Journal of Oral and Dental Care

Review Article

Nerve Injuries in Dentistry: Lingual Nerve

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ABSTRACT

Objectives: The aim of this review was to analyze the incidence of injuries of the lingual nerve due to third molar surgical extractions. The most relevant etiological factors, diagnostic methods and mean recovery periods were analysed. In addition, different therapeutical approaches were described.

Material and Methods: Literature was selected through search of PubMed, Embase and Cochrane electronic database. The keywords used for search were lingual nerve damage, nerve damage and medical treatment. The search was restricted to English language articles.

Results and Discussion: In total 42 literature sources were obtained and reviewed.
The lingual nerve course is highly variable in the vertical dimension. In addition, often the nerve path is submucosal, in contact with the periosteum.

Due to these anatomical relationships, the lingual nerve is very vulnerable when performing surgical procedures in the posterior area of the jaw such as the extractions of lower third molars, the placement of implants, removal of cysts and inferior alveolar nerve block procedures.

Possible loss of lingual sensation is a complication that surgeons must be aware of. This complication causes physiological and psychological disorders in the patient. A full anatomical knowledge of the area is fundamental to prevent this event. The most common clinical outcome is an initial period of anesthesia that gives way to a series of symptoms that can last for months or years after treatment.

Conclusions: A full knowledge of the anatomy of the lingual nerve is essential as a first step for prevention.

Keywords

Lingual nerve damage, Medical treatment, Nerve damage.

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Received: January 08, 2023; **Accepted:** February 20, 2023; **Published:** February 26, 2023

Citation: Carmen L Carriches1, Luis A Moreno-López, Ricardo Bahram-Taheri, José F Martín-Morales, et al. Nerve Injuries in Dentistry: Lingual Nerve. J Oral Dental Care. 2023;1(1):1-5.

Introduction

The lingual nerve is the anterior terminal branch of the inferior maxillary nerve, which is a branch of the trigeminal nerve. It is found first in the interpterygoid space where an anastomosis occurs with the chorda tympanum. It travels around the pterygomandibular region by contacting the anterior border of the internal pterygoid muscle and the inner aspect of the mandible; it then passes immediately below the mucosa of the floor of the mouth. This nerve carries sensory fibers of the mucosa of the anterior two-thirds of the tongue, the adjacent buccal floor, the lingual gum, and the sublingual gland [1].

In certain cases, the nerve has a very superficial location, descending through the pterygomandibular space almost on the surface of the jaw. In addition, in some cases this nerve has been seen in cadavers on the retromolar trigone. Once it leaves this space, it runs superficially just below the mucosa at the periosteum of the lingual lamina of the alveolar process near the gingival margin [2].

The histological classification of nerve injuries is [3]:

1. Neurotmesis: fragmentation that involves the separation of the two parts. All essential structures have been divided. There is a section of all connective tissue layers of the nerve stem, axon discontinuity, myelin sheath, endoneurium, perineurium and epineurium.
2. Axonotmesis: There is less severe damage to nerve fibers than in the neurotmesis. Peripheral degeneration occurs. The epineurium and the more intimate structures supporting the nerve are slightly injured. The internal architecture is well preserved. Recovery is spontaneous and of good quality because the regeneration is guided by intact stems.
3. Neurapraxia. The injury occurs in the absence of peripheral degeneration. Anatomical damage is minimal and axon degeneration does not occur. Recovery is always complete and occurs with remyelination within several weeks.

Objectives

The aim of this review was to analyze the incidence of injuries of the lingual nerve due to third molar surgical extractions. The most relevant etiological factors, diagnostic methods and mean recovery periods were analysed. In addition, different therapeutical approaches were described.

Material and Methods

Literature was selected through search of PubMed, Embase and Cochrane electronic database. The keywords used for search were lingual nerve damage, nerve damage and medical treatment. The search was restricted to English language articles. In total 42 literature sources were obtained and reviewed.

Results and Discussion

The incidence varies, according to different authors, between 0.06% and 11.5% for temporal lesions and permanent injuries range from 0.17% to 13% [4-20] (Table 1).

