Universidad Europea

GRADUATION PROJECT

Degree in Dentistry

COMPARISON OF LOCAL ANESTHETIC EFFECTIVENESS BETWEEN MENTAL NERVE BLOCK VERSUS INFERIOR ALVEOLAR NERVE BLOCK IN LOWER PREMOLARS WITH SYMPTOMATIC IRREVERSIBLE PULPITIS

Madrid, academic year 2025/2026

Identification number: 161

RESUMEN

Introducción: Lograr una anestesia eficaz en los premolares mandibulares con pulpitis irreversible sintomática sigue siendo un reto clínico, especialmente debido al éxito variable de las técnicas convencionales de bloqueo nervioso. **Objetivó**: En esta revisión sistemática y metaanálisis se comparó la eficacia anestésica del bloqueo del nervio mentoniano y del bloqueo del nervio alveolar inferior en premolares mandibulares con pulpitis irreversible sintomática. **Metodología**: Una búsqueda sistemática identificó ensayos clínicos aleatorizados que evaluaban el bloqueo del nervio mentoniano frente al bloqueo del nervio alveolar inferior. Tres estudios cumplieron los criterios de inclusión y fueron incorporados en esta revisión sistemática. El análisis de los resultados no mostró diferencias estadísticamente significativas en el éxito anestésico entre el bloqueo del nervio mentoniano y el bloqueo del nervio alveolar inferior. Los estudios presentaron variaciones metodológicas, incluyendo diferencias en la técnica de inyección y en el agente anestésico utilizado, lo que podría influir en los resultados reportados. **Resultados**: Sin embargo, la mayoría de los estudios informó la necesidad de anestesia complementaria para lograr un control completo del dolor durante los procedimientos endodónticos. Además, los niveles de dolor y la incomodidad referidos por los pacientes durante la inyección fueron generalmente bajos para ambas técnicas, lo que sugiere que tanto el bloqueo del nervio mentoniano como el bloqueo del nervio alveolar inferior son bien tolerados en la práctica clínica. El bloqueo del nervio mentoniano y el bloqueo del nervio alveolar inferior muestran una eficacia anestésica comparable en los premolares mandibulares con pulpitis irreversible sintomática. No obstante, la frecuente necesidad de anestesia complementaria pone de manifiesto la importancia de estrategias complementarias para garantizar un control del dolor predecible y adecuado en la práctica odontológica. **Conclusión**: Estos hallazgos deben interpretarse con cautela debido al número limitado de estudios incluidos y a su heterogeneidad metodológica. Se necesitan ensayos controlados aleatorizados de alta calidad para confirmar estos resultados y optimizar los protocolos anestésicos en este contexto clínico.

PALABRAS CLAVE

Endodoncia, bloqueo del nervio mentoniano, bloqueo del nervio alveolar inferior, anestesia, pulpitis irreversible sintomática, premolares mandibulares.

ABSTRACT

Introduction: Achieving effective anesthesia in mandibular premolars with symptomatic irreversible pulpitis remains clinically challenging, particularly due to the variable success of conventional nerve block techniques. **Objective**: In this systematic review and meta-analysis, we compared the anesthetic efficacity of the mental nerve block and the inferior alveolar nerve block in mandibular premolars with symptomatic irreversible pulpitis. **Methodology**: A systematic search identified randomized controlled trials evaluating MINB versus inferior alveolar nerve block. Three studies fulfilled the inclusion criteria and were therefore incorporated in this systematic review. Analyze of the results revealed no significant difference in anesthetic success between mental nerve block and inferior alveolar nerve block. The studies varied in methodology, including differences in injection technique and anesthetic agent, which may influence the reported outcomes. **Results**: However, most studies reported the need for supplemental anesthesia to achieve complete pain control during endodontic procedures. Additionally, patient-reported pain levels and discomfort during injection were generally low for both techniques, suggesting that both mental nerve block and inferior alveolar nerve block are well tolerated in clinical practice. Mental nerve block and inferior alveolar nerve block demonstrate comparable anesthetic effectiveness in mandibular premolars with symptomatic irreversible pulpitis. Even so, the frequent requirement for supplemental anesthesia highlights the importance of complementary strategies to ensure predictable and adequate pain control in dental practice. **Conclusion**: These findings should be interpreted with caution due to the limited number of included studies and their methodological heterogeneity. Further high quality randomized controlled trials are needed to confirm these results and to optimize anesthetic protocols in this clinical context.

KEYWORDS

Endodontics, mental nerve block, inferior alveolar nerve block, anesthesia, symptomatic irreversible pulpitis, mandibular premolars.

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1. INTRODUCTION

Dental pain management is one of the most challenging aspects of modern dentistry. Symptomatic Irreversible Pulpitis (SIP) might cause intolerable pain to the patients. That's why the election of the anesthetic should fit completely the needs and physiology of the patients. (1) This motivates us to evaluate the efficacy of the different techniques of anesthesia that we can achieve during endodontic treatment.

