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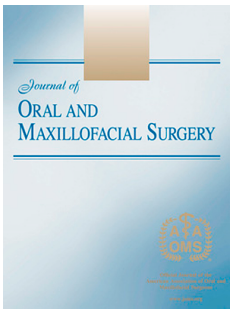

Wide Intraoral Surgical Access to the Inferior Alveolar Nerve During Cryotherapy at the Infratemporal Fossa: Technical Modification

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Wide Intraoral Surgical Access to the Inferior Alveolar Nerve During Cryotherapy at the Infratemporal Fossa: Technical Modification

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Short Title: Surgical Access to the Inferior Alveolar Nerve During Cryotherapy

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Abstract

Trigeminal neuralgia is characterized by unilateral pain in the region supplied by the sensory distribution of the fifth cranial nerve. Pharmacologic therapy is an adequate initial treatment option in 75% of patients. When the Jannetta surgical operation is not available or not indicated, and when conservative treatment fails to relieve the pain or the medication has to be discontinued due to side-effects, one of the remaining surgical options is cryosurgery in the peripherally distributed nerves that emanate from the trigeminal nerve. This technical note aimed to illustrate a perioperative method for exposing and mobilizing the inferior alveolar nerve (IAN) from its bony canal. This approach provided easy access to infratemporal fossa structures during cryotherapy. This technique represented a further development of the technique previously described by our group. This method ensured both direct visualization of the IAN and wide access to the infratemporal fossa during IAN cryotherapy.

Trigeminal neuralgia is a facial pain syndrome with an estimated prevalence of 0.03 to 0.30%.[1,2] It is characterized by unilateral pain (which may become recurrent and chronic) in the region supplied by the sensory distribution of the fifth cranial nerve. Pharmacologic therapy is an adequate initial treatment option in 75% of patients.[3,4] The preferred surgical approach is the Jannetta-operation, when there is an established neurovascular conflict at the

root entry zone of the nerve [5,6]. When this surgical option is not available or not indicated, and when conservative treatment fails to relieve the pain or the medication must be discontinued due to side-effects, one of the remaining surgical options is cryosurgery in the peripheral nerve distribution that emanates from the trigeminal nerve. In 1976, Lloyd et al.[7] first described cryosurgery as a treatment for trigeminal neuralgia to eliminate pain in peripheral nerves. Good results were achieved with an open nitrogen spray directed at the infraorbital nerve. However, that approach requires surgical exposure of the nerve, and when inaccurately applied, the spray is likely to damage adjacent tissue. Moreover, even with the newly developed cryoprobe, wider access is required, particularly in patients that require a redo cryotherapy below a fibrotic region of the nerve that resulted from a previous surgery or cryotherapy at the infratemporal fossa. Direct visualization allows a clear field of view of the operation site, it facilitates the proper application of the cryoprobe, and it ensures that the IAN can be distinguished from the lingual nerve[8-10].

This technical note aimed to illustrate a perioperative method for exposing and mobilizing the IAN from its bony canal. This approach provided easy access to structures in the infratemporal fossa region during cryotherapy. This technique represented a further development of the technique previously described by our group for direct visualization of the IAN during instrumentation and surgical procedures at the mandibular foramen[11]. This modified method ensured both direct visualization of the IAN and wide access at the infratemporal fossa during IAN cryotherapy.

Surgical Technique

The IAN is prone to injury at its point of entry into the mandibular foramen during surgical operations that involve the infratemporal fossa with an intraoral approach. It is necessary to locate the lingula, which lies above the opening of the mandibular canal, and ascertain where

the IAN enters the canal (Fig. 1). Often, the lingula is not directly visible, due to the inclination of the ascending ramus, or due to a thick anterior ridge at the ascending ramus. In those cases, the lingula can be palpated behind the ramus with a nerve hook, but not directly viewed. Also, the extent to which the nerve can be mobilized at the ascending ramus depends on the vertical and sagittal location of the mandibular foramen. The higher and the more posterior the foramen, the less the nerve can be mobilized. Fibrosis and scar formations, due to previous surgeries, can also limit access to the IAN. Therefore, we developed a technique to address these challenges.

Similar to the technique used in the classic sagittal split osteotomy,[12] access to the lingula was achieved by first identifying the lingula with a nerve hook (Fig. 2).

