ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 6, Issue – 2, April - 2023, Page No. : 456 – 466

Anesthetic Success rate of inferior alveolar block and Supplemental infiltration in patients with irreversible pulpitis - A Systematic Review

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Citation of this Article: Dr. Raja Keerthi. R, Dr. Nivedhitha M.S, Dr. Mavishna M V, Dr. Kaviya Baskar, "Anesthetic Success rate of inferior alveolar block and Supplemental infiltration in patients with irreversible pulpitis - A Systematic Review", IJDSIR- April - 2023, Volume – 6, Issue - 2, P. No. 456 – 466.

Type of Publication: Review Article

Conflicts of Interest: Nil

Abstract

Introduction: Successful local anesthesia is the bedrock of pain control in dentistry. Effective pain control is essential to reduce fear and anxiety associated with dental procedures. The inferior alveolar nerve block (IANB) is the conventional method for anesthetizing mandibular molar teeth. This failure rate of inferior alveolar nerve blocks represents a common clinical problem for the treatment of mandibular posterior teeth. Supplemental injections with different techniques and types of anaesthetics are frequently required in certain cases to achieve complete anesthesia.

Objective: To summarize the anesthetic efficacy of 4% articaine inferior alveolar nerve block with various mandibular nerve block technique

Data Collection and Analysis: All the studies included were based on the data extraction and analysis of the studies for quality and publication bias. The data collection form was customized.

Result: Although there is difference in the values com paring the different techniques the data is not significant different in the anesthetic efficacy of various mandibular nerve block in symptomatic dental patients.

Conclusion: Based on this review, most of the articles included showed a better anesthesia efficacy of the classic inferior alveolar nerve block compared to the

other man dibular anesthesia techniques. However due to various variables like types of local anesthesia, experience of the operator and familiarity with the individual techniques it is not possible to conclude that classic inferior alveolar nerve block is intact superior.

Hence, more properly designed randomized clinical trials are needed to evaluate the anesthetic efficacy of inferior alveolar nerve block with various mandibular nerve block.

Keywords: Gow-Gates, inferior alveolar nerve block, local anesthesia, molar, pulpitis.

Introduction

The inferior alveolar nerve (IAN) block is the most routinely used mandibular injection technique for achieving local anesthesia for dental treatment. How ever, the IAN block does not always result in successful painful anesthesia. In Vivo studies in endodontics have identified failure with the IAN block occurring between 44% and 81% of the time. (1)

Due to anesthesia failure clinician found difficult to enter the pulp to give an intra pulpal injection. To overcome it, practitioners should consider supplemental techniques, such as intra osseous, intra ligament, Periodontal ligament injections (Malamed et al., 2000a), to achieve pulpal anesthesia when an IAN block is not sufficient to anesthesia a particular tooth. (2,3)

Gow gates introduced new techniques for mandibular anesthesia in 1973. Gow gates technique uses extra oral landmarks and the insertion site is the neck of the man dibular condyle. Many studies have shown higher anesthetic efficiency with the Gow gates technique (92%-100%) than the conventional inferior nerve technique (65%-86%).

However, Todorovic et al. found a higher success rate with the conventional inferior alveolar nerve block than the Gow gates block, whereas others (Agren and Danie lesson 1981, Mont Agnese et al 1984, and Hung et al 2005) found the two techniques were equivalent.(4,5)

Akinosi introduced his techniques for mandibular anesthesia in 1977. However, Vazirani also highlighted a similar technique in 1960.

Hence the name of this techniques is Vazirani-Akinosi techniques.

This injection method is a closed mouth technique with the landmarks for needle insertion is mucogingival junction of the maxillary second molar. This technique is indicated when there is limited mouth opening, for example trismus, which precludes the use of the inferior alveolar or Gow-Gates techniques.(3)

Sisk et al and Todorovic et al 1986 found the Vazirani-Akinosi techniques was on same scale with conventional inferior alveolar nerve block. (6)

However, it was (Donkor et al 1990, Yucel et al 1995, and Gonzales et al 2003) found that the conventional IANB has good anesthetic efficiency compared to Vaz Irani-Akinosi.(6)

AIM: This systematic review was to aiming at the anesthetic efficacy of inferior alveolar nerve block with various mandibular nerve blocks in symptomatic irreversible patients.

