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Review Article

Alternative Approaches for Inferior Alveolar Nerve Technique in Children: A Review

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Abstract

The inferior alveolar nerve block is the most fundamental and technique sensitive nerve blocks among all. Mastery over achieving the block thus, is of utmost importance. Many techniques have been suggested back and forth in order to perform successful anesthesia. This review provides with a list of alternative approaches for alveolar nerve block which may be followed, as and when required.

Keywords: Alternative Approaches; Inferior Alveolar Nerve Block; Technique Sensitive

Introduction

Pain, often described as an unpleasant emotional experience, is the most distressing component of any dental treatment, including surgical procedures. According to research of University of Pittsburgh, patients avoid dental offices due to their fear for pain than compared to other reasons combined [1]. Thus; its management has been one of the prime concerns for dental surgeons ever since dentistry came into existence. Being dual in nature pain perception and pain reaction must be considered. Among the two, pain perception is controlled by injecting local anesthetics in proximity to the nerve or nerves involved by conduction blockade. In 1884, Dr. William S. Halsted demonstrated that injecting solution in any part of the nerve trunk provides anesthesia as a whole. Dr. Halsted first blocked the mandibular nerve (branch of the trigeminal nerve) [2]. The inferior alveolar nerve (branch of posterior division of mandibular nerve) block, is the second most often used (after infiltration), one of the most important injection technique in dentistry, however with the highest percentage (as high as 15%) of clinical failures even after proper administration [3]. The reasons of failure are many including incorrect techniques, anomalies of the nerve (bifid mandibular nerve), anatomical variances, complicated techniques with high risk, etc. Thus it is important to have thorough knowledge and develop the required skill to achieve proper anesthesia. Following review gives an overall glimpse of various alternatives to perform a successful anesthesia of the inferior alveolar nerve [4].

Materials and Methods

An online search was performed in the Google scholar, database The search covered all articles published prior to 31st of December 2017. The following key words were searched: ("inferior alveolar nerve" OR "mandibular nerve") AND ("pediatric dentistry"). The results of a manual search of the reference list of the included publications were added to the electronic search. Reports in the grey literature (information not appearing in the periodic scientific literature obtained from a library, the Internet, or by ordering) were not pursued.

Selection of studies

Duplicate reporting was an exclusion criterion. One investigator performed the literature search including the selection of titles, abstracts, and full-text publications. All publications obtained by the search were screened by two investigators for meeting the selection criteria. The full text was only reviewed in case the title and the abstract did not contain adequate information for inclusion or exclusion. The amount of evidence and relevance of the findings served as a basis for the final selection of the publications. Any disagreement regarding inclusion was set on by discussion between the two investigators.

Data extraction

The extracted data were synthesized by the lead author and the full text was discussed with all co-authors.

Results

Using the aforementioned search strategy, a total of 247 reports were identified. Of this, 98 reports were eliminated because neither abstracts nor full papers were available. Of the remaining 149 abstracts, 134 were excluded because they were not related to IAN techniques. In this way we retrieved 15 full-text articles. Finally, a total of 15 reports were included in this review.

The inferior alveolar nerve block

The inferior alveolar nerve is the branch of posterior division of mandibular nerve (largest), which is the third division of the trigeminal nerve. It descends downwards medial to the lateral pterygoid muscle and latero-posterior to the lingual nerve, passing through region between sphenomandibular ligament and medial surface of the mandibular ramus (pterygomandibular space) from where it enters the mandibular foramen into the mandibular canal later exiting through the mental foramen giving terminal branches, accompanied by respective artery and vein. It anaesthetizes the body and inferior portion of the mandible, mandibular teeth upto the midline, buccal mucous membrane, mucous membrane anterior to the mental foramen (anterior to the first molar). The nerve block is indicated for providing analgesia (especially for quadrant dentistry), surgical procedures, diagnostic and therapeutic purposes. Various factors influence success for achieving anesthesia including, anomalies of nerve, anatomical variances (width of ascending ramus, arch of mandible, obliquity of the angle of mandible), incorrect technique. Since, it is the only block required in controlling pain in pediatric group, thus it is an important task at hand to have thorough knowledge and skills to administer the anesthetic solution at the correct anatomical site. Various alternative techniques have been tried upon, in order to accomplish successful anesthesia [5].

