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Novel Modifications in Administration of Local Anesthetics for Dentoalveolar Surgery

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Additional information is available at the end of the chapter

<http://dx.doi.org/10.5772/59235>

1. Introduction

The importance of pain management during dental procedures cannot be over-emphasized, but without proper anesthesia, the treatment plan may not be feasible or may result in potential harm to some of the patients. Anesthetic injections should be as painless as possible, especially in the palate which is the most sensitive area of the oral cavity for injection [1].

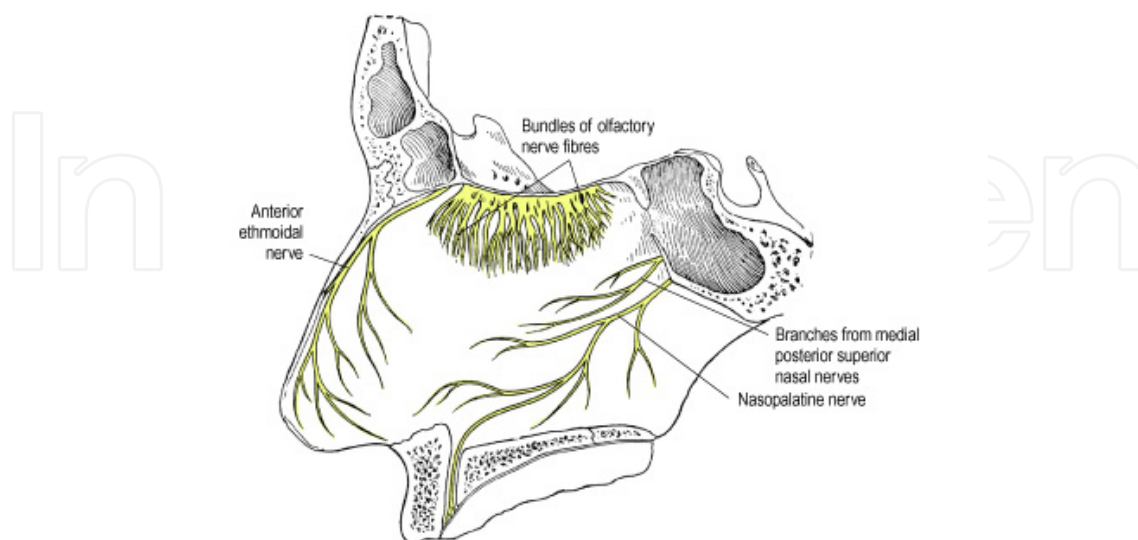
The conventional nasopalatine nerve block is commonly used to obtain anesthesia in the anterior portion of the palate. The painful nature of this approach, however, has led investigators to seek alternative methods to obtain an anesthesia. Labial infiltration of the maxillary central incisors can be considered an effective anesthetic substitute for procedures of the anterior palate. This chapter presents the anesthetic effect of a modified labial infiltration method for anesthetizing the nasopalatine nerve. The authors have reported this method of labial infiltration to be an effective alternative to the painful conventional nasopalatine nerve block to obtain efficient anesthesia of the anterior palate ($p < 0.001$).

1.1. Modified labial infiltration method to obviate nasopalatine nerve block or lessen pain of injection

1.1.1. Clinical anatomy

Anesthesia of the nasopalatine nerve is a mandatory prerequisite to perform surgical procedures on the soft and hard tissues of the anterior palate and for extraction of upper anterior

teeth [1]. The nasopalatine nerve passes through the Incisive fossa which is posteroinferior to anterior nasal spine and finally enters the oral cavity via the incisive foramen and innervates the anterior palate, maxillary central incisors and nasal floor (Figure 1). [1-3]



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Figure 1. Diagram of the nasopalatine and surrounding nerves

Labial tissues are anaesthetized by labial infiltration. Obtaining anesthesia for the relevant palatal soft tissue is however, not possible this way and necessitates direct injection of an anesthetic agent in the palatal area (incisive papilla). Palatal soft tissues, especially in the vicinity of the hard palate, are tightly attached to the underlying bone. Injection in this area is thus, painful when the conventional method for injecting the anesthetic agent directly into or aside the incisive papilla is used [4]. Therefore removal of maxillary teeth without a palatal injection is desirable.

1.2. Technique

In this technique two injections at two sites should be done.

