Accidental injection related nerve damage following a mandibular block - Narrative review

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ABSTRACT

Purpose: The aim of this article is to review the signs, causes and management of non-surgical damage to the inferior alveolar or lingual nerve following a mandibular block.

Materials and Methods: The following electronic databases - Google Scholar, Science Direct, Pubmed and The Cochrane Library were searched. The publication year of each article selected range from 2005 to 2016. No language restrictions were applied.

Results: The exact cause of nerve injury is uncertain, but it may be related to one or more factors including direct trauma to the nerve caused by the needle, hematoma formation or potential neurotoxicity from the local anesthetic. In an event such accident does occur, the clinician must manage this situation in a proper and prompt manner whether it is pharmacologically or surgically and according to the severity of the damage.

Conclusions: Nerve injury following a dental injection is considered to be rare, however some may experience undesired side effects (temporary or permanent) after mandibular block analgesia. These injuries can affect the patients' quality of life leading to potential social, emotional, psychological and/or functional problems. Many of these injuries can be avoided with careful patient evaluation and planning by the dentist.

KEYWORDS

Impaired sensation, local anesthetics, needle damage/injury, mandibular nerve/block.

INTRODUCTION

Local anesthetics are the most frequently used drugs in clinical dental practice.[1, 2] A temporary reduction of nociception (pain) associated with dental treatments can be achieved.[2, 3, 4] Using analgesia during a variety of dental procedures is essential in order to complete sessions successfully[3] and reduce the patients' risk of having a negative experience.[4] Although the use of analgesia is usually safe and sensation returns to normal after a short period of time, this procedure may trigger complications. [2-10] Nerve injury following a dental injection is considered to be rare,[8] however a small portion of patients may experience undesired side effects of neurosensory function impairment (temporary or permanent) after a mandibular block analgesia.[1-11] These injuries can affect the patients quality of life leading to potential social, emotional, psychological and/or functional problems.[7, 9-11] Approximately 90 percent of these injuries are temporary and heal within 8 weeks. However, if nerve injury persists more than 6 months, the risk of permanent injury is increased.[10, 11] Current research has shown that the inferior alveolar nerve has better prognosis in comparison to the lingual nerve.[10]

Studies about the exact etiology of injection related nerve injury are diverse and controversial.[2, 4-6, 8, 10] Pogrel and colleagues,[5] suggested three mechanisms:

- Mechanical injury due to direct trauma from needle injection;[2, 4-8, 10]
- Mechanical injury caused by hematoma formation;[2, 4-6, 8, 10]
- Neurotoxicity of local anesthetic.[2, 4-8, 10]

Following a mandibular block, the inferior alveolar and lingual nerve can be injured. Injury to these nerves cause impaired sensation and pain to the area innervated by the nerve.

This impaired sensation can be classified as (www.iasp-pain.org):[11]

- Paraesthesia: An abnormal sensation, whether it be spontaneous or evoked.
- Anaesthesia: Complete absence of perception of stimuli including touching.
- Dysaesthesia: An unpleasant abnormal sensation, whether evoked or spontaneous.
- Hyperalgesia: Increased pain from a stimulus that normally provokes pain.
- Allodynia: Pain due to a stimulus that does not normally cause pain.
- Hypoaesthesia: Decreased sensitivity to stimulation, excluding the special senses.
- Hyperaethesia: Increased sensitivity to stimulation, excluding special senses.

Altered sensation caused by inferior alveolar nerve damage can be located in the ipsilateral lower lip, buccal mandibular gingivae, chin and dentition. Lingual nerve damage may lead to unilateral sensory deficit of the two-thirds of the tongue and lingual mandibular gingivae. Injury to the lingual nerve may also cause ageusia (loss of taste perception) and dysguesia (altered taste perception).[11]

MATERIALS AND METHODS

The following electronic databases: Google Scholar, Science Direct, Pubmed and The Cochrane Library were searched. The publication year of each article selected range from 2005 to 2016. No language restrictions were applied.

