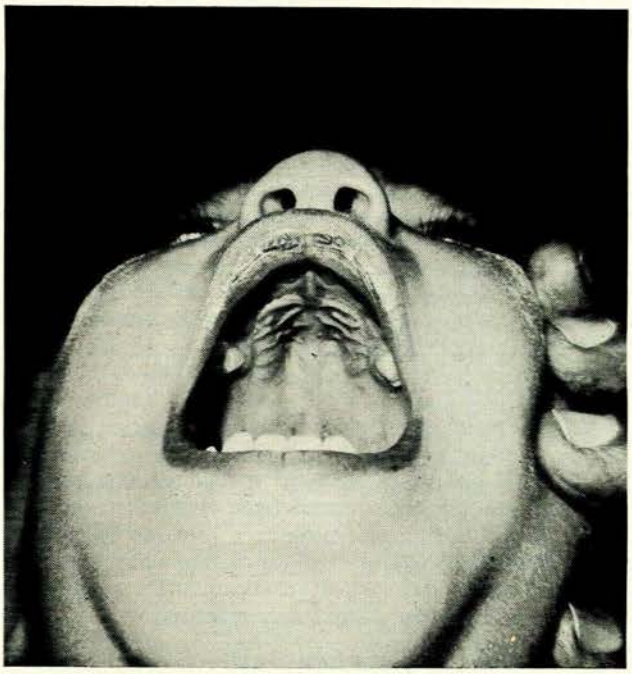

Fig. 1. Palatal furrow in a girl of 2½ years. Even at this age the slot for the nipple is clearly illustrated. (Photograph by courtesy of Dr. M. Hellig.)

ANATOMY

Look into any baby's mouth. Quite obviously the palate is meant to take a nipple. Its contour is simply not related to the underlying tongue. Invariably described as an arch, this description, though accurate enough in an architectural sense, misses its purposeful structure in a paediatric sense. The anterior half-inch of the palate, beginning behind the gum, forms a furrow clearly suited to receive a nipple. Further posteriorly the furrow gradually merges into a wider trough or arch.

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The Roof

The palatal groove is formed by a roof and by sides covered with red mucosa. Where the palatal sides extend laterally onto the gums, the mucosa is suddenly much paler. A median raphe extends down the length of the tunnel roof, and anteriorly, on either side, there are well-marked horizontal rugae, similar to the much more prominent ridges in puppies and kittens, and obviously useful for holding the nipple.

The Floor

The floor of the tunnel is formed by the tongue. This tunnel is peculiarly well adapted for the receipt of a nipple. It will be noted that whereas the external surface of the maxillary gum in the incisor region is vertical, the internal surface slopes inwards at a more gentle incline and forms a ridge or platform which fixes behind the lacteals under the areola, whereupon the infant's tongue proceeds to squeeze, draw and pull the trapped milk from the (in any event propellant) lacteals into the nipple proper and thence into the mouth. The internal surface of the lower gum is also sculptured at an incline so that the tip of the tongue can have excellent access to the base of the nipple.

The nature of the floor of the tunnel, i.e. the tongue, is also of interest, and on this matter there is also but little information to be found. The merest glance at babies who are crying or who have just had a nipple, teat or pacifier removed from their mouths, reveals 2 groups of lingual responses. Most babies have a flat tongue surface, but about a third of them have a distinct concavity, a shallow longitudinal furrow about ½ inch long, extending backwards from the tip of the tongue. In this latter group the palatal tunnel is virtually cylindrical and I have the impression—it is no more than an impression—that this group of babies generally suck better than those who do not curl their tongues. Perhaps the 'curlers' act more evenly, and hence effectively, along the circumference of the nipple with its underlying lacteals.

Effect of Age

A palatal groove, although not so obvious in premature babies, is well marked during the first year of life and remains reasonably distinct until 3 - 4 years of age. The curling of the lateral edges of the tongue, however, becomes more distinct with the passage of time, and about half the 'flat tonguers' grow up to be able to curl or roll the sides of their tongues so that the edges touch superiorly.

FUNCTIONAL ANATOMY

Tongue Curling

Tongue curling has, to my knowledge, been investigated in adults but not in children. Some two-thirds of adults can curl their tongues and the ability to do so is generally thought to be inherited as a dominant trait.[1] In my own observations on families where the parents can and the children cannot curl their tongues (the reverse is not common but does occur) one must perforce invoke heterozygosity or failure of penetrance rather often in

order to explain the lack of dominance as expected.

It is also generally supposed that the ability to curl the tongue is a kind of trick which adults with suitable heredity can learn. This is manifestly not true. If some newborn babies can curl their tongues, the ability to do so is clearly based on anatomical differences and I imagine that there are differences in the structure of the intrinsic muscles of the tongue. Texts on anatomy have no information on this problem and I cannot see how it can be resolved unless known 'curlers' and 'non-curlers' finally donate their tongues for dissection.

The Nature of Sucking

Exactly what happens, or what should happen, within the palatal tunnel is by no means clear. Textbooks on physiology deal but scantily with the swallowing mechanism.

In her excellent essay on 'The nursing couple', Mavis Gunther[2] also misses the significance of the palatal tunnel. She stresses the importance of a long nipple (more than $2\frac{1}{2}$ cm.) which can be drawn far into the mouth.

The orthodontist Straub,[3-6] on the other hand, writes that a long nipple or especially teat, with a free flow of milk, results in a perverted swallowing habit with an eventual anterior open bite. He recommends a short teat with a small hole (sold in South Africa as the Nuk teat).

Straub has obviously given a lot of thought to the problem, but he fails to perceive the nature of the palatal tunnel, and the type of teat he favours does not fit a tunnel. He sees the shape of the palate as related to the tongue: 'the proper position of the tongue against the palate . . . (maintains a) . . . proper arch width in the maxilla',[3] though he does note: 'In the act of swallowing, the formation of a seal, beginning posteriorly on the lateral borders of the palate, was seen.'[4]

Some idea of what happens during suckling can be gauged by inserting the little finger into a baby's mouth. A few things happen very quickly. Lips and gums tighten on the finger, the base of the tongue drops, thus presumably creating a very short-lived negative pressure within the pharynx now closed off by the soft palate, and immediately the infant's tongue begins hard pulling movements on the finger. This must raise the intra-oral pressure, and Straub, quoting investigators from 1880, writes that manometric pressure rises to about 20 cm. of water.[3]

Straub's views on tongue thrust have been contested by Wildman *et al.*[7] who also stress that 'in normal swallowing there is no evidence of a sucking action' and that it is propulsion (along the palatal tunnel) which accompanies swallowing, while in the case of liquids gravity also plays a part. Recently electronic instruments have been devised for measuring intra-oral swallowing pressures,[8] and Kydd and Toda,[9] also using an electronic transducer, have shown that the swallowing pressure in the anterior and lateral portions of the palate is in the order of 80 - 90 G/sq.cm., while in the centre of the palate it is only some 50 G/sq.cm., and even less if the arch is high.

None of these investigations, however, have involved infants and it should not be too difficult for a mechanically-minded clinician to fill a teat with instruments designed to measure the various pressures between lips and gums and within the palatal tunnel during the process of sucking and swallowing.

SUMMARY

The shape of the baby's palate is not related to the tongue but to the nipple. The palate acts as a roof and the tongue as a floor for a palatal tunnel traversed by a nipple behind whose lacteals the baby's gums fix.

Babies use their tongues differently during nursing. While there is exact knowledge on tunnel pressures during swallowing in adults, no such studies have been done in babies.

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