Discovery of local anesthetic is ancient. Egyptians used to use opium, juniper, beer and other extracts from various type of plants to soothe the pain. Hippocrates who was the father of medicine believes in healing power of nature and on their side, Indians used to use herbal medicine and yoga to appease the pain. Even if local anesthetics are relatively safe drugs to use in the dental clinics, there is still a risk of overdose.(2)

1.1 Mechanism of action and indications of anesthetics

1.1.1 Mepivacaine

Mepivacaine belongs to the amide group. Its mechanism of action consists of blocking nerve impulse through sodium channel inhibition. This occurs by binding to some specific voltage-gated sodium channels in the neuronal cell membrane. Its onset is rapid with an intermediate duration of action compared to other alternatives of oral local anesthetic. Its safety profile is favorable with a low incidence of systemic toxicity and allergic reactions. That's why it's indicated to use it in case of children, elderly, patients suffering from infections and patients with sulphite allergy. It still should always be used with high caution when certain medical conditions are present such as hepatic impairment or cardiac conduction disturbances and hypersensitivity to amide-type local anesthetics. A correct medical history of the patient should always precede any type of local anesthetic administration. (3)

If we consider using a 3% Mepivacaine anesthesia without epinephrine, the concentration of a 3% solution is 30mg/mL, knowing that a dental cartridge contains 1,8mL solution, then we must do 1,8 mL x 30 mg/mL = 54mg. The maximum dose would be 6,6mg/kg, up to 300mg. The maximum duration of this anesthesia in soft tissue will be 1,5-2 hours and 20 minutes in pulp (4)

2% Mepivacaine with vasoconstrictors gives a more advantageous success rate than 3% mepivacaine without vasoconstrictor but it shows a similar onset time of pulpal anesthesia with an higher pain control during injection phase. (5)

Epinephrine is a medication and hormone widely used in the medical field to manage a broad spectrum of medical conditions because of its actions on the sympathetic nervous system. In dentistry we administrate it coupled to the local anesthesia in order to give vasoconstrictor properties to the injected solution.

1.1.2 Lidocaine

Lidocaine is a local anesthetic from the amide group widely used in dentistry for local and topical anesthesia. It also has antiarrhythmic effects. Lidocaine mechanism of action consists in blocking temporarily the sodium channels of the pain receptors. Then the nociceptors can't transmit pain information via the cranial nerve V to the nervous system no more. Lidocaine is indicated in small surgery and in patients suffering from cardiac arrythmias. Lidocaine must be injected in small amount with respect of the maximal dose. These anesthetic present vasodilating properties, that's why a vasoconstrictor can be added to its solution to constrict the drug inside of the sodium channel for a longer period and consequently, reduce blood flow. To achieve optimal effectiveness, it is important to inject the anesthetic as close as possible to the nerve who will carry the sensory information form the area of planned intervention. Lidocaine can cause abnormal stimulation of the Central Nervous System (CNS) which can be followed by a depression and decreased in electrical excitability, conduction rate and force of contraction. The metabolization process is mainly and rapidly done by the liver. The kidneys are responsible for eliminating both drug metabolites and unchanged compounds. The local anaesthetic of amide type have a considerably longer duration of action and are metabolised in the liver via microsomal enzymes. (6)

If we consider using a 2% 1:100,000 adrenaline, Lidocaine anesthesia, the concentration of a 2% solution is 20mg/mL, dental cartridge containing 1,8mL solution, then we have to do 1,8 mL x 20 mg/mL = 36mg. The maximum dose would be 7mg/kg. Up to 500mg. In 2% lidocaine, 1:50,000 epinephrine the maximum dose will also be 7mg/kg. While using only 2% lidocaine without adrenaline the maximum dose will be 4,5mg/kg which is up to 300mg. The maximum duration of this anesthesia coupled with adrenaline in soft tissue will be 2-4 hours and 45-60 minutes in pulp.(4)

1.1.3 Articaine

Articaine is a member of the amide class of local anesthetics. It is unique in that it contains both a triophene ring and an extra ester group. Its mechanism of action involves a reversible interaction with the alpha subunit of voltage-gated sodium channels within the inner portion of the nerve, thereby inhibiting nerve impulse transmission.

This anesthetic is safe and effective, particularly recommended for specific population including the elderly, children and pregnant women. In addition to its reliability and low chances of producing allergic reaction than ester anesthetic. Articaine offers several advantages, including low toxicity, effective local infiltration and high safety profile. It is therefore often considered a preferred option for dental anesthesia during routine treatment. (7)

Even if articaine belongs to the amide-type local aesthetics, it's also metabolised via plasma esterase because it presents an additional ester linkage. The metabolization via plasma cholinesterase in the bloodstream is for the ester type agent, that's why they have a shorter type duration of action which is around 15 minutes. (8)

Considering using a 4% Mepivacaine anesthesia with 1:100,000 of adrenaline, the concentration of a 4% solution is 40mg/mL, knowing that a dental cartridge contains 1,8mL solution, then we must do 1,8 mL x 40 mg/mL = 72mg. The maximum dose would be 7mg/kg, up to 500mg. The maximum duration of this anesthesia in soft tissue will be 3-5 hours and 60-75 minutes in pulp (4)

1.2 Anatomy and innervation

1.2.1 Anatomy and innervation of Inferior Alveolar Nerve

The inferior alveolar nerve (IAN) is a sensory branch of the mandibular division of the trigeminal nerve which is the 5th cranial nerve. Its origins take place deep to the lateral pterygoid muscle. It enters the mandibular foramen and subsequently passes through the mandibular canal. This nerve is mostly responsible for the innervation of the cheek, lip, chin and gingivae (9).