Classification of alternative techniques for achieving inferior alveolar nerve block

The following classification enumerates the multiple approaches that can be used to achieve a proper anesthesia for the inferior alveolar nerve and hence, ensuring a painless procedure thus benefiting the dental surgeon (Figure 1).

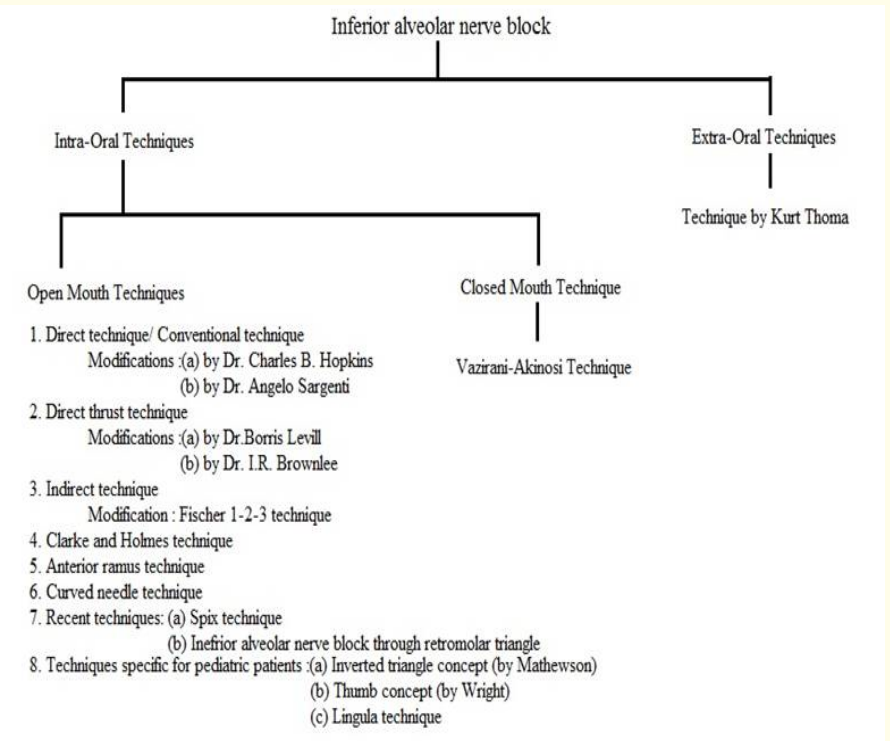

Figure 1: Classification of inferior alveolar nerve block techniques.

Intra-oral techniques

Open-mouth technique

Direct technique/conventional technique

For administering a right inferior dental nerve block, the right handed operator stands in front of the patient positioned comfortably. A short needle is usually avoided to prevent breakage; therefore a 26 gauge needle is used (42 mm long). Point of insertion is determined by carefully palpating the mucobuccal fold using index finger of the left hand until external oblique ridge is felt reaching for the retromolar triangle or fossa. Tissues are pulled laterally and made taut for better visualization and less traumatic injection. Imaginary line formed by the fingertip to the deepest part of the pterygomandibular raphe helps in estimating the height of insertion. The needle is inserted at point bisecting the fingernail of the guide finger, usually 0.5 mm medial to it, and is moved deeper until it contacts with the bone, entering about 2 - 2.5 cm, which may vary according to the anatomical variances and solution is deposited after multiple aspirations [6].

Modification by Dr. Charles B. Hopkins

This technique was given by Dr. Charles B. Hopkins. The anatomical landmarks are palpated carefully, by keeping the guide finger in the coronoid notch. The needle is approached from the opposite side of the arch by keeping it at the level of first and second molar thus making path of insertion perpendicular to the ramus of the mandible. Once, the needle makes contact with the bone, solution is injected after a series of multiple aspirations [7].

