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The Anatomy of the Intrinsic Musculature of the Tongue in the Early Human Fetus:

PART 1, M. LONGITUDINALIS SUPERIOR

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M. longitudinalis superior of the tongue was examined histologically in early (15-week) fetal specimens (N=28). Its points of attachment and relationships are described and compared with corresponding features in the adult.

This study, in particular, clarifies the relationship of the two longitudinal muscles (superior and inferior) in the tip of the tongue as well as the demarcation between the superior longitudinal and hyoglossal muscles in the root of the tongue.

Introduction

Although the morphology of lingual musculature has been discussed at some length in the literature (reviews: Dickson et al., 1975; Barnwell, 1976; Maue-Dickson, 1977), detailed descriptions of the origins, insertions, courses, and relations of the intrinsic tongue muscles are difficult to find, especially with reference to their development. It is the purpose of this study to describe the morphology of the longitudinalis superior muscle in the tongue of the fifteen-week human fetus.

A majority of investigators note that the superior longitudinal musculature arises from an intermittent origin on the lamina propria along the dorsum of the tongue (Cruveilhier, 1844; Salter, 1852; Abd-El-Malek, 1939; Strong, 1956). This muscle has been described as originating, in addition, from the hyoglossal membrane (Salter, 1852), from the epiglottis, and from the hyo-epiglottic membrane (Abd-El-Malek, 1939). Only Blandin (1823) described the m. longitudinalis superior as being derived from extrinsic fibers arising from the lesser horn of the hyoid bone.

Musculus longitudinalis superior in general, arises posteriorly in the tongue as a thin membrane which thickens in mid-course and again attenuates as it approaches its insertion anteriorly (Curveilhier, 1844; Salter, 1852; Abd-El-Malek, 1939; Miyawaki, 1973). Along its course, small fascicles of fibers arise from and terminate, in relays, within the dorsal lamina propria (Soemmering, 1841; Cruveilhier, 1844; Salter, 1852).

As it proceeds anteriorly, the lateral fibers of the m. longitudinalis superior joins with fibers of the mm. stylo-glossus, hyoglossus, and longitudinalis inferior on the edge of the tongue (Abd-El-Malek, 1939; Miyawaki, 1973). In the posterior tongue, fibers of the m. longitudinalis superior are described as interdigitating with those of mm. genioglossus and verticalis linguae medially, and with fibers of m. transversus linguae laterally (Miyawaki, 1973).

There seems to be general agreement within the literature that the superior longitudinal muscle terminates anteriorly with its fibers inserting into the lamina propria of the tip of the tongue (Barnwell, 1976).

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Methods and Materials

Twenty-eight human fetuses, determined by physical inspection to be without gross malformation and by staging criteria (Streeter, 1920) to fall within a 15 + 2 week age range, were selected for this study. Following routine histological processing, the specimens were sectioned as follows: coronal (8), sagittal (10), transverse (10).

Alternate sections were stained with a modified Masson trichrome technique and examined microscopically.

Results

In the fetus, m. longitudinalis superior exists as a bilateral stratum of longitudinally-oriented fibers running just beneath the dorsal lamina propria of the tongue. In all specimens, it was observed to be relatively thick posteriorly and medially, but to attenuate anteriorly and laterally. The muscle mass is confined to the anterior two-thirds of the tongue (Figure 1).

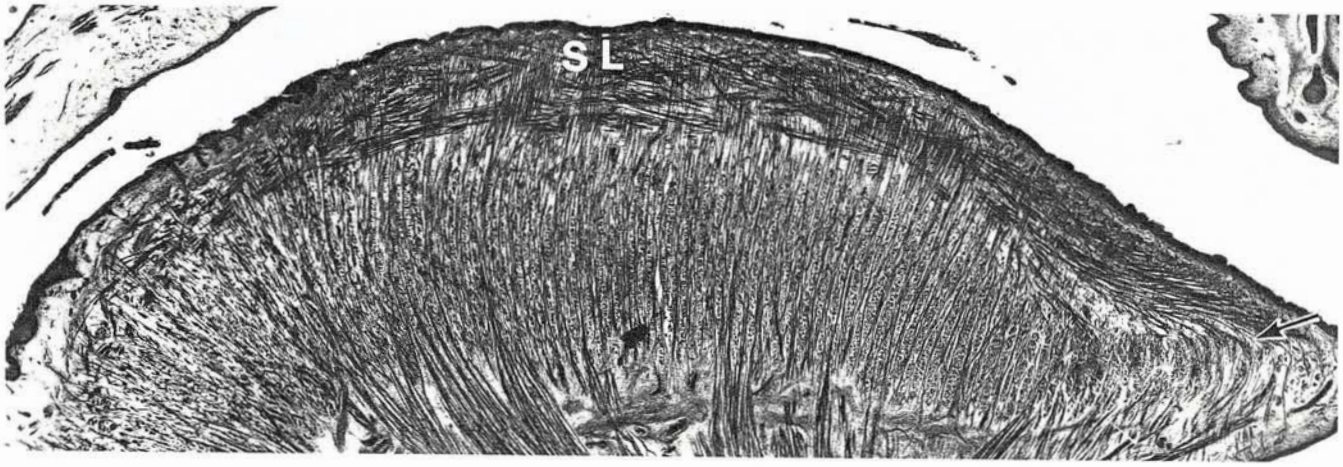

Figure 1. Parasagittal section taken near midline through the tongue, illustrating the course of the m. longitudinalis superior (SL). Note the serial attachment of fibers dorsally into the lamina propria, as well as an anterior insertion into the median lingual septum. (The thin septum has been cut tangentially and appears here as a stippled density in the region of the arrow.) (Specimen No. 3-106, section No. 482, magnification 17.5X.)

