Variant Innervation of the Medial Pterygoid Muscle from the Lingual Nerve

GRAHAM DUPONT *, JOE IWANAGA * AND R. SHANE TUBBS *.*

* Seattle Science Foundation, Seattle 98122, USA,

** Department of Anatomical Sciences, St. George's University, University Centre, Grenada, West Indies

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Summary: During a routine dissection of the infratemporal fossa and lateral face, a branch of the left lingual nerve was observed entering the medial pterygoid muscle. Normally, the nerve to the medial pterygoid is a direct branch from the mandibular nerve, with no communications with the lingual nerve. There are many reports involving variations of the mandibular nerve; however, few reports describe lingual nerve variations involving the medial pterygoid muscle. Reconstructive surgeries for cosmesis and trauma, tumor excision, and impacted third molar removal may all damage the lingual nerve and might, as seen in the present case, affect the medial pterygoid muscle. Given the presumed rarity of this variation, we discuss the possible embryological origins as well as the surgical conflicts that may arise with this type of variation.

Key words lingual nerve variation, medial pterygoid muscle, maxillofacial surgery, mandibular nerve, infratemporal fossa

INTRODUCTION

Detailed knowledge of craniofacial anatomy and variation is crucial to the maxillofacial surgeon in order to reduce intraoperative complications and prevent iatrogenic injury. Of the cranial nerves, the mandibular nerve (V3) division of the trigeminal nerve demonstrates remarkable variability in its branching patterns to provide motor branches to the muscles of mastication, mylohyoid, and accessory muscles of the ear and palate, and in its conveyance of sensory branches that interface with the lower jaw, tongue, and lower teeth [1]. The sensory branch arises laterally from the trigeminal ganglion, while the motor root courses under the ganglion—both exit the foramen ovale and rejoin just inferior to it. The main trunk is then carried into the infratemporal fossa that houses the majority of its branches, along with the chorda tympani, lingual nerve, otic ganglion, and middle meningeal, inferior

alveolar, deep temporal, and buccal arteries [2]. The mixed nerve then passes between the tensor veli palatini and lateral pterygoid and sends a direct branch to the medial pterygoid before splitting into anterior and posterior divisions. This is the normal course for the medial pterygoid nerve.

During routine dissection of the infratemporal and pterygopalatine fossae, a variation of the posterior division of V3 was observed unilaterally, in which the nerve to the medial pterygoid arose as a direct branch of the lingual nerve. The direct branch from the lingual nerve was the only nerve supply to the medial pterygoid observed on the variant side, and the direct branch from V3 before dividing into its anterior and posterior parts was not present. However, the medial pterygoid on the contralateral side did receive a direct branch from the mandibular nerve, as normal. To our knowledge, this variation has only been reported by a

few authors; however, despite its rarity, it is something the oral maxillofacial and dental surgeon should be aware of when performing dental implant and reconstructive procedures, as well as in general approaches to the infratemporal and pterygopalatine fossae such as in tumor excision, trigeminal nerve blocks, third molar extraction, and harvesting inferior alveolar artery for anastomosis [3-5]. Possible embryological origins of such variation will also be discussed.

CASE REPORT

During routine dissection of the lateral face and infratemporal fossa of a 46-year-old at death Caucasian male cadaver, a variation of the nerve to the medial pterygoid was observed. The insertion of the medial pterygoid muscle was carefully detached from the mandible and the mandible was resected from the head. The lateral dissection of the mandibular nerve (V3) and its divisions in the left infratemporal fossa revealed an aberrant innervation to the medial pterygoid by a branch of the lingual nerve (Figure 1). The diameter of the nerve was 0.52 mm. The diameter of the lingual nerve before and after branching off the nerve to medial pterygoid was 2.54 mm and 2.36 mm, respectively. There were no deviations in orientation, branching, or communications between the lingual and inferior alveolar nerves of the left lateral face. On

the contralateral (right) face, normal innervation of the nerve to medial pterygoid was observed, receiving a direct branch from the mandibular nerve. Anatomical quality assurance guidelines were followed [6,7].

DISCUSSION

Variations of the lingual nerve may be plexiform in root, arise from a combination of anterior and posterior divisions of the mandibular nerve, and may have several communications with the inferior alveolar nerve. The lingual and inferior alveolar nerves may also have communications that are divided by the maxillary artery [1]. Similar to the current report, Rácz et al. [8] reported a lingual nerve that innervated the lateral and medial pterygoid muscles and palatoglossus muscle. The nerve to mylohyoid may also anastomose with the lingual nerve at the lateral sulcus of the tongue, coined the “mylohyoid or sublingual curl” [8].