1.2.2 Anatomy and innervation of Mental Nerve

The mental nerve arises as a direct extension of the IAN. Upon emerging from the mental foramen, it is referred to as the "mental nerve". It provides sensory innervation to the anterior region of the buccal mucosa, the lower lip and the skin of the chin located ventral to the foramen. After exiting the mental foramen, the nerve divides into three branches just beneath the depressor anguli oris muscle.

Its blood supply is provided by the inferior labial artery, mental & submental artery, and the inferior alveolar artery. (10)

1.3 Common errors that could affect the effectiveness of local anesthetics

1.3.1 The experience of the operator

While local anesthesia is most of the time administered by dentist it can also be operated by the dental hygienist with the support of a dental assistant. The role of the assistant here would be to prepare the necessary equipment and material available, so the operator only has to assemble the dental syringe. A well know previous study and knowledge of the anatomy is needed for the operator to succeed the anesthesia. The operator should also know the structure of the needle, how to hold the patient tissues while injecting, the place of the bissel and how it is recommended to place the syringe while injecting the anesthesia in order that the product reach the optimal spot to act. (11)

1.3.2 Time of action

The operator needs to wait a specific amount of time with each different types of anesthetics for them to deliver their effects.

If the dentist start the treatment right away and does not wait enough for the anesthetic to do effect the patient might feel pain. (12)

We clearly need to take that into account to plan the best operation possible.

In this case we must assess that IANB provide a more sustained regional block. While using Articaine 4% the duration is sufficient to complete the instrumentation phase. (13)

1.3.3 Influence of a decreased tissue pH

The effectiveness and onset of local anesthesia can be compromised in inflamed tissues, such as those affected by abscesses or pulpitis. According to the Henderson-Hasselbalch principle, when a local anesthetic solution is adjusted to a pH closer to its pKa, a greater proportion exist in uncharged, lipid-soluble form. In contrast, inflamed tissues often have a reduced pH, sometimes as low as 5, which promotes the ionized form of the anesthetic. This shift limits the ability of the drug to penetrate nerve membranes, thereby decreasing its anesthetic effectiveness. (14)

1.3.4 Anxiety of the patient and its effects

Achieving consistent pain control in dentistry remain a big challenge due to the inherent variability in patient response. Stress influence pain perception an also the analgesic efficacity. In the dental field, stress-induced variability in anesthesia can considerably

impact treatment outcomes and patient satisfaction. In situation of stress, the body activate its physiological stress response which trigger the release of stress hormones such as cortisol and adrenaline. Theses hormones interact with various neurotransmitter system involved in nociception which means that they modulate the pain perception. While impacting both physiological response and patient experience on the dental chair, anxiety has a profound effect on anesthesia delivery and outcome.

Dental anxiety is mostly characterized by fear and apprehension related to dental treatment which can be manifested in various way. Exaggerated cardiovascular response can be one of them or also if the perception of pain is exacerbated the threshold will be lowered and the sensations intensified. Patients suffering of high-level anxiety may report increased discomforts during the insertion of the needle and infiltration of the liquid. Which make it really challenging to achieve an effective anesthesia as patients might require alternatives techniques or higher doses. Moreover the physiological changes induced by anxiety could interfere directly with the efficacity of local anesthesia like elevated heart rate, elevated blood pressure or acceleration of the metabolism that will affect by accelerating the distribution and absorption of the local anesthesia and in that way reduce their duration of action. (15)

1.3.5 Anatomic variations of innervation

Anatomical variations of nerves are more frequent than generally assumed and can have a considerable effect on the success of local anesthesia. These variations influence the path of needle insertion, which in turn affects the distribution of the anesthetic solution and may reduce the overall effectiveness of the block.

Recent progress in local anesthetic techniques has greatly enhanced both the accuracy and safety of pain management. In particular, the growing use of ultrasound guidance in recent years has improved the practice of regional anesthesia. However, failures still occur, often due to incorrect nerve identification or atypical diffusion of the anesthetic caused by anatomic differences. Such variations remain a significant source of both complications and ineffective anesthesia. Furthermore, modifications at the level of nerve roots may result in the formation of peripheral nerves with altered patterns, meaning that conventional block techniques can unintentionally anesthetize adjacent and non-targeted nerve territories.

The mental nerve, which represents the terminal branch of the inferior alveolar nerve, also present notable anatomical variability. The most common differences concern the position of the mental foramen and the presence of accessory mental foramina. Typically, the mental foramen is located below the second mandibular premolar, at an

average distance ranging between 13,7mm and 20,4mm from the alveolar crest. Throughout life, factors such as aging, tooth loss, or trauma may lead to bone resorption, causing a downward shift in the position of the foramen.
Accessory mental foramina are most often found posterior to the primary foramen. The mental nerve may divide into multiple branches that pass through distinct canals and emerge via both the main and accessory foramina. When these accessory openings are relatively large and located close to the main foramen, they can transmit significant nerve branches. In rare cases, the presence of triple mental foramina has been reported, resulting in a broader neurovascular distribution and consequently increasing the risk of neurovascular injury during clinical procedures. (16)

1.3.6 Inadequate selection of the local anesthetic

Even if maximum dosage rarely needs to be administrated it is mandatory to know well the doses that we shouldn't exceed. If we use them properly, local anesthetic is the saftest and most effective drugs in the dental field for pain prevention and control. Health professional, student and teacher should be aware that the primary reference for maximum local anesthetic doses is the recommendation provided in the drug's Food and Drug Administration (FDA) approved package insert.