Author	Year	Temporal (%)	Final (%)
Red (4)	1983	6.6	0
Goldberg (5)	1985	0.6	0.2
Alling (6)	1986	0.06	13
Sisk (7)	1986	0.8	0.25
Wofford (8)	1987	0.7	0.17
Blackburn (9)	1989	11	0.5
Jones (10)	1992	5	1
Chiapasco (11)	1996	0.05	0
Appiah-Anane (12)	1997	0.2	0
Robinson (13)	1999	4.23	0
Gargallo-Abiol (14)	2000	2.74	0
Malden (15)	2002	0.4	0
Pogrel (16)	2004	0.4	0
Xerxes (17)	2006	6.5	1
Xerxes (18)	2010	1.8	1.6
Years (19)	2011	6.6	1.1
Shad (20)	2015	11.57	0.5

Table 1: Lingual nerve damage incidence.

The most frequent cause of injury to the lingual nerve is iatrogenic injury due to poor flap design, misuse of instruments and fracture of the lingual bone lamina. Although it is not always due to surgical error.

For many years, the most frequent causes of this injury have been analyzed [21]:

1. The local anesthetic needle going through the nerve stem.

According to Harn [22] there is a 3.62% chance of damaging the lingual nerve during the administration of anesthesia, due to direct trauma with the needle, although most of these injuries produce neuropraxia and recover in approximately two weeks.

The injury can be caused by the anesthetic fluid or by compression that causes a hemorrhage.

Frequently the patient's reaction during the injection suggests nerve trauma (the patient refers to "electric shock", "intense pain" or "burning¨).

2. Abnormality in anatomy.

The nerves can run higher into the lingual mucosa and even over the alveolar crest. It is proven that the anatomy of the lingual nerve undergoes variations in many individuals [2].

3. Retraction of a lingual flap.

It can be a direct cause of nerve injury from crushing or stretching the nerve. Blackburn [9] states that there are more lesions of the lingual nerve when using a retractor, as does Mason [23] who also agrees that retracting the lingual flap is associated with an increased incidence of injury.

Retracting the lingual flap is also difficult for some reason, such as the presence of scar tissue, soft tissue tearing during separation or

unusual bleeding, there is greater dysesthesia when the incision is made towards the lingual area [24].

There is a great controversy about the use or not of the retractor. When inserting the retractor we can cause damage to the nerve. However, it can protect it during the ostectomy. The most recent literature advocates the use of the retractor [25]. The retraction of a lingual flap favors surgery which can avoid injury [16].

4. Absence of lingual lamina due to infection or third molar inclined towards lingual. This situation can produce postoperative edema or infection [26].
5. Fracture of the lingual lamina. This is a very important factor because of the anatomical relationships already explained.
6. Removal of a follicle from a third lower molar attached to the lingual tissues.

Sometimes the pericoronary sac is very attached to the lingual tissues and when pulled abruptly can damage the nerve [24].

7. Lingual flap design.

The nerve can be severed by making the surgical incision too lingualized if there is a small anatomical variation.

8. The suture needle going too deep through the lingual flap. Just as it can happen with the anesthesia needle.
9. Lingual area examination to locate a fractured root. Because of the anatomical proximity.
10. The bur of the handpiece reaches the lingual nerve during bone removal over the distolingual segment of the tooth crown. This event may happen in complicated horizontal or distoangular inclusions. In these cases, the lingual retractor could protect the nerve.
11. The bur passes through the lingual lamina when the tooth is sectioned. Great care must be taken when operating with the handpiece in this area.
12. Scar tissue formation after surgery of the third molar affecting the lingual nerve. The lingual nerve may become trapped in this scar tissue resulting in persistent paresthesia. Scar tissue strangles the nerve producing ischemia with hypoxia induced by this pressure (hypoxic ischemic neuropathy), nerve conduction is blocked and the regeneration of injured fibers is prevented [24].
13. Tooth angulation. The distoangular and horizontal position are more frequently related to injuries of the lingual nerve [19,27].
14. Duration of surgery. Time represents the degree of difficulty. In longer and more complicated procedures there is a higher risk of injury [23]. Blackburn [9] and Sadler [28] found a higher incidence of lingual dysesthesia in cases where the operation was performed under general anesthesia. It should be noted that general anesthesia usually involves more complicated procedures. Sisk [17] states that the experience of the surgeon is very significant in minimizing the risk of the occurrence of lingual dysesthesia. Cases of lingual nerve injury have been reported on orotracheal intubation [29].

The symptoms of lingual nerve injury are classified as: [30]

Paresthesia: Altered sensation ranging from pain, cold, heat and numbness to punctures, tingling and burning. The most characteristic sensation is tingling (needles and pins).