The objective of this article is to evaluate the signs, causes and management of non-surgical damage to the inferior alveolar or lingual nerve following a mandibular block.

RESULTS

Despite the potential for nerve injury to occur following a dental injection, estimates of its incidence are low [2, 4, 12] and found to be approximately 1:785 000, with 4 percent articaine and 4 percent prilocaine.[6] Furthermore, after a mandibular block, the lingual nerve is at greater risk of injury than the inferior alveolar nerve.[2, 4, 6, 8, 12] When the mouth is opened for a mandibular block, the lingual nerve is stretched tightly and is just few millimeters beneath the mucosal surface. For this reason, it is less likely to deflect during an injection.[2] The lingual nerve is also more susceptible than the inferior alveolar nerve to needle-related injury due to structural differences. At the area of the mandibular lingula, the lingual nerve is constituted of few fascicles or even only one fascicle, opposed to the inferior alveolar nerve that is multi-fascicular at this point.[2, 4, 6, 10] The exact cause of nerve injury is uncertain, but it may be related to one or more factors including direct trauma to the nerve caused by the needle, hematoma formation or potential neurotoxicity from the local anesthetic.[2, 4-8, 10]

Direct Trauma due to Needle Injection

Several authors suggest that the direct mandibular block technique, which consists in hitting the bone before injecting the local anesthetic, may lead to bur deformation at the needle tip, consequently transecting the nerve upon its withdrawal.[2, 10] Harn and Durham[5] reported an electric shock sensation upon needle contact with the nerve.[2, 5, 8, 12] However, a study conducted by Kraft and Hickel reported that only 7 percent of patients experienced such electric shock sensation, however none suffered from temporary or permanent nerve injury.[5, 8] Pogrel and colleagues concluded that is unlikely for a needle (25-gauge) which largest diameter is 0.5 millimeters to shear all nerve fibers and connective tissue layers since the diameter of the mandibular nerve measures up to 3 millimeters, and the lingual nerve diameter up to 2 millimeters.[2, 4, 5] This indicates that direct trauma from the needle injection has a minor chance of being the etiology for the nerve injury.[2, 5, 8]

Hematoma Formation

A second hypothesis states that the needle may traumatize the intraneural blood supply, creating an intraneural hematoma within the nerve, as well as outside the nerve. A hematoma within the nerve is capable of compressing nerve fibers involving the epineurium. Nerve damage could be extensive 30 minutes after the injection. Hematoma formation outside the epineurium can

compress the nerve and affect the segmental blood supply. If direct needle injury to the medial pterygoid muscle occurs, then concurrent trismus may appear.[2, 4] Recovery over time is possible as pressure is released and subsequent remyelinization occurs.[4]

Neurotoxicity from the local anesthetic

Chemical trauma may be caused by the anesthetic itself, if injected intra-fascicularly or if deposited within the nerve as the needle is withdrawn.[2, 4] This type of trauma has been shown to cause demyelination, axonal degeneration and inflammation of neighboring nerve fibers within the fascicles. Such occurrence leads to endoneurial edema, consequently causing ischemia, followed by an attempt of the nerve to heal. During this process of reperfusion, reactive free radicals can provoke cytotoxic nerve damage.[4] Some studies suggest that the use of 4 percent articaine and 4 percent prilocaine in dentistry cause more injuries than 2 percent lidocaine.[2, 4, 7, 10] Studies by Haas and Lennon, Hillerup and Jensen and Gaffen and Haas suggest that these 4 percent concentrations are more likely to produce damage.[6, 7, 10] Based on studies by Perez-Castro et al, where increasing the concentration of the local anesthetic affected the neurons in vitro survival rate, the concentration of the local anesthetic agent may be associated to persistent neuropathy.[10] Therefore, dentists should consider these results when choosing 4 percent local anesthetics for mandibular block anesthesia.[6]