"Alle Dinge sind Gift, und nichts ist ohne Gift; allein die Dosis macht, dass ein Ding kein Gift is. " - Paracelsus, 1538

Which might be traduced as: All things are poison, and nothing is without poison; the dosage alone makes it so a thing is not a poison.

Many studies have shown that dental anesthesia can cause auditory and ocular issues. This is du to the site of injection which is sometimes really close to other cranial nerves in function of the mouvement of eyeball, eyelid, earing apparatory… This issues are mostly ophtalmic complications such as diplopia (the eye perceive double vision) and blindness.
Others complications of neurological type can be observed such as palsy, paresthesia of inferior alveolar nerve and lingual nerve. (2)

1.3.7 Election of the best anesthetic formula

Numerous investigations have explored the comparative efficacy of commonly used local anesthetic agents in infiltration techniques, particularly lidocaine, articaine and mepivacaine. Overall, the literature suggests that articaine tends to provide improved anesthetic outcomes compared to the other agents. This advantage is often linked to its physiochemical properties, notably its greater lipid solubility, which enhances its capacity to diffuse through mineralized tissues such as cortical bone. This characteristic is very beneficial in the mandibular region, where dense bone structure can compromise the effectiveness of conventional anesthetic solutions. (17,18).

Consequently, articaine has frequently been associated with higher success rates and, in certain cases, a more rapid onset of action when used for infiltration anesthesia (19,20).

Lidocaine remains the most widely used local anesthetic in dental practice and continues to be regarded as a reference standard due to its predictable clinical performance and well-documented safety profile. Despite its reliability, several comparative studies have indicated that its efficacy in infiltration techniques may be slightly lower than that observed with articaine, particularly in situations where achieving profund anesthesia is more difficult, such as mandibular teeth. (18,20)

Mepivacaine, in comparison will generally exhibits anesthetic effectiveness that is similar to or inferior to the one of lidocaine. The most important advantages of mepivacaine lies in its reduced vasodilatory effect that allow it to be used without vasoconstrictor in certain clinical situations, making it particularly suitable for patients with contraindications to epinephrine. However, its relatively lower ability to penetrate dense bone may limits its performance if used in infiltrative anesthesia in posterior mandible. (19)

Overall, the available evidence favors the use of articaine for infiltration anesthesia, mainly because of its better tissue diffusion and higher success rate in achieving effective anesthesia. However, lidocaine and mepivacaine continue to be important options, and the selection of the most appropriate anesthetic should depend on clinical needs and individual patient characteristics. (17)

1.3.8 Use of complementary anesthetic

Intrapulpal anesthesia is one of the complementary anesthesia. It acts through both pharmacological and mechanical mechanisms. When the anesthetic solution is injected directly into the pulp tissue, it disrupts the nerve conduction by blocking the sodium channels in the neuronal membrane, thereby preventing the influx of sodium ions necessary for the transmission of nerve impulses. This direct action produces a rapid

and localized anesthetic effect, resulting in immediate pain relief during endodontic procedures through temporary inhibition of nociceptive signals. The pressure generated during injection into the pulp chamber prior to pulp removal increases the effectiveness of this technique. Although the exact mechanism remains unclear, it is suggested that sustained pressure contribute to structural alteration or disruption of nerve fibers, thereby producing effective anesthesia. (21)

Intraligamentary anesthesia, also known as periodontal ligament injection, involves delivering the anesthetic solution into the space between the tooth and the surrounding alveolar bone. This technique is particularly useful for achieving a single tooth anesthesia while minimizing numbness of adjacent soft tissues such as lips or facial muscles. This technique can be used either as primary approach or as a supplementary method when conventional nerve block is not sufficient. It is considered a safe option that provide high success rates including for bleeding disorders patients as it carries a low risk of hemorrhagic complications. (22)

Even if the most known and used method to achieve pain control is typically by administering local anesthesia with an injection. In some case it’s not enough. Different methods for providing local dental anesthesia have been explored and discovered theses past years. One of them is topical anesthesia that is widely used in patients scared of syringe and pinch feeling. This is a good physical and psychological method because even if the anesthetic action on the gingiva is poor, the mental effect can really provide a more relaxing experience for stressed patients. Topical anesthetics are widely employed in both dental and medical settings to reduce painful sensations or to control chronic pain conditions. Research has demonstrated their effectiveness in lowering discomfort during procedures. These agents are available in various formulations including gels, cream, ointments, liquids, lotions sprays and powders. (23)

2. OBJECTIVE

2.1 Objectives

Compare the anaesthetic effectiveness of mental nerve block versus inferior alveolar nerve block on lower premolars with symptomatic irreversible pulpitis.

3. MATERIAL AND METHODS

The work presented is a documentary research study that is based on the systematic selection and analysis of published articles and documents.

This is a comparative clinical research evaluating the effectiveness of the inferior alveolar nerve block (IANB) versus the mental incisal nerve block (MINB) in endodontic treatment of mandibular premolars diagnosed with symptomatic irreversible pulpitis (SIP).

3.1 Research question

This systematized review was conducted to answer the following research question: “On patient suffering from symptomatic irreversible pulpitis on mandibular premolar what the best anaesthesia technique would be to elect between mental nerve anaesthesia and Inferior alveolar nerve anaesthesia?”

