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RISK FACTORS ASSOCIATED WITH LINGUAL NERVE PARAESTHESIA IN RELATION TO MANDIBULAR THIRD MOLAR SURGERY: REVIEW OF LITERATURE

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ABSTRACT

Purpose: The aim of the present study was to identify and discuss risk factors associated with mandibular third molar surgery, that could help the surgeon to prevent or minimize the risk of lingual nerve injury in mandibular third molar extraction. **Materials and Methods:** An electronic search was conducted across the various databases such as PUBMED, SCOPUS, EMBASE. In addition, a search over the Google search engine was conducted to find related studies. The search terms used were were "lingual nerve injury", lingual nerve and paraesthesia", "lingual nerve and prevention", "lingual nerve and anatomy", "lingual nerve and third molar or wisdom tooth", "lingual nerve and lingual flap", "lingual nerve and lingual split", "lingual nerve and mandibular block" and "lingual nerve and anaesthetics". **Results:** A total of nine risk factors have been identified that are associated with lingual nerve injury or paraesthesia in relation to third molar surgery. **Conclusion:** Through this paper, any reader can easily comprehend the effect of each of the risk factors by relating to best evidence available, thus making it easy to apply the academic knowledge towards preventing lingual nerve injury.

KEYWORDS: Lingual nerve paraesthesia, lingual nerve injury, mandibular third molar surgery, mandibular third molar extraction, lingual flap retraction, risk factors lingual nerve injury.

INTRODUCTION

Lingual nerve injuries may occur during routine procedures like mandibular third molar extractions, inferior alveolar nerve blocks, periodontal surgeries and placement of dental implants.[1] In relation to lingual nerve injury resulting from extraction of mandibular third molars, a wide range[2,3] of incidence has been reported, from 0% in study by Gomes et al[4] (2005) to 22% in some studies.[2,3] The clinical signs of such an injury may include hypoesthesia, hyperesthesia, anaesthesia, dysesthesia and altered taste sensation in the corresponding side of tongue. Such symptoms and signs are usually transient, with different studies reporting the chance of spontaneous recovery as 60% at three months and 35% at six months.[5] However, when the effects of injury last for more than six months, the chances of spontaneous recovery are significantly lower and may be considered permanent.[6] Bagheri et al[5] showed that in patients with lingual nerve injury lasting longer than 9 months, the chances of recovery are less than 10%. Zuniga et al[7] reported that the incidence of permanent lingual nerve injury following third molar extraction was in a range of 0.04% to 0.6%, while Blackburn et al[8] reported the upper range as 2%. Though the incidence of lingual nerve injury associated with mandibular third molar surgery is low, patients should be informed about the associated complications before the procedure.

MATERIALS AND METHODS

An electronic search was conducted across the various databases such as PUBMED, SCOPUS, EMBASE. In addition, a search over the Google search engine was conducted to find related studies. The search terms used were "lingual nerve injury", lingual nerve and paraesthesia" , "lingual nerve and prevention" , "lingual nerve and anatomy", "lingual nerve and third molar or wisdom tooth", "lingual nerve and lingual flap", "lingual nerve and lingual split", "lingual nerve and mandibular

block" and "lingual nerve and anaesthetics".

The abstract of each article was viewed and the article was analyzed on basis of following selection criteria : for the surgical section, articles reported clear and complete information on the technique used, the number of procedures, the number of extracted third molars, the relative incidence of temporary and permanent nerve damage with at least six months of follow-up; for the section related to local anaesthesia, articles reported the data on incidence, mechanisms and preventive standards of nerve damage; for the anatomy section, articles reported data on topographical relations between the lingual nerve and neighbouring anatomical relations. Cross-checking was carried out using the references of all collected articles and the missing studies that met the above mentioned selection criteria, were added. Articles that were not in English language, were excluded. Owing to considerable differences in study design of different studies, it was not possible to apply any statistical method to determine the risk of bias and the degree of inconsistency (heterogeneity).