Structured question: Is there a difference in anesthetic efficacy of inferior alveolar nerve block when compared to various mandibular nerve blocks in achieving anesthesia in irreversible pulpitis patients?

Pico analysis

- **Population:** Symptomatic irreversible pulpitis
- **Intervention:** Inferior alveolar nerve block
- **Comparison:** various mandibular nerve block technique
- **Outcome:** Anesthetic efficiency in patients with irreversible pulpitis

Materials and methods

Sources Used

For identification of studies included or considered for this review, detailed search strategies were developed for the database searched.

The MEDLINE search used the com bination of controlled vocabulary and free text terms. Ethical approval for this study Institutional human ethical committee [Ref NO: IHEC/SDC-ENDO-1712/ 20/ 149] was provided by Institutional human ethical committee of Saveetha Institute of Medical and Technical Sciences, Chennai, India (chairman Dr. Guha Pradeepa) on 2 July 2020.

Searched Databases

- PubMed
- PubMed Advanced Search
- Science direct
- Cochrane Database of Systematic Review

Language

There were no language restrictions.

Hand Search

- The following journals were hand searched.
- International Endodontic Journal
- Journal of Endodontics
- Journal of International Oral Health
- Dental Research Journal

Table 1: Search Methodology

Recent queries in PubMed			
Search	Query	Items found	Time
#33	Search (((((((Pulpitis) OR Irreversible pulpitis) OR Dental decay tooth) OR Symptomatic irreversible pulpitis) OR Hot tooth)) AND ((((((((((((((((((Local infiltration) OR Lingual nerve block) OR Long buccal nerve block) OR Vibrotactile devices) OR Vibrajet) OR Dental vibe) OR Accupal) OR Wand system) OR Comfort control syringe) OR Syrijet) OR Med jet) OR Safety dental syringe) OR Ultra safe syringe) OR Hypo safety syringe) OR Safety wand) OR Revvac) OR Stab ident) OR X tip) OR Intra flow) OR Computer controlled local anaesthesia)) AND ((((Mandibular nerve block) OR Gow gates technique) OR Vazirani Akinosi technique) OR Inferior alveolar nerve block)	65	21:32:30
#32	Search (((Mandibular nerve block) OR Gow gates technique) OR Vazirani Akinosi technique) OR Inferior alveolar nerve block	999723	21:32:03
#31	Search Inferior alveolar nerve block	1163	21:31:46
#30	Search Vazirani Akinosi technique	13	21:31:25
#29	Search Gow gates technique	998796	21:31:02
#28	Search Mandibular nerve block	1050	21:30:40
#27	Search ((((((((((((((((((Local infiltration) OR Lingual nerve block) OR Long buccal nerve block) OR Vibrotactile devices) OR Vibrajet) OR Dental vibe) OR Accupal) OR Wand system) OR Comfort control syringe) OR Syrijet) OR Med jet) OR Safety	36164	21:29:57

	dental syringe) OR Ultra safe syringe) OR Hypo safety syringe) OR Safety wand) OR Revvac) OR Stab ident) OR X tip) OR Intra flow) OR Computer controlled local anaesthesia		

Inclusion criteria

Criteria for considering studies for this review.

- Randomized Controlled trials or Clinical trials.
- Anesthetic efficacy assessed after various mandi bular nerve block administration
- Irreversible pulpitis patients with pain in mandi bular region
- Inferior alveolar nerve block compared to various mandibular nerve blocks
- Anesthetic success after administration of mandibular nerve block

Exclusion criteria

The following studies were excluded,

- Case report
- Review articles
- Studies comparing with oral.