During embryonic development, the trigeminal ganglion, originating from both neural crest and respective epidermal placode, is the most easily observed of the nascent cranial nerves and is first visible in week 4, Carnegie Stage (CS) 10 [9]. Beginning with the development of the mesencephalic and CN V-VII crests from the neural folds (visible when 7 somites are present), the first pharyngeal arch forms. Upon de-

Fig. 1. Left infratemporal fossa illustrating the lingual nerve variation. The lateral pterygoid muscle (LPM) is reflected from the lateral plate of the pterygoid process (LPP) to provide access to the lingual nerve (LN). The inferior alveolar nerve (IAN) is also reflected for clarity. The dissector indicates the branch of the lingual nerve (white arrow) to the medial pterygoid muscle (MPM).

velopment of the first three pharyngeal arches, mesencephalic and trigeminal cells can be seen migrating to the first pharyngeal arch, and their ganglia appear as aggregates of neural crest cells (CS 11). The trigeminal crest is joined by cells of the ectoderm and proceeds to migrate in the direction of the first two pharyngeal arches (CS 12). Embryonic nerve fibers are observed in the trigeminal ganglion as cells, which migrate toward it from the roof of the rhombomere 2 [10]. At this stage, the majority of rostral neural crest cells have reached their destination and formal development of the face begins [2]. During weeks 3.5 through 6, the main trunk of the mandibular nerve is developing along with pre-muscle masses of the cephalic muscles. Specifically, between weeks 5 and 6, the cephalic muscles are observed with their respective nerves [11]. By week 11, extensive branching of the mandibular nerve is seen in addition to intermingling with other cranial nerves, with fibers of the lingual, facial, and buccal branches migrating to the far reaches of the lateral and anterior face. Presumably, aberrancies in trigeminal nerve branching and innervation occur during this interval due to deviations in normal Hox signaling that influence expression and activity of fibroblast growth factor (FGF) and retinoic acid (RA) signaling pathways which contribute to the growth of various areas of the embryonic brain. The expression of a family of vestigial-like (VGLL) proteins, specifically *vgll3* and its gene, have been demonstrated to influence the development of the trigeminal placode and sequential nerve formation [9]. Furthermore, expression of *vgll3* is required for normal neural crest cell migration and localization [9]. These findings indicate deviations in normal expression of *vgll3* may result in aberrant nerve formation due to improper neural crest cell signaling and migration.

Differences in the expected anatomy of the lingual nerve may result in unintended nerve trauma, confusion during access of the infratemporal and temporomandibular fossae, both increasing chances of surgical complications. Often, inferior alveolar nerve blocks result in permanent lingual nerve damage (70% of cases) due to a low number of nerve fasciculi (mean = 3) compared to the inferior alveolar nerve (mean = 7.2) at the level of the lingula [12]. Lingual nerve damage in the present case may result in radiating pain to the medial pterygoid. Variants of the lingual nerve such as in cases where the nerve is penetrated by arterial branches or compressed by an ossified pterygospinous ligament may result in neuropathic pain of the

lower jaw or oral cavity [13]. Observations by Shimokawa et al. demonstrated full penetration of the medial pterygoid muscle by the lingual nerve and may offer insight as to the many origins of trigeminal neuralgic pain; presence of an ovalis canal may compress the main trunk of the mandibular nerve, which cannot glide between the pterygoid muscles like the lingual nerve, and also may result in neuralgic pain [14]. Trauma to the lingual nerve can occur in up to 11.5% of patients during surgical removal of impacted third molars, and in variant cases, may contribute to the development of mandibular neuralgia, loss of taste, burning sensations, and impaired speech [15]. For the current case, transparotid approaches to this space may injure the aberrant branch of the lingual nerve supplying the medial pterygoid muscle. Furthermore, reconstructive procedures for trauma and or cosmetic purposes involving the lateral walls of the palate, mandible, or temporomandibular joint may also place the lingual nerve and its branches at risk. Therefore, a good working knowledge of the possible anatomical variations in this region can help minimize patient morbidity.

CONCLUSION

The present case illustrates an interesting variation of the lingual nerve that may be of use to the oral maxillofacial surgeon operating on the lateral face.

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DECLARATION OF INTEREST: none.

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