To develop our research question, we broke it down into four main components:

Population (P): Adults from 18 yo with SIP on mandibular premolar.

Intervention (I): Inferior alveolar nerve block anestesia.

Comparison (C): Mental nerve anestesia.

Outcome (O): Effectiveness of anestesia.

PICO:

P: Patient	**I: Intervention**	**C: Comparison**	**O: Outcome**
Adults from 18 yo with SIP on mandibular premolar	Inferior alveolar nerve block anestesia	Mental nerve anestesia	Effectiveness of anestesia
Adults [MeSH] AND Pulpitis [MeSH] AND Premolar tooth [MeSH] AND Mandible [MeSH]	*Nerve block [MeSH] AND Mandibular Nerve [MeSH]*	*Nerve block [MeSH] AND Mental Nerve [MeSH]*	*Treatment outcomes [MeSH] AND pain measurement [MeSH]*

3.2 Sources of information and search strategy

Data base	Search strategy	Record obtained	Search date
Scopus	"local anesthesia" OR "dental anesthesia" AND ("mental nerve block" OR "inferior alveolar nerve block" OR IANB) AND (premolar) AND ("irreversible pulpitis" OR "symptomatic pulpitis") (1997 – 2025)	20	09/02/2026
Medline	("Mental Nerve" OR "mental nerve block") AND ("Inferior Alveolar Nerve"OR "inferior alveolar nerve block" OR "mandibular nerve block") AND ("Pulpitis" OR "irreversible pulpitis" OR "symptomatic irreversible pulpitis") AND ("Premolar" OR "mandibular premolar") AND ("Local Anesthesia" OR "dental anesthesia") (2016 – 2025)	4	09/02/2026

3.2.1 Keywords

We carried out a litterature search using two databases, Scops and MEDLINE Complete, to identify relevant scientific articles. The search strategy incorporated MeSH (Medical Subject Headings) terms along with Boolean operators such as "AND", "OR" and "NOT". while combining search items.

The keywords used for ours advanced search are: "Dentistry", " Adult", "Mental nerve block", "Inferior Alveolar Nerve block", "Anesthesis", "Symptomatic Irreversible Pulpitis", "Mandibular premolars", "Articaine" & "Mepivacaine"

"local anesthesia" OR "dental anesthesia"

AND

"mental nerve block" OR "inferior alveolar nerve block" OR IANB

AND

“premolar”

AND

“irreversible pulpitis” OR “symptomatic pulpitis”

3.3 Study selection: inclusion and exclusion criteria

3.3.1 Criteria of inclusion

Inclusion criteria	
Study Type	Clinical trials including randomized controlled trials, prospective, longitudinal and cohort studies examining the comparison between inferior alveolar nerve block and mental nerve anesthesia in adult patients with symptomatic irreversible pulpitis affecting mandibular premolars.
Languages	Studies published in English or Spanish
Target Population	Adult female and male participants
Condition	Studies focused on comparison of Inferior alveolar nerve block anesthesia and Mental nerve anesthesia

Table 1: Inclusion criteria

3.3.2 Criteria of exclusion

Exclusion criteria	
Study Type	Systematic reviews, narrative review and meta-analyses.
Research Focus	Studies which are not specific of mandibular premolar; Studies on different anesthesia technique than Inferior alveolar nerve block anesthesia and Mental nerve anesthesia
Duplicate Publications	Articles that have been published multiple times across different journals
Publication Date	Studies older than ten years were excluded, unless they were deemed necessary to offer contextual or anatomical background for the introduction