DISCUSSION

Few studies have analyzed treatment for this type of nerve injury. Both surgical and medical treatment have been used, with different success rates.[4, 11] Most patients recover normally without treatment.[9] However, some patients must be referred to an oral and maxillofacial surgeon for microsurgery.[4, 9, 10] Microsurgery may be indicated when confirmed transection of the nerve occurs or if total anesthesia or dysesthesia in the affected area prolongs for more than 2 months. The well-informed dentist must perform an initial evaluation and then refer the patient at the appropriate time to maximize the chances of functional recovery.[9] Although significant functional improvement is seen in high risk nerve trauma cases, regaining full sensation is unlikely.[4, 9]

Another approach that has been applied in treating several patients is pharmacologic therapy.[4, 11] Since peripheral and central neuronal dysfunction may cause neuropathic pain, a medical approach using antiepileptics, antidepressants and analgesics can be applied.[4, 9, 11] Benefits have been shown in patients suffering from dyesthesias and those sympathetically mediated.[4]

CONCLUSIONS

Nerve damage following a mandibular block can have serious consequences for the patient, pain being a major symptom. Nevertheless, injury can be prevented. One should always keep in mind that the overall prognosis is good and most cases recover progressively within the first few weeks. However, the longer the symptoms persist, the lower the recovery rate. Dentists should take the following precautions during their practice:

- Preference for local anesthetics infiltrations instead of mandibular blocks,
- Avoidance of multiple blocks and high concentration local anesthetics.
- Lastly, 2 percent lidocaine (instead of articaine/prilocaine) should be used when possible in mandibular blocks.

In conclusion, if nerve trauma does occur, it is important to appropriately manage the patient and to effectively communicate the implications and prognosis of such event.

CONFLICT OF INTEREST

The authors declares that there is no conflict of interest regarding the publication of this article.

References

1. Khalil H. Local anesthetics dosage still a problem for most dentists: A survey of current knowledge and awareness. The Saudi Journal for Dental Research. 2014;5(1):49-53.
2. Sambrook P, Goss A. Severe adverse reactions to dental local anaesthetics: prolonged mandibular and lingual nerve anaesthesia. Australian Dental Journal. 2011;56(2):154-159.
3. Tzermpos F, Cocos A, Kleftogiannis M, Zarakas M, Iatrou I. Transient Delayed Facial Nerve Palsy After Inferior Alveolar Nerve Block Anesthesia. Anesthesia Progress. 2012;59(1):22-27.
4. Smith M, Lung K. Nerve injuries after Dental Injection: A Review of the Literature. J Can Dent Assoc. 2006;72(6):559-64.
5. Hillerup S, Jensen R, Ersbøll B. Trigeminal nerve injury associated with injection of local anesthetics. The Journal of the American Dental Association. 2011;142(5):531-539.
6. Garisto G, Gaffen A, Lawrence H, Tenenbaum H, Haas D. Occurrence of paresthesia after dental local anesthetic administration in the United States. The Journal of the American Dental Association. 2010;141(7):836-844.
7. Renton T, Adey-Viscuso D, Meechan J, Yilmaz Z. Trigeminal nerve injuries in relation to the local anaesthesia in mandibular injections. BDJ. 2010;209(9):E15-E15.
8. Hillerup S, Jensen R. Nerve injury caused by mandibular block analgesia. International Journal of Oral and Maxillofacial Surgery. 2006;35(5):437-443.
9. Caissie R, Goulet J, Fortin M, Morielli D. Iatrogenic Paresthesia in the Third Division of the Trigeminal Nerve: 12 Years of Clinical Experience. J Can Dent Assoc. 2005;71(3):185-90.
10. Renton T. Prevention of Iatrogenic Inferior Alveolar Nerve Injuries in Relation to Dental Procedures. Dental Update. 2010;37:350-363.
11. Coulthard P, Kushnerev E, Yates J, Walsh T, Patel N, Bailey E et al. Interventions for iatrogenic inferior alveolar and lingual nerve injury. Cochrane Database of Systematic Reviews 2014;(4). Art. No.: CD005293.
12. Pogrel MA. Permanent Nerve Damage from Inferior Alveolar Nerve Blocks - An Update to include Articaine. J Calif Dent Assoc. 2007;35(4):271-73.