1. Anesthesia of the maxillary hard and soft tissue of the labial area is obtained by injection of 1 cc of local anesthetic agent in the labial vestibule, with the syringe parallel to the long axis of the lateral incisor tooth and the needle bevel toward the bone. This is a nerve block because local anesthetic is deposited close to the main nerve trunk [2] (Figures 2, 3 and 4). With this injection the canine, lateral incisor, central incisors, hard and soft tissue of the alveolar area to the midline are anesthetized.
2. After 2-3 minutes and relative anesthesia of the labial area, infiltration of about 0.6 ml of the remaining solution is administered via a needle inserted superior to the apices of central incisors in the vicinity of the superior border of the base of the anterior nasal spine near the nasal floor at a 45 degree angle to the long axis of the central incisor, to obtain anesthesia in the anterior palate (Figure 5).

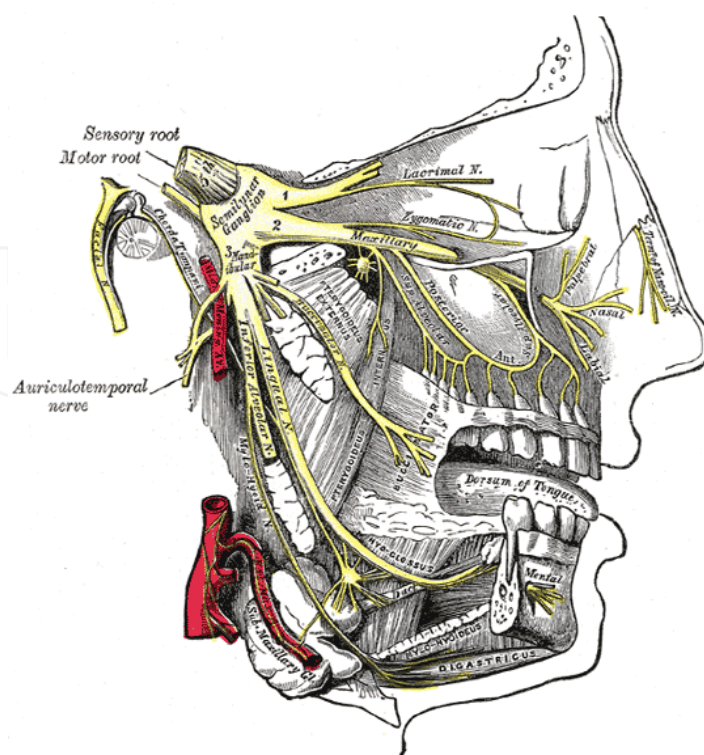


Figure 2. Diagram of the nasopalatine and surrounding nerves (from Gray's Anatomy, 37th Ed.).

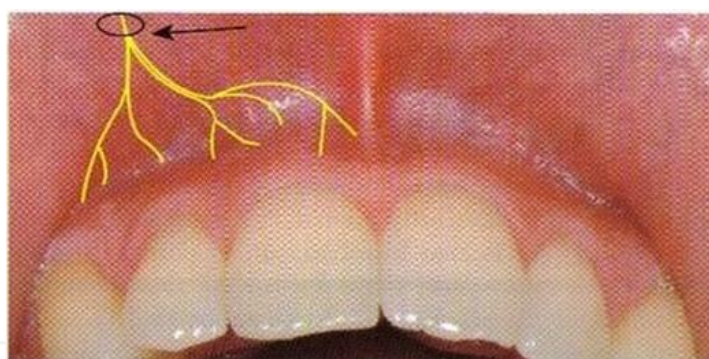


Figure 3. Nerve block (from Malamed 2013, 5th ed.)

Five to six minutes following the second injection, the extension and efficiency of anesthesia in the anterior palate is assessed by an explorer or periosteal elevator and if pain-free the nasopalatine nerve need not be injected from the palate and there is no need for another injection for extraction or dentoalveolar surgery. In the case of mild pain, severe pain, moderate pain or no anesthesia, a complementary injection in the palate is needed. The authors assessed this via a clinical trial that included 60 patients referring for the extraction of maxillary incisors and canine. They showed complete anesthesia of the anterior area of the palate in 76.7% of patients using this method; 23.3% needed a conventional nasopalatine nerve block to complement the effect of anesthesia prior to treatment. In controls we used the conventional technique.



Figure 4. The anesthesia of the maxillary hard and soft tissue of the labial area is obtained by injection of 1 cc of local anesthetic agent, with the syringe parallel to the long axis of the tooth. Orient the needle level toward the bone.



Figure 5. Needle inserted superior to the apices of central incisors in the vicinity of the superior border of the base of the anterior nasal spine near the nasal floor at a 45 degree angle to the long axis of the central incisor, to obtain anesthesia in the anterior palate.