Table 2: Exclusion criteria

3.3.3 Research flowchart

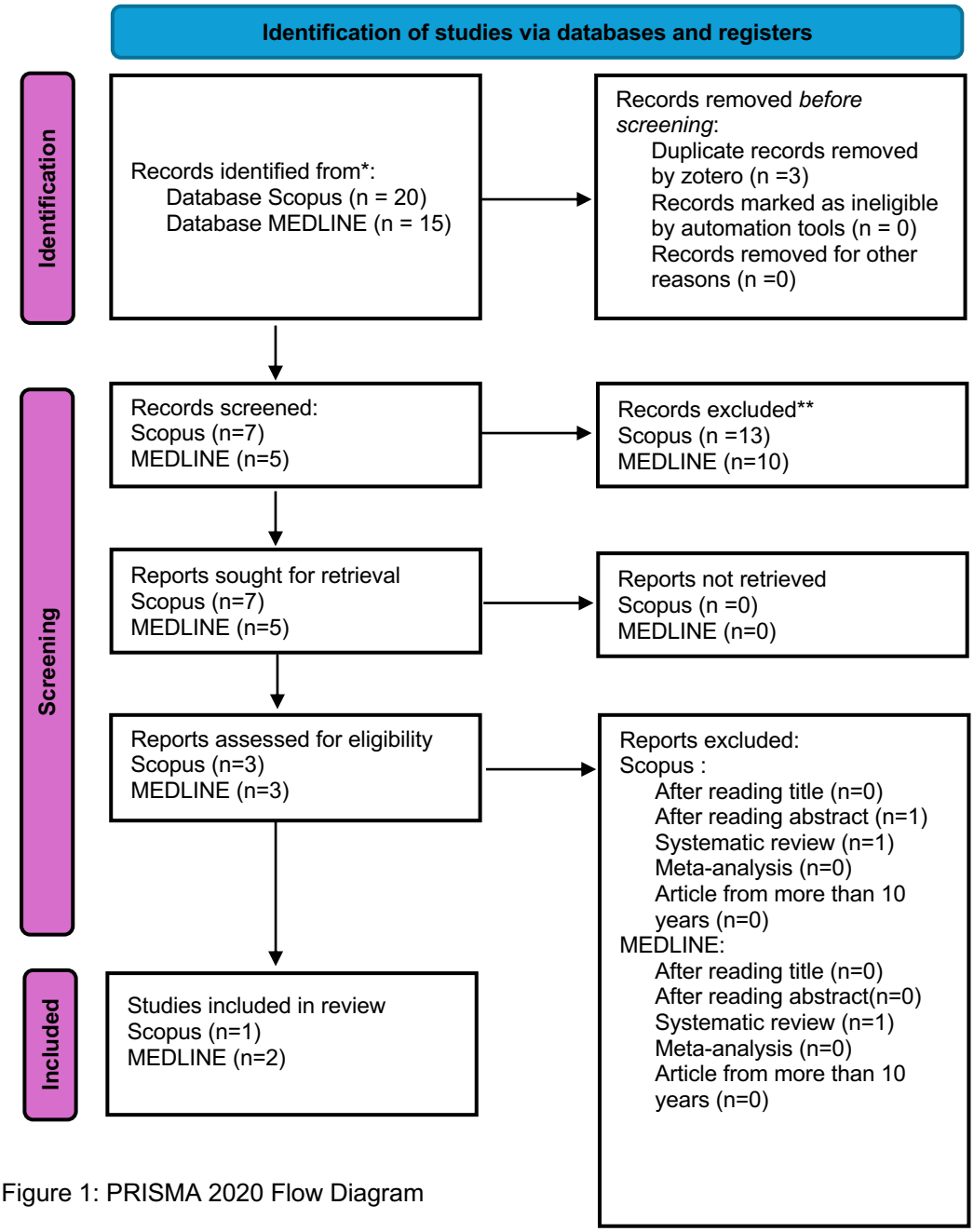


Figure 1: PRISMA 2020 Flow Diagram

4. RESULTS

4.1 Study selection

This study was conducted in several phases in accordance with the PRISMA 2020 flow diagram (Figure 1). Initial search yielded 20 records from Scopus and 15 from MEDLINE. to narrow down this dataset, we first performed an automated deduplication using Zotero, which detected and removes 3 duplicate articles.

We then screened 8 articles from Scopus and 5 articles MEDLINE. At this point 12 articles from Scopus were excluded because they did not specifically focus on first lower premolar, infiltrative techniques of anesthesia or endodontics.

After this step, 3 articles from Scopus and 3 articles from MEDLINE remained for full-text review.

At this stage, regarding Scopus articles we excluded:

- 1 based on it abstract
- 1 systematic review

Moreover regarding MEDLINE we have excluded only one article:

- 1 systematic review

Once all inclusion and exclusion criteria were implemented, only three studies fulfilled the eligibility requirement, including:

- 1 trial from Scopus
- 2 trials from MEDLINE

Three studies were incorporated in this systematized review to compare the anaesthetic effectiveness of mental incisive nerve block (MINB) versus inferior alveolar nerve block (IANB) on lower premolars with symptomatic irreversible pulpitis (SIP).

4.2 Synthesis of results

Title	Author & Year	Country	Purpose of the study	Study type	Data collection methods	Sample	Primary outcomes
Anesthetic Effectiveness of Mental/Incisive Nerve Block versus Inferior Alveolar Nerve Block in Mandibular First and Second Premolars with Symptomatic Irreversible Pulpitis: A Randomized Clinical Trial	Sülek et al. (2025)	Turkey	This study assess and compare the anesthetic efficacy of the MINB and the traditional IANB in the context of endodontic treatment of mandibular first and second premolars presenting SIP	randomized, double-blind, clinical trial.	Before endodontic treatment, patients were asked verbally about their prepoperative pain and instructed to rate it using a Numeral Rating Scale (NRS) form. A cold test was subsequently carried out, after which patients were promptly asked to record their pain intensity again on a separate NRS form.	N=120	The aim of this study is to evaluate and compare the efficacy of mental/incisive nerve block (MINB) and IANB for anesthesia during endodontic treatment of mandibular first and second premolars affected by SIP. The findings indicated that both MINB and IANB offer similar levels of pain control during such procedures. No significant difference was identified between the two techniques in terms of aesthetic effectiveness during cavity preparation or pulp removal. However, MINB appeared to be more effective for the first mandibular premolar than for the second. Overall, the study suggests that additional anesthetic measure may be necessary to ensure adequate pain management in these clinical situations.
Comparative Evaluation of Mental Incisal Nerve Block, Inferior Alveolar Nerve	Aggarwal et al. (2016)	India	The objective was to evaluate and compare the anesthetic performance of the MINB and	Randomized, double-blind clinical trial.	Ten minutes later, the standard access cavity preparation started. Patients were asked to raise their hands if they experienced	N=153	The study found that combining a mental/incisive nerve block with an IANB enhances anesthetic effectiveness in symptomatic mandibular premolars. The success rate was 53% for MINB group and 47% for IANB group when each techniques were used alone. However, when both blocks were administred together, the