RESULTS

LINGUAL INCLINATION AND LINGUAL FLAP RETRACTION – As reported by Pichler et al[9] (2001), lingual nerve injury is 8.8 times more likely to occur in buccal approach with lingual retractor than buccal approach without lingual retractor. Various studies have reported that the incidence of temporary lingual nerve injury is more frequent with lingual flap retraction[10] but it decreases the chances of permanent lingual nerve injury. Pogrel et al[11] and Greenwood et al[12] recommend lingual flap retraction with broader retractors. Although different types of lingual retractors have been proposed, including those of Howarth, Ward, Meade, Hovell, Walters and Rowe, there is no scientific evidence supporting the superiority of one instrument over another, the choice of which seems strongly influenced by the surgeon's personal experience.[12-16] However, a large and smooth surface rather than a narrow and pointed active retractor surface has been suggested to be less traumatic on the lingual nerve during flap retraction.[12] Some investigators have suggested that lingual flap detachment for retractor placement, although associated with a strong possibility of temporary nerve damage, could decrease the incidence of permanent nerve injury, through improved access to and better visibility of the surgical area, thus ensuring safer use of manual and rotating instruments.[11,12,14,17]

Pippi et al[10] (2017) presented a review of literature, suggesting to avoid lingual flap detachment as much as possible to decrease the incidence of lingual nerve damage. They further recommended that lingual nerve protection through lingual flap should be restricted to selected cases in which the presence of more unfavourable surgical variables predict a high risk of nerve injury.

LINGUAL NERVE ANATOMICAL RELATION TO THIRD MOLAR – Pippi et al[10] found that the average horizontal distance between the lingual nerve and the third molar lingual alveolar wall was approximately 3.05 mm (standard error [SE], 0.48 mm; range 0.57 to 9.3 mm). The average vertical distance from the lingual nerve to top of alveolar ridge was 7.24 mm (SE, 0.95 mm; range, 2.28 to 16.8 mm). Direct contact between the lingual nerve and lingual alveolar wall of third molar was reported in a wide range of cases (0 to 62%). The nerve was located at the same level or above the top of the ridge in 0 to 17.6% of cases. Lingual nerve minimum and maximum diameters in the third molar region were 1.86 mm and 3.45 mm, respectively.

The influence of degree of mandibular atrophy on the topographical relations of the lingual nerve has been overlooked in many studies. In this regard, Dias et al[18] (2015) have stressed the strong discrepancy in location of lingual nerve in relation to type of edentulism, noting the possible greater proximity of lingual nerve to the mandibular alveolar crest, in edentulous patients. Thus, marked bone loss could be an important risk factor for lingual nerve injury during routine oral surgery involving lingual access flap management in the posterior region of the mandible.[19] Almost all anatomic studies have highlighted the risk of the lingual nerve being close to the lingual surface of the alveolar process (0 to 62%) or at a level higher than the mandibular bone crest (0 to 17.6%) and almost directly on the retromolar region.[18-26]

LINGUAL NERVE INJURY AND SURGICAL TECHNIQUE – A review of literature by Pippi et al[10] showed that for the variable "temporary lingual nerve injury in buccal approach plus lingual flap retraction versus buccal approach", the buccal approach plus lingual flap retraction was significantly associated with higher chances of lingual nerve injury, as compared to buccal approach. However, for "permanent lingual nerve injury", no statistically significant differences were found between these two techniques.

For the variable "temporary lingual nerve injury in lingual split technique versus buccal approach plus lingual flap retraction", the lingual split technique was more significantly associated to lingual nerve injury, as compared to buccal approach plus lingual flap retraction. However, for permanent lingual nerve damage, no statistically significant difference was found between the two techniques.

For the variable "lingual split technique versus buccal approach", there was a significantly higher risk of temporary and permanent lingual nerve damage for the lingual split technique.

STATE OF ERUPTION – Valmeseda-Castellon et al[27] reported that incidence of lingual nerve paraesthesia was higher when the mandibular third molar was in an unerupted state, i.e. completely covered by bone.

TOOTH POSITION – Lata J et al[28] have reported that in addition to buccolingual inclination of tooth, incidence of lingual nerve paraesthesia was higher when the mandibular third molar was in horizontal and distoangular impaction. These cases mostly require distal bone cutting which has been reported to be a causative factor for lingual nerve paraesthesia, as confirmed by Valmeseda-Castellon et al.[27]

DEPTH OF IMPACTION – Mason[29] found that depth of impaction is significantly associated to lingual nerve injury. This finding was confirmed by Lata J et al[28] who reported that incidence of lingual nerve paraesthesia was higher in cases where mandibular third molar was present below the cemento-enamel junction of mandibular third molar.