Modification by Dr. Angelo Sargenti

Dr. Angelo Sargenti gave a modification of the direct technique in 1966, wherein the approach of the needle is at a higher level than usual. A 26 gauge, 42 mm long needle is used and guide finger is placed into the coronoid notch, fingernail facing lingually. Needle is inserted at midpoint of the fingernail, 0.5 mm away from it while keeping the tissues taut. While the needle is still into the tissues, the direction of the barrel of the syringe is changed. It is placed in between the upper premolars of the opposite side, and needle is inserted deeper. This automatically guides the needle in a downward and backward direction. Once contact with the bone is achieved, usually 1cm deep, local anesthetic solution is injected after multiple aspirations. However, analgesia onset takes longer time and more anesthetic solution is required [8].

Direct thrust technique

This technique was given by Dr. Mendel Nevin. The coronoid notch is palpated and needle is inserted at the point bisecting the fingernail of the guide finger. Upon entering the pterygomandibular space, the solution is deposited in the posterior part of the mandibular sulcus after the needle makes contact with the bone and multiple aspirations achieved.

Modification by Dr. Borris Levill

Direct thrust technique was modified by Dr. Borris Levill in 1935. The needle is inserted at the midpoint of the occlusal planes of the maxilla and mandible, lateral to the lateral pterygoid muscle (not more than one inch deep Anesthetic solution is deposited after multiple aspirations) (Figure 2).

Figure 2: Modified direct thrust technique.

Modification by Dr. I.R. Brownlee

Dr. I.R. Brownlee modified the direct thrust technique by taking into consideration the posterior border of the mandible as a guide for estimating the width of ramus of mandible, which is useful in calculating the depth of needle insertion according to anatomy pertaining to a particular patient.

Indirect technique

Indirect approach may be considered if need be. For a right inferior alveolar nerve block using indirect approach, 25 gauge needle (minimum and relatively rigid) is used. The anatomical landmarks are carefully palpated and needle is inserted at the point bisecting the fingernail of the guide finger into the retromolar triangle. Initially the insertion must be more laterally so that needle immediately hits the bone, followed by movement of the syringe to the right side to achieve parallelism with right mandibular molars. Once needle is approximately 7 mm deep into the tissues, the syringe must be swung back to the left side by keeping over the mandibular premolars. Needle insertion is done until pterygomandibular space is

reached and bony resistance is felt multiple aspirations are done and solution is slowly injected [9] (Figure 3).

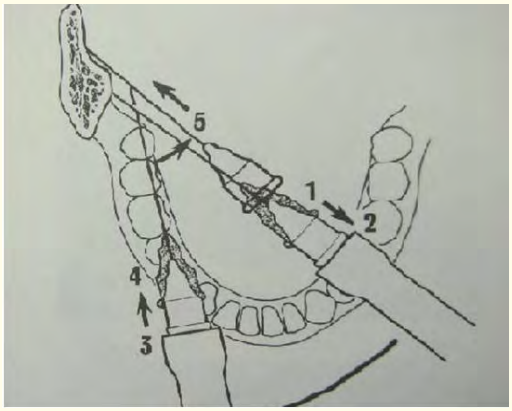

Figure 3: Indirect technique.

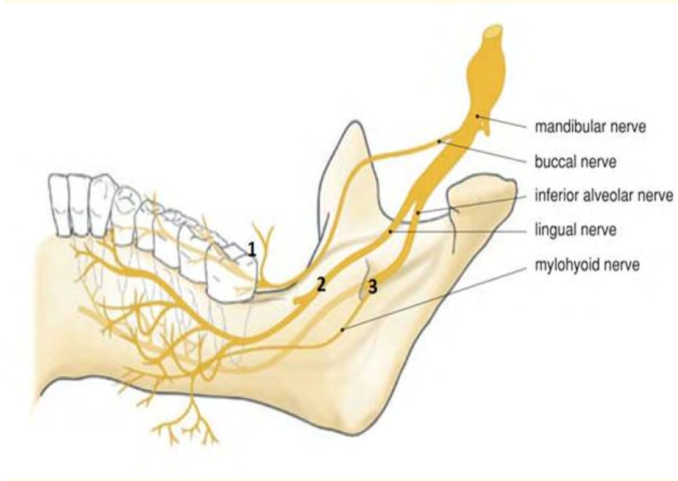

Figure 4: Fischer 1-2-3 technique.

