REVIEW ARTICLE

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Marginal Mandibular Branch of Facial Nerve - A Literature review

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ABSTRACT

The Marginal Mandibular Nerve, a branch of the seventh cranial nerve (facial nerve), exhibits notable variability in its branching and course. Incorrect identification of the nerve and its branches poses a risk of injury during head and neck surgeries. The muscles supplied by the Marginal Mandibular Nerve are essential for maintaining facial symmetry. Preserving the functional integrity of the MMN is challenging during head and neck surgeries, and inadvertent injury to it can have significant consequences. Such an injury has the potential to distort facial expressions, underscoring the importance of careful consideration and preservation of the nerve during surgery. Therefore, meticulous attention to the anatomy of the Marginal Mandibular Nerve is crucial to minimize the potential for harm during surgical procedures in the head and neck region.

INTRODUCTION

The Marginal mandibular branch of facial nerve (MMN) typically has a varying course.[1] When dissecting the submandibular triangle to remove lymph nodes in Level 1b as part of a neck dissection for head and neck malignancies, the cervical component of the nerve is susceptible to damage. Inferolateral movement is rendered impossible by the paralysis of the depressors anguli oris and labii inferioris, which results in the ipsilateral lip being inverted and flattened. This causes the lower lip to rise in an asymmetrical smile.[2] When the patient is crying, the deformity is more noticeable. This deformity results in a notable perceived incapacity.[3] A damage to this nerve further causes a shift in the mouth's angle, salivary dribbling, and difficulties speaking and chewing. It is important to locate the MMN in procedures requiring dissection in the submandibular triangle. For the purpose of preventing the cosmetic disfigurement that comes with nerve palsy, it is essential to have a thorough awareness of the nerve's anatomical course, surface, and surgical landmarks that aid in nerve localization.

ANATOMY OF THE MARGINAL MANDIBULAR NERVE: The seventh cranial nerve, facial nerve, provides sensory supply to the anterior two thirds of the tongue, secretomotor supply to the muscles of the face, and the lachrymal, sublingual, and submandibular glands. MMN is one of the extracranial part of facial nerve's five terminal branches. The facial nerve emerges from the antero-inferior boundary of the parotid and passes beneath the deep cervical neck fascia and the platysma muscle before becoming

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superficial to the facial arteries. The nerve that originates from the inferior border of the mandible bends upward over the jaw's body and provides motor innervations to the risorius, depressor anguli oris, depressor labii inferioris, and mentalis, to maintain face symmetry during different facial expressions. The inferior border of the parotid gland is often where the marginal mandibular nerve emerges. It then passes along the inferior border of the mandible and the angle before emerging anteriorly and superficially at the anterior border of the masseter muscle, where it meets the facial artery and vein.[4] The nerve often travels medially towards the lower lip by passing over the mandibular boundary after passing beneath it lateral to the facial artery.

MARGINAL MANDIBULAR NERVE IN RELATION TO PAROTID GLAND AND FACIAL ARTERY: The position of the MMN in relation to the parotid gland has been extensively analyzed. According to Marcuzzo et al[5] meta-analysis, the nerve is located above the parotid gland in 76% of cases and below it in 18% of cases. Atif et al[6] study reports that MMN exits the parotid gland from its anterior border in 95% of cases, in contrast to Khanfour et al[7] findings, which suggest that the nerve originates from the parotid apex in 70% of cases. In the majority of cases, the MMN flows above the lower border of the mandible.[8] Owsley et al[9] observed that in 19% of cases, the nerve passes 1-3 cm below the lower mandibular boundary, becoming superficial to the facial artery near the masseter muscle's anterior border. Balagopal et al[10] emphasized the facial artery as a landmark, noting that the mean distance from the lower mandibular margin to the intersection with MMN was 1.73 mm. The "masseteric fusion zone," identified by Huettner et al, is the likely location of iatrogenic facial nerve damage following superficial musculo-aponeurotic system (SMAS) release.[11]