TOOTH SECTIONING AND OSTECTOMY – During tooth sectioning, the lingual nerve could be involved by the bur. For mandibular third molar surgery, the predisposing conditions include pre-existing bone fenestrations and iatrogenic intraoperative perforation of lingual alveolar wall at the level of the lingual nerve.[10] Therefore, some authors suggest that it would be a good rule to perform subtotal mandibular third molar sectioning and then complete the separation of fragments using an elevator or other hand instruments.[30] However, tooth sectioning can decrease the extent of ostectomy or even help or even help avoid it altogether in some cases, thus making it a possible protective factor against lingual nerve injury.[27,30,31] In a review of literature by Pippi et al,[10] removal of periradicular bone tissue, especially at the lingual and distolingual sites, was strongly correlated to lingual nerve damage. Furthermore, the authors stated that confounding factors which play a role in surgical results, cannot be ignored. These include presence of inflammatory adhesions as a result of recurrent pericoronitis, lingual nerve and mandibular third molar local anatomic variability, surgeon's skill and experience and variables related to surgical technique (anaesthesia, flap design, need for ostectomy and its characteristics, suturing, etc).

Several authors have suggested that ostectomy should be carried out only when a total view of the periradicular bone surface is possible. Thus ostectomy should not be blindly performed, especially at mandibular third molar distal and distolingual sites.[8,32,33] If preoperative planning indicates the need to remove bone at mandibular third molar distal and distoangular sites, then limited retraction of the lingual tissue might be appropriate to improve surgical field visibility and to allow lingual nerve protection during bur use.[34]

LINGUAL NERVE INJURY AND REGIONAL ANAESTHESIA – Damage to the lingual nerve during inferior alveolar nerve block, can be directly caused by the syringe needle[35-37] during needle penetration because the nerve cannot be easily moved away during needle advancement as it is stabilized within the interpterygoid fascia, when the mouth is fully open. The nerve can also be directly damaged by the needle during its retraction from the tissues,[35,38] especially when common chamfered needles are used because their tips are easily susceptible to distortion and irregular curvatures, particularly as a result of bone contact or multiple injections. That could break the perineurium and induce herniation of endoneurium, along with interruption of multiple nerve fibers or entire fascicles.[38,39,40] Furthermore, needle penetration can be responsible for direct trauma to the intraneural vessels, with the formation of intraneural haematoma, that can exert a certain degree of compression to the nerve fibers, leading to a focal block of nerve transmission, without any interruption of axonal and perineural continuity. The return to normality can take several weeks because the progressive decrease of haematoma pressure allows nerve remyelination.[35-38, 40,41]

Some authors have suggested that local anaesthetics can cause localized chemical injury to the nerve, if deposited in the intrafascicular space or inside the nerve during needle retraction.[35,37] Chemical trauma can lead to demyelination, axonal degeneration, inflammation and edema of endoneural fibers.[42] In this regard, articaine and prilocaine have shown greater cytotoxic power than lidocaine.[35,37,40,43]

Harn et al[36] reported an approximately 3.62% chance of lingual nerve trauma, whenever mandibular nerve block anaesthesia is performed, while Krafft et al[44] found a 0.15% incidence of lingual nerve injury during nerve block anaesthesia not performed for surgery. Other studies have shown that nerve damage from local anaesthesia more frequently affected the lingual nerve (more than two thirds of cases) rather than the inferior alveolar nerve.[35,45,46] Although the diameter of the two nerves was found to be approximately the same at the injection site, the lingual nerve seemed to be more exposed to needle trauma and possess fewer nerve fascicles, compared with the inferior alveolar nerve.[47] Pogrel et al[47] reported that in approximately 33% of cases the lingual nerve was formed by only a single fascicle at the injection site, as opposed to 7 to 39 fascicles in the mandibular third molar area. This may explain why nerve alterations resulting from local anaesthesia most frequently involve the entire lingual nerve distribution area.[35,44,47]

SUTURE – Some studies have suggested suture as a possible risk factor for lingual nerve injury, through direct trauma from the needle or through "throttling" during knot closure.[11,17,34] Therefore, it is recommended to avoid inserting the needle too apically in relation to the incision line. Chossegros et al[17] have suggested safe insertion of the needle at approximately 3 mm from the gingival margin of lingual flap.

CONCLUSION

A thorough analysis of various risk factors associated

with lingual nerve paraesthesia in relation to mandibular third molar surgery revealed nine underlying factors which need to be understood in order to prevent lingual nerve injury. Through this paper, any reader can easily comprehend the effect of each of these risk factors by relating to best evidence available, thus making it easy to apply the academic knowledge towards preventing lingual nerve injury.

Conflict of interests

The author declares that there is no conflict of interests that could influence this work.

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Ethical approval

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