The level of anesthesia obtained by our method in the anterior palate is satisfactory. The labial infiltration method resulted in total anesthesia in the majority of the cases. Failures may be the result of anatomic and physiologic variations. An eight minute wait or longer may be more effective than five minutes following the second injection. The amount of pain experienced by the patients during the injection in the labial infiltration approach is less than the conventional approach in most cases. [5]

2. Modified mental incisive nerve block technique

2.1. Overview

- The mental-incisive nerve block can be used where lower premolars and anterior teeth require treatment. In this chapter we present our method of mental-incisive nerve block for extraction of the lower premolars and anterior teeth or dentoalveolar surgery.

- The authors reported a 95% success rate with the modified injection distal to the second lower premolar, while the success rate was 72.5% when the injection was done traditionally between lower premolars.
- This modified mental-incisive nerve block with injection done distal to the second premolar is more successful than between premolars

2.2. Background

The Inferior Alveolar Nerve Block (IANB) is the most important injection technique in dentistry. Unfortunately it also proves to be the most frustrating; with the highest percentage of clinical failure [6]. Potocnik and Bajrovic reported that even when a proper technique is employed, clinical studies show that IANB fails in approximately 30% to 45% of cases [7]. When dental treatment involved procedures on mandibular premolars and anterior teeth the incisive nerve block can be administered with greater success [6]. However, the injection technique for mental-incisive nerve block (MINB) may also influence the success rate.

2.3. Clinical anatomy

The target is the mental foramen located on external surface of the body of the mandible below the first and second premolars where the IAN divides into terminal (incisive and mental) branches. The incisive branch continues forward in a bony canal or in a plexiform arrangement, giving off branches to the first premolar, canine and incisor teeth, and the associated labial gingiva. The lower central incisor teeth receive a bilateral innervation, fibers probably cross the midline within the periosteum to re-enter the bone via numerous canals in the labial cortical plate. The mental nerve passes upward, backward and outward to emerge from the mandible via the mental foramen between and just below the apices of the premolar teeth [8].

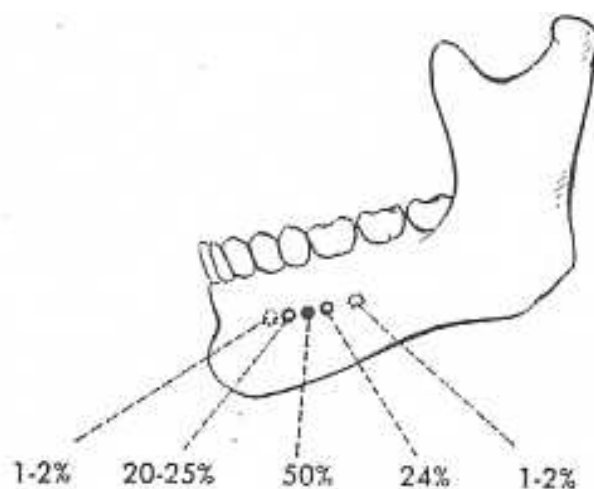


Figure 6. In 24% of individuals the mental foramen is located distal to the root of the second premolar; in 20 to 25%, between the premolars roots, in 50% at the site of the second premolar root and in 1% to 2% anterior to the first premolar or mesial to the first molar.

However, the location of mental foramen varies in different people [8-13]; in 24% of individuals the mental foramen is located distal to the root of the second premolar; in 20 to 25%, between the premolars roots, in 50% at the area of the second premolar root and in 1% to 2% anterior to the first premolar or mesial to the first molar (Figure 6). [13] This variability in location may cause problems in obtaining anesthesia [8, 10, 13-15].

2.4. Technique

There are different methods for MINB; the authors compared 2 mental-incisive nerve block techniques for the extraction of lower premolars and anterior teeth bilaterally. One method was to inject between the first and second premolar so that the needle passed between the two premolars vertically. In the other method, the injection was performed distal to the second premolar.

This randomized double blind, split-mouth clinical study was done; in the case group, the needle penetrated the depth of the vestibule distal to the second premolar using a 27 gauge needle. Entry was from behind the patient at the ten O' clock and the opposite side at the 2 O' clock position. The needle entered the soft tissue about 5-8 mm supraperiosteal, with mouth half-open and lip and buccal tissues retracted. When standing behind the patient, the anatomical landmarks were the second premolar and buccal vestibule (Figure 7).



Figure 7. The injection administered distal to the second premolar. The syringe should be from posterior to anterior, from above to below and from lateral to medial while standing behind the patient.

In the control group an injection was done in the depth of buccal mucosa between two premolars at a depth of 5-6 mm using a 27 gauge needle with the mouth half open standing behind the patient (Figure 8). [16]

In both groups the local anesthetic solution was lidocaine 2% (1 cc) with epinephrine (1/80000). It is not necessary for the needle to enter the mental foramen. Data was statistically analyzed using the chi-square test. All patients had a lingual injection (0.5 cc) which was administered 5 mm distal to the tooth in the floor of the mouth.