Hazani et al[12] suggested MMN as a reliable landmark for nerve identification, passing above the facial artery at a consistent distance from the masseteric tuberosity to the mandibular midline. Dingman and Grabb[4] found that the nerve branches within 1 cm below the inferior mandibular margin, lying above the inferior margin in 81% of cases and below in 19%. However, Wang et al[13] reported different percentages, with the nerve above the inferior mandibular margin in 67% and below in 33% of cases. The facial vein is considered a definite landmark, showing a consistent relationship with the MMN. It is identified lateral to the facial vein in 95% of cases, despite the importance of the facial artery in localizing the MMN.[14] When multiple branches are present, a single-branched MMN coursing on the lateral aspect of the anterior facial vein is reported in 57% of cases.[5] Savary et al[15] found that the MMN is located below the inferior boundary concerning the facial artery. Their results indicated that the MMN is situated below the mandibular border in 27% of cases and posterior to the facial artery in 63% of cases. They recommended making incisions 2-4 cm below the jaw to minimize nerve damage. This observation was supported by Nason et al,[16] who concluded that the nerve's lowest point is 1.25 ± 0.7 cm inferior to the mandibular margin between the anterior and posterior facial veins during neck extension. To reduce the risk of nerve damage, they advised supra-platysmal dissection of the flap up to the lower border of the mandible.

Since MMN anatomically courses beneath masseteric fascia and above the masseter muscle in the ramus of the jaw, the pterygo-masseteric sling method is recommended for procedures involving this area. MMN palsy frequently occurs during surgical procedures on the submandibular area,[7,17-22] especially in the submandibular triangle, where the MMN is often observed in conjunction with perifacial lymph nodes. Removal of these nodes is crucial due to their significance as the main lymphatic draining sites for oral carcinomas, with a higher risk of spreading.[23] Møller et al[24] found the highest frequency of iatrogenic MMN injury in neck dissections involving level Ib nodes. Numerous investigations have addressed the oncological safety of the nerve during surgical neck dissection procedures,[17,25,26] with the Hayes-Martin procedure being a well-established method for preserving nerves during such surgical interventions. In a study involving 63 neck dissections, Tirelli et al[27] discovered that 60% of cases had anterior perifacial nodes in contact with a nerve, and the Hayes-Martin maneuver failed to remove all involved nodes in 59% of cases. These nodes were situated within 5 mm of the MMN. Nelson and Gingrass[28] proposed that the discrepancies in findings between freshly extracted cadaver specimens and clinical settings, compared to embalmed cadaver specimens, might explain the variations in nerve placement. They argued that, almost exclusively, the MMN courses below the lower mandibular border. Contrary to the idea that incisions 2 cm below the inferior mandibular margin pose a greater risk, Dingman and Grabb[4] suggested that placing incisions at this level can prevent nerve injury. Marcuzzo et al meta-analysis[5] revealed that 39% of MMN branches are located below the mandibular boundary, emphasizing the importance of considering this fact when making submandibular incisions. During procedures above the inferior mandibular edge prior to the facial vessels, it is crucial to advance the dissection from the mandibular margin beneath the platysma supra-periosteally to avoid the MMN, which is situated within the platysma muscle directly anterior to the facial vessels.[25] In this region, a dissection plane in subplatysmal tissue

is established, reflecting the platysma away from the deep cervical fascia to the inferior mandibular margin. This maintains a tissue bridge that protects the nerve from iatrogenic injuries.[9]

Maximum reported downward deviation of this nerve from the inferior border of the mandible varies; it can range from + 14 mm to + 40 mm in populations of Caucasians,[29-31] -3.5 mm to + 30 mm in populations of Mongoloids,13,[22,32-34] + 0.8 to + 13 mm in populations of Americans,[16,19,35-36] and 2.3 mm in populations of Africans.[37]