Fischer 1-2-3 Technique (Modification): The indirect technique was modified by Dr. Guido Fischer. On this technique the anesthesia is achieved in 3 steps.

1. **Step 1:** Syringe is placed on the occlusal surfaces of the premolars on the opposite side. After palpation of the anatomical landmarks, needle is inserted 6mm deep at point bisecting the fingernail of the guide finger on the external oblique ridge. Solution is deposited slowly anaesthetizing the long buccal nerve.
2. **Step 2:** Syringe barrel is retracted back and directed to the same side of the arch so that it glides over the temporalis tendon and onto the internal oblique ridge. Needle is further advanced and solution is injected anaesthetizing the lingual nerve.
3. **Step 3:** Finally, syringe is repositioned on the opposite side at first premolar region and needle is further inserted deeper until bone is contacted. The solution is injected anaesthetizing the inferior alveolar nerve (Figure 4).

Clarke and holmes technique

The standard direct or indirect techniques achieve anaesthesia by depositing solution immediately behind the mandibular foramen, where the anterior portion of the nerve is concealed by the lingula and sphenomandibular ligament. It is thus difficult to anaesthetize the anterior fibres which are well protected. Deposition of the solution at higher level will help in reaching the anterior fibres. The patient is requested to keep mouth wide open and occlusal plane parallel to the floor. Palpation of anatomical landmarks is done properly and guide finger is positioned at the retromolar fossa. The needle is inserted just above the fingernail and not at its midpoint as discussed in the indirect technique. As the needle hits the bone, syringe is redirected over the lower central incisors and kept parallel to the molars in horizontal plane. Needle is inserted approximately 2 cm deep and solution is deposited 1 cm higher than the usual after multiple aspirations [10].

Anterior ramus technique

This technique was published by Dr. Lawrence I. Gaum and Dr. Allan C. Moon in the 2nd decade of 1900. This technique is simple and easy to learn and most significantly, utilizes the lower portion of the pterygomandibular space, hence no danger of deposition of the anaesthetic solution into maxillary artery, vein, middle meningeal artery and vein or temporomandibular joint capsule. The ramus and the coronoid notch are palpated and the antero-posterior width of the mandible ramus is estimated using the middle finger and the thumb. Needle is inserted till it contacts bone at the coronoid notch (needle positioned buccal to the posterior molars) thumb is used to further guide the needle in medial-posterior direction, inserting upto half of the needle (insertion depth depends on the variations in ramus and hence modified accordingly). Further needle is redirected approximately 30 degrees horizontally, syringe resting on the anterior teeth of the same side. Needle is finally positioned slightly supero-medial to mandibular foramen [7]. Aspiration in multiple planes is done, and solution is injected slowly [11].

Curved needle technique

This technique involves modifying the needle in order to achieve anesthesia. The use of curved needle was given by Dr. P.E. Cox while the use of curved hub needle was given by Dr. Benjamin Bradin.

Recent techniques

Spix technique

This technique has been recently introduced. The needle is directed towards the lingula. Thus it is inserted into the pterygomandibular space before it penetrates into the mandibular canal.

Inferior alveolar nerve block through retromolar triangle

It is the technique of choice in patients suffering from blood dyscrasias. Needle is inserted directly into the retromolar triangle, 5 mm from the distal surface of last molar [12].

Techniques specific for pediatric patients

Inverted Triangle Concept (by Mathewson)

This technique is used to estimate position of the inferior alveolar nerve in pediatric patients. The coronoid notch is palpated using guide finger. An imaginary triangle is formed by the anterior border of ramus, internal pterygoid muscle and the vault of the palate (Figure 5), apex directed inferiorly and another imaginary line which divides the tip of the finger or the thumb positioned at the coronoid notch passing medially over a depressed area above the apex. Once bone is contacted, the solution is deposited [13] (Figure 5).