The MINB with needle entrance distal to the second premolar from behind had a 95% success rate and MINB with needle entrance between premolars had a 72.5% success rate respectively



Figure 8. The injection administered in the depth of buccal mucosa between two premolars at a depth of 5-6 mm using a 27 gauge short needle with the mouth half open while standing behind the patient.

($p < 0.01$). Thus, if the mental nerve block injection is administered with the needle entrance between premolars, the chance of failure is greater (R.R=5.5).

2.5. Discussion

The MINB can be an alternative to the IANB when dental procedures requiring pulpal anesthesia on mandibular teeth anterior to the mental foramen (e.g. canine to canine or premolar to premolar) are treated. According to the result, we found that MINB with needle penetration distal to second premolar was more effective (95%) than injection between two premolars (72.5%). Al Yasser and Al Nwoku [15] showed that the mental foramen location on both sides of the mandible in 80% of cases is symmetrical and in 46.2% of cases the mental foramen is located between the longitudinal axes of the two premolars. Moiseiwitch [10] reported that anterior-posterior positions of mental foramens in most cases are symmetrical. In most studies on mental foramens in different cases, researchers reported that most mental foramens are in line with second premolars [11, 14]. What most scientists agree with is the presence of mental foramen in range of the long axis of the second premolar [10-12] with about 50% of cases at the level of the root of second premolar, between the two premolars in about 20% to 25% and posterior to the second premolar in about 24%, and in approximately 1% to 2% it lies as forward as the first premolar or as far back as the first molar [13]. This may be why the technique in which the needle penetrates mucosa distal to second premolar may yield the success rate of MINB higher. According to the results, the success rate of anesthesia administered distal to second premolar was 95% and with needle penetration between premolar was 72.5% [6, 9]. According to Malamed the correct position of the dentist is in front of the patient so that the syringe may be placed into the mouth below the patients line of sight and the thumb or index finger in the mucobuccal fold against the body of the mandible in the first molar area and moved slowly anteriorly until feeling the bone become irregular and somewhat concave [6] while in our technique there is no need to palpate the area and produce discomfort for patients. Mucosal penetration done from the distal of the second premolar hides the needle

from the line of sight of the patient. When standing in front of the patient it is easier for the patient to see the needle whereas when standing behind the patient it is unlikely for him or her to visualize the needle. [17]

2.6. Conclusion

Mental-incisive nerve block injection distal to the second premolar from behind the patient was more successful than between premolars from the front.

3. Modified direct inferior alveolar nerve block technique

3.1. Overview

This modified direct technique is easier and more practical than the conventional technique described by Malamed in the handbook of local anesthesia [18]; also it is easier to learn and teach dental students. We have used this technique in practice for many years with a high success rate (up to 98%).

3.2. Technique

- a. A 27 gauge short or long needle is recommended.
- b. The mouth should be open wide.
- c. Placement of the syringe barrel at the first molar of the opposite side.
- d. Needle penetration occurs at the point one centimeter above the occlusal plane of the mandibular molar and parallel to it just at the lateral border of pterygomandibular raphe. In this situation, the needle touches the medial aspect of the ramus at about a 90 angle. When entering the pterygomandibular space injury to the medial pterygoid muscle should be avoided. The pterygomandibular fold may serve as a landmark for the anterior border of the muscle. The needle pierces the mucous membrane lateral to the pterygomandibular fold and injury to the medial pterygoid muscle is avoided easily [18-21]
- e. While slowly advancing, the needle contacts bone; then we withdraw the needle about 1 mm to prevent subperiosteal injection. If aspiration is negative, we slowly deposit 1.5 ml of anesthetic within 60 seconds; the remaining solution is deposited for lingual nerve anesthesia while withdrawing the needle. The average depth of needle penetration to bony contact depends on soft tissue thickness of the area on the medial aspect of the ramus. This will be approximately 8-10 mm or less, it is not necessary to advance the needle in the posterior direction at all or you will be far from the exact injection site. In this technique using the thumb or finger is not necessary, a dental mirror or Minnesota retractor can be used; however there is really no need to use these instruments. With this technique the inferior alveolar and lingual nerves are anesthetized. The long buccal nerve should be anesthetized separately for molar extraction (Figure 9).



Figure 9. The modified direct technique.

4. Conclusion

With regard to the high success rate of the technique and because of simplicity and easy learning curve by dental students it can be placed into the academic curriculum.

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