Block, and Their Combinatio n on the Anesthetic Success Rate in Symptomati c Mandibular Premolars: A Randomize d Double-blind Clinical Trial			IANB, wether administere d individually of together, for achieving anesthesia in smptomatic mandibular premolars.		any discomfort during the procedure. If pain occurred, the treatment was immediately paused and patients were asked to assess their pain intensity using HP VAS scale.		success rate increased to 82%, representing a statistically significant improvement compared with either method used individually.
Anesthetic efficacy of mental/incis ive nerve block compared to inferior alveolar nerve block using 4% articaine in mandibular premolars with symptomati c irreversible pulpitis: a	Ghabra ei et al. (2018)	Iran	The aim was to evaluate and compare the onset time, anesthetic success, pain experience d during injection and discomfort after injection between the	random ized, parallel, double-blind.	Patient were provided seven HP VAS forms to record pain, discomfort or soreness at the injection site over the followong week. In addition, patients were asked to evaluate pain in the injection area and were guided on how to differentiate	N=64	This study included 64 patients, with root canal treatment initiated 10 minutes after the anesthetic injection. The results indicated a higher success rate for the MINB compared with the IANB, although the difference was not statistically significant. Both MINB and IANB, were performed with 4% articaine, demonstrated comparable effectiveness in achieving anesthesia in mandibular premolars suffering from irreversible pulpitis. However, greater post-injection discomfort was reported in the

randomized clinical trial			MINB and the IANB, both performed with 4% articaine, in mandibular premolars affected by SIP.		between postoperative dental pain and discomfort related to the injection site. An electric pulp test was performed.		MINB group than in the IANB group. (13)

Table 3: Synthesis of results

4.2.1. Study selection and characteristics

Studies summarized in table 3 were included in this systematized review comparing local anesthetic effectiveness between mental nerve block versus inferior alveolar nerve block in lower premolars with symptomatic irreversible pulpitis.

Variation was observed among the studies in term of sample size, methodology and data collection approach. Selected research was conducted between 2016 and 2025 across multiple country like South Asia, Eurasia and Middle East. Sample size ranged between sixty-four and one hundred fifty-three patients. The data collection techniques were based on clinical assessments and patient reported outcome via HP VAS, Numerical Rating Scale (NRS) papers and Electrical pulp test.

4.2.2. Primary outcomes

The main outcomes of this systematic review differ between the articles. In the first article, the primary focus is on the success rate of local anesthesia, defined as experiencing no or only mild pain during access cavity preparation and endodontic procedures. In the second article, the primary outcome centers on the intensity of pain experiences by patients during the endodontic treatment itself.

The comparison is done in pain intensity scores between MNB and IANB. While the 3rd article focuses on the success rate of each technique but also the need for supplementary anesthesia. A detailed breakdown of these outcomes is summarized in table 3.

Several studies focuses of the differences between theses two local anesthesia techniques.

5. DISCUSSION

Pain control during endodontic treatment of symptomatic irreversible pulpitis (SIP) is still a daily challenge for dentist that try to find each day the more effective and sustainable way to treat it.
Considering that almost every dental act triggers the patient because of the fear of pain, the need to control the pain is a non negligeable factor for a good treatment.
For that, searchers have compared the Mental/Incisive Nerve block (MINB) and the Inferior alveolar Nerve block (IANB) also different types of anesthesia.

5.1 Overall Anesthetic Success and the Role of anesthetic solution

The selection of the anesthetic solution has a major impact on the outcome of pain during or after endodontic procedure. Articaine, due to its higher concentration (4%) and increased lipophilicity, diffuses more effectively through bone, resulting in higher success rates than 2% lidocaine particularly for buccal infiltrations or when combined with other anesthetic techniques. Increasing the volume of 4% articaine further enhances its efficacity, in contrast, 2% lidocaine is associated with lower success rates and less reliable electric pulp results. (13)

5.2 The second premolar challenge

One of the aims of these studies is to determine whether the MINB is equally effective for both inferior premolars. However, inconsistencies were revealed in the results. One study reported that MINB was notably more effective for the first premolar (76,9%) than for the second premolar (64,7%). In the same study, the efficacy of the IANB was 71,4%. For the first premolar and 68,8% for the second when evaluated separately. In contrast other studies dis not observe such statistical differences. For instance, Aggarwal et al. reported success rates of 41% for the first premolar and 59% for the second premolar with MINB, with no significant difference between them. Similarly, Ghabraei et al. found a much higher overall success rate that was around 94,4%, again without any significant difference between the two premolars (13).

The significant difference observed in the study by Sülek et al. (2025) may be explained by its larger sample size, which could account for variations in reported success rates. (24)

From an anatomical perspective, the mental nerve mainly supplies the region of the first premolar. The second premolar area, however, often has a more complex innervation pattern, potentially receiving branches from the incisive nerve or directly from the IAN (inferior alveolar nerve) before it reaches the first premolar. Additionally, the nerves supplying the second premolar tend to lie deeper within the mandibular canal, making them less accessible through the mental foramen. Increased tissue resistance and the presence of inflammation in more posterior region may also reduce anesthetic effectiveness. (24)

The position of the mental foramen is another important factor due to its anatomical variability. In some individuals, it is located closer to the second premolar, which may improve anesthesia in that region. Aggarwal et al. (2016) reported that the injection site did not influence anesthesia success for the first premolar, whereas for the second premolar, administering the anesthetic directly into the mental foramen resulted in better outcomes.(25)

5.3 Temporal dynamic onset and duration

The timing of the anesthetic effect is a major distinguishable factor between these two techniques.