Different patients have varied marginal mandibular nerve anatomy and, more significantly, diverse courses. All research on the marginal mandibular nerve conducted up until recently used cadaveric tissue, which is constricted and largely immobile.[36] The nerve's location in relation to the mandibular lower border was characterised by Dingman and Grabb.[4] According to his findings, in 81% of dissected cadavers, the marginal mandibular nerve passed beyond the lower boundary of the mandible when its route was posterior to the facial artery, and in 19%, one or two branches of the nerve ran up to 1 cm below the mandibular rami. On the other hand, if the nerve was located above the facial artery, it never went below the mandibular lower border. In contrast, there is a significant fluctuation in the course and position during neck dissection when the patient's neck is extended and rotated to the contralateral side because of traction on the investing layer of deep fascia. Based on their experience with parotidectomies, Baker and Conley observed that the marginal mandibular nerve nearly invariably runs 1 to 2 cm below the bottom border of the mandible. This study unequivocally shows that the path of the mandibular nerve differs between neck dissection and preserved cadavers.[38]

BRANCHING PATTERNS AND COMMUNICATIONS: Despite the widespread misconception that the marginal mandibular nerve is a single branch, it actually travels in one or two branches towards the oral commissure before terminating in several branches to innervate the muscles of the chin and lower lip. [14,28,39] Studies by Dingman, who found two branches in 67% of the dissected specimens, and Wang,[13] who found two or more branches in 68% of the specimens, refuted this conventional wisdom. In every example, Nelson et al. described three branches.[28] In Balagopal et al study, 12.8% of patients had two branches, and 6.9% had three or more branches.[10] The mean distance from the lower jaw was just 1.73 mm, despite a broad variance in the number of branches and their placement in reference to the facial artery. It was also reported in their study that the marginal mandibular nerve had numerous branches in 15% of men and 30% of women. When Batra et al[14] looked for peripheral contacts between the MMN and the other facial nerve branches, they discovered that in 12% of the instances, there was communication between the MMN and the buccal branch. Additionally, they discovered that it spoke with the mental nerve frequently (28%). In 2 out of 25 cases, Brennan et al[40] discovered connections between the marginal mandibular division of the facial nerve and the great auricular nerve. In the investigation by Karapinar et al[41] communications with the buccal branch were only observed in 2 specimens (4.6%); in the remaining 42 specimens (95.4%), no communications were found.

CLINICAL IMPLICATIONS: Marginal mandibular nerve frequently sustains accidental damage at this location during submandibular area procedures. Between 0 and 20% of cases of injury to the marginal mandibular nerve are reported to occur following submandibular gland excision.[42-44] However, because underreporting occurs and the majority of these studies are retrospective, it is possible that the true incidence is higher.[3] The nerve passes most superficially across the facial artery and vein, just anterior to the face artery, making it the danger zone. Due to its superficial course and the thin superficial musculoaponeurotic system, the marginal mandibular nerve is particularly susceptible at this location. According to Seckel, the region where the nerve crosses across facial arteries is referred to as the "danger zone" because it is where the platysma-SMAS thins out and puts the MMN at greater risk of iatrogenic harm.[45] The center of this zone, which has a radius of 2 cm, is said to be 2 cm posterior to the labial commissure. Planning dissections superficial to platysma-SMAS as the nerve transits into the subplatysmal plane where it meets the facial artery along the inferior mandibular edge will assure safe dissections in this zone. Because of the superficial position of the nerve near the mandibular boundary, nerve injury may occur more frequently with jowl and neck liposuction than with other procedures. Neurapraxia may result from blunt trauma following liposuction. In 16–23% of individuals, dissection around the nerve to identify it resulted in transient neuropraxia, which typically lasted for a few weeks.[16,46]

CONCLUSION

Comprehending the intricate structure and diverse pathways of the marginal mandibular nerve is crucial for surgeons engaged in procedures within the head and neck areas. Understanding the likely anatomical course, branches, and landmarks utilized for nerve isolation is paramount. Surgeons should formulate surgical approaches specifically crafted to safeguard the nerve, aiming to prevent potential damage and mitigate associated risks, such as cosmetic disfigurement and functional

impairments. The emphasis on continuous research and advancements in surgical techniques remains pivotal to minimize these complications.

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