Clamp- and Dumbach retractors were then positioned at the coronoid process to protect the nerve. A suction device was positioned parallel, and about 1 cm cranial, to the Dumbach retractor. Anterior to the IAN, the entire cortical bone of the inner part of the ascending ramus was removed with a thick round drill, while the Dumbach retractor protected the nerve (Fig. 3). The amount of bone removed was about the width of the Dumbach retractor.

With the Dumbach retractor in place, and a proper view of the canal entrance, the soft tissues below were mobilized, and a second Dumbach retractor was placed below the first retractor.

Next, a cut was made in the cortical bone, about 1 cm below the upper surgical bone margin, with the piezzo-tome. The cut passed through the cortex, but no deeper than the cortex (Fig. 4). (The piezzo-tome was the same one used for the lower-border cut in the bilateral sagittal split osteotomy (BSSO)-technique)

After the bone cuts were performed with the piezzo-tome, the bone fragment was removed with a freer or a molt. This procedure freed the IAN over an extended area; the lower part was liberated from the bony canal, and could be readily accessed with a cryoprobe (Fig. 5).

The Dumbach retractor was then repositioned to bring the nerve anterior to the retractor for a direct surgical view (Fig. 6).

It is important to keep in mind that the inferior alveolar artery lies directly posterior to the IAN. With the thick cryoprobe, the nerve was then frozen for about 2 min at -89°C (Fig. 7). This freezing procedure was repeated 3 times.

Discussion

In 2014, Agbaje et al[11] described a surgical technique that ensured safe access to the mandibular nerve at the infratemporal fossa. Although that surgical technique provided sufficient access for orthognathic surgery, wider access was necessary for recurrent cryotherapy procedures at the lingula, to avoid jeopardizing the integrity of the nerve. Cryotherapy safeguard the anatomical integrity of the nerve, despite the fact that freezing causes deep neuropraxia. It produces a reliable, prolonged and reversible nerve block with no aggravation of symptoms [9]. Wide surgical access technique prevent the development of postoperative neuropathic pain due to damage to IAN during the surgical procedure. This technique is different from other surgical procedures such as posterior fossa surgery or partial rhizotomy which many patients are unwilling, or medically unfit, to undergo major surgery but are prepared to accept peripheral procedures to give relief [13]. Most peripheral techniques such as injection of alcohol, phenol or lignocaine, neurectomies and peripheral radiofrequency thermolysis present with associated complications such as sensory loss, neuritis or neuroma formation[13].

Here, we described a technique that provided wide intraoral surgical access to enhance procedures involving the region below the fibrotic region, and this technique facilitated mobilization of the IAN from its bony canal. This technique also facilitated the ability to distinguish the lingual nerve from the IAN. One of the authors (C.P.) has used this technique in cryotherapy procedures. In all cases, visual control of the nerve enabled visual confirmation that no damage was incurred to other structures around the IAN.

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Legends

FIGURE 1. Positions of the lingula of the mandible, the mandibular foramen, and the inferior alveolar nerve. (*Left*) A lateral view of the mandible shows the locations of (a) the lingula of the mandible (vertical red arrow) and (b) the mandibular foramen (horizontal blue arrow). (*Right*) A diagram of a lateral view of the mandible shows the path of the inferior alveolar nerve and its point of entry into the mandibular canal.

FIGURE 2. The mandibular canal entry is ascertained with a hook-like object. The dash blue line indicate the part of the bone that will be removed.

FIGURE 3. (*Left*) Round drills are used to remove the bony camber on the medial side of the ascending ramus, which obstructs a direct view of the mandibular foramen. (*Right*) View inside a patient's mouth: a Dumbach retractor protects the nerve.

FIGURE 4. Lateral views of the mandible shows (*left*) the locations of the bone cuts, relative to the mandibular canal, and (*right*) mobilization of the inferior alveolar nerve

FIGURE 5: The lingula of the mandible and the liberation of the inferior alveolar nerve (yellow) and artery (red) over an extended area

FIGURE 6: The nerve is positioned anterior to the retractor

FIGURE 7: (*Left*) The position of the retractor, the nerve, and the cryoprobe; (*right*) view of the entire cryoprobe