MINB has a significantly faster onset time with an average of 3 minutes. This is way less than IANB which has approximately an onset time of 7 minutes.

Although MINB present a shorter onset time one of its main disadvantage is the pulpal anesthesia effect might fade away after 20-30 minutes. (13)

5.4 Patient Comfort: Injection vs. Post-operative Pain

The patient's experience varies significantly from the moment of injection until the recovery period.

MINB gives lower injection pain because its administration is less painful. Shallower needle penetration is required and also it doesn't have to pass through as much non-anesthetized deep tissue as it would for and IANB.

Even if a slow injection significantly reduce IANB injection pain it is still superior to the MINB if also slowly injected.

On the other hand the negative aftermath of MINB administration is a significantly higher post injection pain during the fisrt four days at the soft tissue site. This pain is considered as generaly "mild" and resolve with days but it is still more prononced than the soreness following an IANB. (13)

5.5 Safety, Invasiveness, and Potential Complications

Due to it site of injection position and proximity, the MINB is a less invasive alterative that effectively avoid the deep tissue trauma linked to the IANB technique.
MINB is a selective type of anesthesia and that's also why it is so interesting and usefull. With MINB we avoid lingual nerve anesthesia which prevent the uncomfortable feeling of numb tongue that so many patients refers after getting an IANB. While avoiding the numb tongue feeling we also reduce the risk of lingual nerve paresthesia and preserve the aptient of an unecessary dolor.
IANB is linked to some rare but serious risks. Theses are transient facial nerve palsy, trismus and present an higher systemic toxicity due to it proximity with major vascular structures. While MINB Is limited mostly to prolonged numbness of the metal nerve distribution path, hematoma and/or localized swelling. (24)

5.6 Clinical strategies for treatment failure

As we just saw before neither technique can guarantee and 100% success rate and that's why supplemental strategies are ofter required in presence of symptomatic irreversible pulpitis.(13)
We can combine both techiques which means doing simultaneous administration of MINB and IANB. This process significantly boost the success rate up to 82%. MINB will provide a rapid peak of action while the IANB will help sustain it. (25)

Cross-Switching is also an option that can be used if an initial MINB fails. In this case we first try with an MINB injection and if it fails we follow it with an IANB (or vice versa) which can result in a 100% success rate.(24)

Supplemental injections is about intraligamentary anesthesia which despite the choice of primary block will be needed in approximatively 30% of patents in order to complete the procedure without moderate to devere pain. Success with supplemental intraligamentary anesthesia is reported at approximatively 50%. (24)

5.7 Limitations

This review has several limitations that need to be considered. The evidence is limited, with only three randomized trials available, each carrying a high risk of bias and inconsistencies in how the MINB was administred, such as variations in mandibular foramen localization. Therefore, the findings should be interpreted cautiously and cannot

serve as definitive clinical recommendations. The focus solely on patients with SIP limits the applicability of the results to other populations, including healthy participants or those with different dental conditions. Dependence on patient-reported pain measures may introduce variability in responses. Even though injection volume and duration were standardized, small differences could still affect anesthetic outcomes. Moreover, the small overall sample size and exclusion of alternative anesthetic techniques such as intraosseous or intraligamentary injections, reduce generalizability and highlight the need for larger, higer-quality studies in the future.

6. CONCLUSION

This systematic review, which included three randomized controlled trials, showed than MINB and IANB provide similar levels of anaesthetic success in mandibular premolars affected by symptomatic irreversible pulpitis, although the certainty of the evidence remains low. Despite their comparable performance, both techniques often required additional anesthesia to achieve a full and effective pulpal numbness. These results indicates that MINB may serve as a practical alternative to IANB in the management of symptomatic irreversible pulpitis cases. However, further high-quality randomized controlled trials employing standardized protocols are warranted to confirm and reinforce these findings.

7. SUSTAINABILITY

7.1 Economic sustainability

Both MINB and IANB are cost-effective techniques. However, their frequent need for supplemental anesthesia can increase overall treatment costs, including material and chair time. Improving anesthetic efficiency may reduce these additional expenses and enhance productivity. Minimizing complications can also lower the indirect costs that will be related to the follow-up care and patient management.

7.2 Environmental sustainability

Even if dental local anesthesia techniques such as MINB and IANB have limited environmental impact individually, they still contribute to clinical waste through disposable materials (cartridge, needles and protective equipment). Reducing the need for repeated and/or supplemental injections can help limit waste production and improve resource efficiency. Optimizing anesthetic success may therefore support more environmentally responsible dental practice.

7.3 Social and Ethical Sustainability

Patient comfort, safety and informed decision-making are essential considerations. Techniques associated with less pain and faster onset may improve patient experience and cooperation. Practicians must ensure equitable access to effective anesthesia and be totally transparent and communicate well about the benefits and limitations of each approach, especially given the current uncertainty in evidence.

7.4 Future perspectives

In the future we will need new well-designed studies to strengthen the evidence base and guided clinical decision-making. Advances in imaging, anesthetic techniques, and materials may improve both effectiveness and sustainability. Integrating sustainability principles into dental practice and education will be important for promoting more efficient and responsible care in the future.

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