This muscle takes a broad "V"-shaped origin from the lamina propria, extending bilaterally along the limbs of the sulcus terminalis as far as the base of the palatoglossal arch (Figure 2).

Figure 2. Transverse section through the tongue which demonstrates fibers of the m. longitudinalis superior (SL) attaching in the region of foramen cecum posteriorly, and approaching the tip of the tongue anteriorly (arrows). The central continuity between these elements has been lost due to the convexity of the dorsum of the tongue. (Specimen No. 3-838, section No. 328, magnification 21X.)

Posteriorly, the m. longitudinalis superior is intersected by transverse fibers of m. palatoglossus as well as by the oblique fibers of m. hyoglossus, arising from the greater horn of the hyoid bone. Hyoglossal fibers, derived from the angle of the hyoid apparatus between its lesser horn and body, run more vertically in the root of the tongue to interdigitate with fibers of the superior longitudinals on the lamina propria of the root of the tongue (Figure 3).

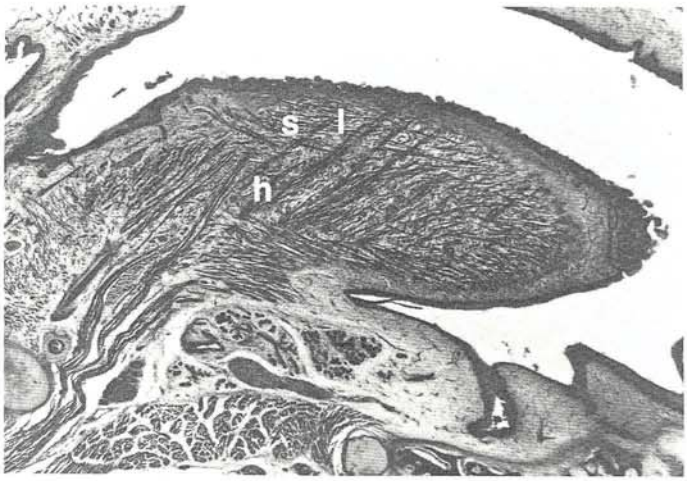

Figure 3. Parasagittal section through the tongue (taken lateral to the section in Figure 1) which shows the interrelationship between fibers of the mm. longitudinalis superior (SL) and hyoglossus (H). (Specimen No. 3-206, section 318, magnification 23X.)

Between foramen cecum and the anterior one-third of the tongue (Figure 4), the bilateral superior longitudinal bundles are separated at midline by fibers of m. genioglossus, which take a vertical course to insert on the lamina propria of the dorsal midline. An adjoining, more laterally-placed mass of vertically-oriented fibers, m. verticalis linguae, penetrates the superior longitudinal lamina in the middle one-third. Finally, still more laterally, the up-sweeping terminations of m. transversus linguae also interlaces with the lateral extent of the m. longitudinalis superior.

In the anterior one-third of the tongue, the m. longitudinalis superior runs in close relationship with fibers of neighboring muscles: mm. styloglossus, hyoglossus, and palatoglossus (laterally); mm. hyoglossus and longitudinalis inferior (inferiorly); and m. genioglossus (medially) (Figure 4).

Figure 4. Coronal section taken through the anterior one-third of the tongue, to illustrate the disposition of the lingual musculature into an inner medullary area and a peripheral cortical region. Within the medulla, the transverse (a), intrinsic- (b) and extrinsic- (c) (genioglossal) vertical fibers may be easily defined. Conversely, note how the peripheral fibers form longitudinally-oriented continuum, comprised of a superior longitudinal (d) component covering the dorsum, followed by palatoglossal (e), styloglossal (f), hyoglossal (g), and inferior longitudinal (h) fibers, respectively. (Specimen No. 3-1243, section No. 246, magnification 25X.)

The m. longitudinalis superior terminates on either side in the anterior one-third of the tongue as its medial fibers converge toward midline to descend and attach to the superior aspect of the median septum (Figure 1). In 20 percent of the sagitally-sectioned specimens (n=10), the medial component appeared to be stratified into superficial and deep fiber bundles, the deeper terminating in the septum just posterior to the more superficial group. The lateral fibers coursed further into the tip of the tongue to attach to its thickened lamina propria, together with the fibers of mm. styloglossus, palatoglossus, hyoglossus and longitudinalis inferior.

Discussion

The use of histologic preparations of fetal tongue in the present study allows both the posterior fiber attachments of m. longitudinalis superior and the anterior attachments of the chondroglossal portion of m. hyoglossus to be clearly defined on the lamina propria along the sulcus terminalis. Thus, the data support the concept that, while the dorsal muscular stratum reaching from hyoid apparatus to the tip of the tongue may function as a whole, it is comprised of both intrinsic and extrinsic fiber groups.

The observation in this study that the m. longitudinalis superior runs to the tip of the tongue with fibers of mm. styloglossus and hyoglossus is in agreement with that of Abd-El-Malek (1939). However, fibers of the mm. longitudinalis superior and inferior were not observed to merge along their lateral borders in the fetus, as described for the adult by the same investigator. Nevertheless, both sets of fibers do ultimately terminate in dense connective tissue (the anterior arch of Abd-El-Malek, 1939) at the tip of the tongue.

Finally, by virtue of the partial insertion of the m. longitudinalis superior to the median septum, the present study also demonstrates the muscle to be bilaterally disposed within the tongue.

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