Hyperesthesia: There is a hyperacute sensation. It is usually a sign of recovery. It may seem confusing for the patient as during the recovery period there is increased sensitivity to stimuli.

Dysesthesia: Sensation of pain from stimulus or produced spontaneously. The sensation is diminished but not completely lost. The biggest sensory loss is to touch.

Hypoesthesia to anesthesia: From partial to total loss of sensation. Implies more severe nerve injury because of conduction loss. Due to the lack of sensation, the patient can easily bite his tongue without feeling it, he can also drool, have masticatory dysfunction, burning sensation, pain and even have impaired speech [6,24,31]. It has been related also to loss of taste due to involvement of the chorda tympani nerve. Less frequently, atrophy of the fungiform papillae may occur [32].

The diagnosis is based on exhaustive clinical tests, which must be performed and collected by the same evaluator in the patient's medical history.

The most used are:

- Subjective references of the patient. Blackburn [33] suggests asking the following questions: To assess touch, if you touch your tongue with your finger can you feel your finger? To assess taste, is your sense of taste affected? to assess temperature can you distinguish the temperature of food and drink on that side of the tongue?, if you pass your tongue over your teeth, can you feel if they are clean or dirty?, trauma, do you bite your tongue by accident?, tingling, do you feel tingling in your tongue? speech, is speech affected? (lisp, etc) Everything must be recorded in the medical record.
- Two-point discrimination test. A vernier caliper is progressively closed or opened and is noted in a diagram when the patient is able to discriminate two points as different. It is also performed on the healthy side that will act as control [34].
- Static light touch test. To see the tactile sensitivity of the tongue, with a cotton swab or suture thread. The midpoint of the tongue and two points equidistant from the midline are stimulated. If the lingual nerve is well it has to perceive 100% of the stimuli. Points where the patient does not feel the stimulus or feel it differently should be recorded. Recovery begins at the tip of the tongue and ends at the posterior lateral area [33].
- Tactile extinction test. It refers to the inability to detect simultaneous and bilateral stimuli. Under normal conditions a subject is able to perceive 100%.
- Puncture test. A fine needle is applied firmly and quickly until a small spot of blood appears. The patient should feel severe and sharp pain [35].
- Thermal discrimmination test. With a cotton soaked in ethyl chloride, a non-soaked applicator will be used as a placebo [35].
- Testing should be done after the injury and repeated every month after. The hypoesthesia area can be drawn with a special pen and then photographed at a fixed distance. Another option is to measure the area and transcribe it into a diagram [36]. These periodic evaluations allow to record the evolution of the lesion.

The treatment can be:

- Passive or waiting treatment. The patient is reassured that it is a temporary discomfort that will subside after weeks, months or years. It is usually difficult to predict the degree of nerve regeneration since the process is very slow. An early partial recovery is a very good symptom.
- Medical treatment. Although there is not much literature on the subject, Vitamin B12 (Cobalamin) is important in the regeneration of damaged nerve tissues [37]. Cyanocobalamin 1500 units/day are used [19]. They are also useful steroidal anti-inflammatory drugs to reduce postoperative edema and accelerate nerve recovery [38]. Improvements have been found in animal models with dexamethasone, methylprednisolone, atorvastatin and L-carnitine [39].
- Surgical treatment with microsurgery. The lingual nerve is localized, the traumatic neuroma is removed, and the edges are sutured without tension using 9-0 nylon suture. It is recommended to wait between 3 and 6 months to see if spontaneous recovery occurs [40]. In cases of patients who have persistent neuropathic pain or hyperalgesia, good results are achieved to eliminate these symptoms according some authors [41]. Although others claim that surgical repair does not improve neuropathic pain [42].

The prognosis is better when the size of the affected area is reduced and also if there is only loss of sensation at the tip of the tongue or only at the lateral edge rather than if it affects several extended areas [23]. The faster the appearance of spontaneous recovery signs, the better the prognosis. If recovery takes more than 6 months it may not be fully achieved [10,23]. The average recovery time from injuries is between 3.5 weeks and 7 months [4,9].

Conclusions

A full knowledge of the anatomy of the lingual nerve is essential as a first step for prevention. In addition, special care should be taken when performing surgery in this region because injuries to this nerve cause abnormal sensations to the patient and can lead to legal claims.

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