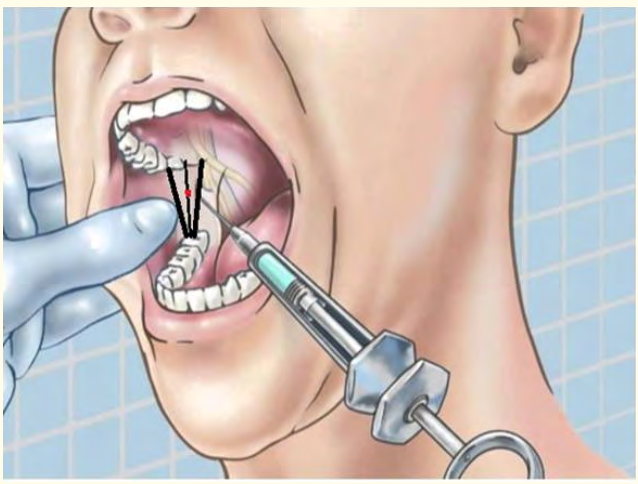

Figure 5: Inverted triangle concept.

Thumb Concept (By Wright)

For a right inferior alveolar nerve block, the left thumbnail is positioned over coronoid notch and slightly over the deep tendon of temporalis muscle, pterygomandibular raphe being medial to the thumb. The needle is inserted at middle of the thumbnail, between deep tendon of temporalis (laterally) and pterygomandibular raphe (medially) entering the mandibular sulcus at the level of the lingular notch.

Lingula technique

This technique was developed taking into consideration the level of mandibular foramen of pediatric patients which is at a lower level than occlusal level of the primary teeth. Therefore, the needle is to be inserted at a lower level and posterior as compared to in adults. The anterior and the posterior borders of the ramus are palpated for targeting the lingula.

Closed mouth technique

Vazirani-Akinosi technique

This technique was given in 1977. The advantage in this technique is that it anaesthetizes lingual and buccal nerve along with the inferior alveolar nerve. Patient is requested to close the mouth and needle is positioned parallel to the occlusal plane. The needle is inserted (up to 1 ¼ inches)medial to the ramus while keeping syringe at level of muco-gingival junction of maxillary molars and solution is deposited after multiple aspirations [14] (Figure 6). It gives advantage over the classical open mouth approach as landmarks are easily identified and three nerves that innervates the mandible are anaesthetized by a single injection (Figure 6).

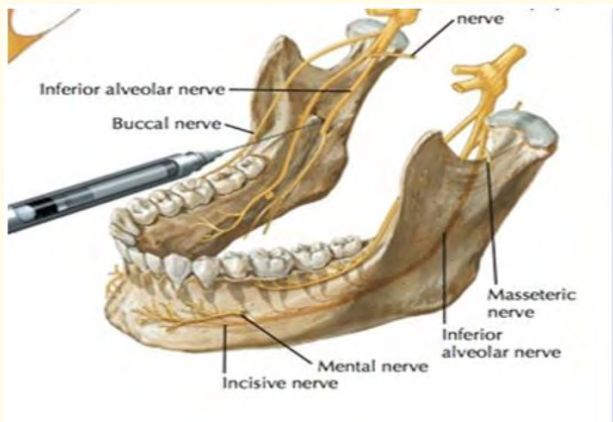

Figure 6: Vazirani-Akinosi technique.

Extra oral technique

Technique by Kurt Thoma

This technique is especially beneficial when there is severe limitation of the opening of jaws. Skin must be cleansed properly before injecting. Professor Kurt Thoma has been given credit for this technique. Firstly, anterior border of masseter is located. Patient is asked to clench his teeth and lowest point is identified. Line is drawn which connects this point and the tragus of ear and midpoint is marked, which indicates the position of the mandibular foramen externally. A line is drawn and measured from this point parallel with the posterior border of the mandible (Figure 7). 21 gauge needle is marked with the same length as measured. Long needle is inserted on inner aspect of lower border of mandible, keeping it as near as possible to the bone. Needle is inserted up till the mark and solution is injected slowly [15] (Figure 7).

Figure 7: Technique by Kurt Thoma.

Conclusion

The following review provides an insight into the numerous alternative approaches for inferior alveolar nerve block. The aim of each one of them is ultimately reaching one goal, and that is, a successful anesthesia by improving the efficiency of the block, thus providing a painless treatment and in return ensuring a better patient cooperation and ease of procedure for the operator specifically considering the pediatric group. We, as dental surgeons must therefore have a thorough knowledge and must choose a technique wisely as and when circumstances dictate its need.

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