Chart 1: Search flow chart

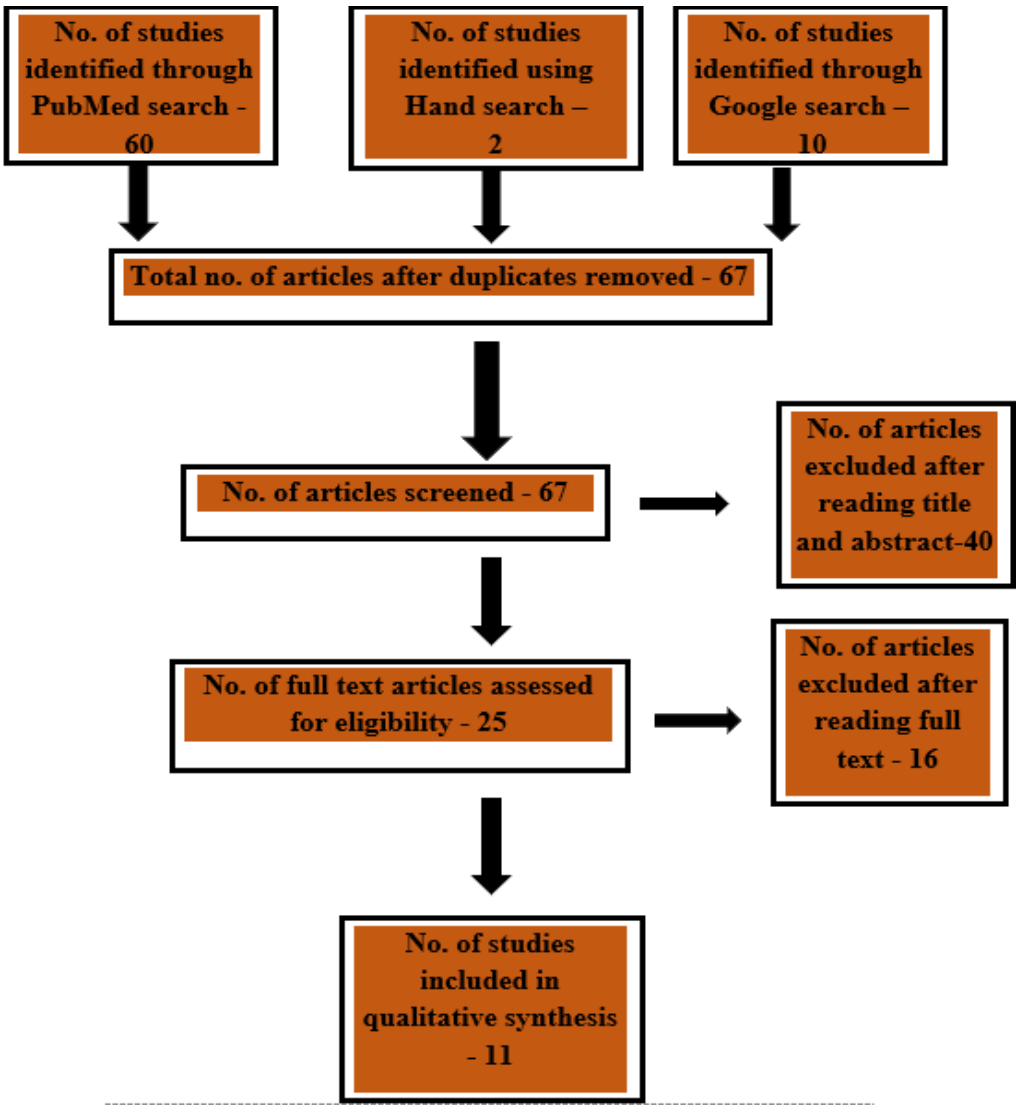


Table 2:

s.no	Author	year	Country	Study Design	Sample Size	Age	Set-up	Technique used	Method of evaluation	Mean Value	Outcome
1	Shahriar et al	2018	Iran	Randomized Double blinded clinical trail	96	>18	university	Inferior alveolar nerve block, buccal infiltration	Lip numbness and initial access opening	IANB with Intraligamentary injection 75%, IANB with buccal infiltration 65.5%, IANB alone 28.1%	IANB with intrligamentrary injection success rate 75% which was significantly higher than the IANB 28.1% (p<.05)
2	Michael et al	2018	USA	Randomised double clinical trial	199	>18	university	Inferior alveolar nerve block, buccal infiltration	Lip numbness and initial access opening	Success rate of IANB 25% with 4% articaine, buccal infiltration in first molar 61% and second molar 63%, lidocaine in first molar 66% second molar is 32%	In first molars, articaine BI was successful 61% of the time, and lidocaine was successful rate is 66%(p>.05). second molar 63% articaine buccal infiltration significantly better than 32% of lidocaine.
3	Yilmaz k et al	2018	Turkey	RCT	40	>18	University	Inferior alveolar nerve block, buccal infiltration	Lip numbness and initial access opening	Success rate of buccal infiltration 41.35% signifi cantly higher compared to IANB 35.6% (P>0.05)	Thers is no difference between buccal infiltration 41.35% and IANB (p>0.05)
4	Jamilah et al	2018	Iran	Randomized double blinded Clinical Trial	80	>18	University	Inferior alveolar nerve block, Gow gates, buccal infiltration, lingual infiltration	Lip numbness and initial access opening	Success rate of Gow gates 50% and Inferior alveolar nerve block is 42.5% (p<0.05)	IANB and Gow-Gates was comparable in mandibular molars with symptomatic irreversible pulpitis (P<0.05)
5	Singha et al	2014	India	Randomized double blinded Clinical Trial	234		university	Inferior alveolar nerve block	Lip numbness and initial access opening	IANB success rate 37% buccal infiltration 62%	Success rate of IANB with buccal infiltration was higher compared to IANB 37%(p>0.05)
6	Brandon et al	2014	USA	Randomized double blind study	100	>18	university	Inferior alveolar nerve block	Lip numbness and initial access opening	Success rate of IANB is 26% with supplemental buccal infiltration 62% and 37% for articaine(p<.05)	Success rate of IANB is 26% with supplemental buccal infiltration 62% and 37% for articaine(p<.05)
7	Hengam eh et al	2013	Iran	Randomized double blinded Clinical Trial	125	<20	university	Inferior alveolar nerve block, infiltration	Lip numbness and initial access opening	Infiltration injection after an incomplete IANB by using lidocaine 29%. whereas articaine 71% (P <.001)	Infiltration injection after an incomplete IANB by using lidocaine 29%. whereas articaine 71%(P<.001)

8	Dou et al	2012	China	Randomized single blinded study	80	>18	university	Inferior alveolar nerve block, lingual infiltration, IANB plus Buccal Infiltration	Endodontic access and initial instrumentation	Buccal Infiltration 70% Buccal plus Lingual Infiltration 62.5%	Buccal Infiltration 70% Buccal plus Lingual Infiltration 62.5%
9	Saravanan poorni et al	2011	India	Randomized Double blind clinical trial	156	>18	university	Inferior alveolar nerve block buccal infiltration	Endodontic access and initial instrumentation	IANB in 4% articaine 75% buccal infiltration 69.5% IANB in 2% lidocaine is 65.4%	IANB in 4% articaine 75% buccal infiltration 69.5% IANB in 2% lidocaine is 65.4%
10	Vivek aggarwal et al	2009	India	Randomized Double blind clinical trial	87	>28	university	Inferior alveolar nerve block, supplemental Infiltration	Endodontic access and Initial instrumentation	IANB Plus Lidocaine infiltration 66% (first molar)34%(second molar) IANB Plus articaine infiltration 64% (first molar) 36% (second molar)	Supplemental infiltration 4% articaine or lidocaine increased the success rate of IANB (P<0.05)
11	Vivek Aggarwal et al	2009	India	Randomized Double blind clinical trial	100	>28	university	Inferior alveolar nerve block, supplemental infiltration	Endodontic access and Initial instrumentation	Success rate of IANB 36%, Gow-Gates 52%, Vazirani-Akinosi 41%, Infiltration 27%	Gow-Gates increase the success rate 41%compared with IANB. (P>0.05)

Table 3: General information – results

Sn.	Author	Technique	Method of Evaluation	Mean Value	Outcome
1.	Shahriar et al 2018 (7)	Inferior alveolar, buc cal infiltration and intra lig mentary in jection	Lip numbness, initial access opening	IANB with Intraliga mentary injection 75%, IANB with buccal infilt ration 65.5%, IANB alone 28.1%	IANB with intrligamentrary injection success rate 75% which was significantly higher than the IANB 28.1% (p<.05)
2.	Michael et al 2018(8)	Inferior alveolar nerve block, buccal in filtration	Lip numbness, initial access opening	Success rate of IANB 25% with 4% articaine, buccal infiltration in first molar 61% and second molar 63%, lidocaine in first molar 66% second molar is 32%	In first molars, articaine BI was successful 61% of the time, and lidocaine was successful rate is 66%(p>.05) . second molar 63% articaine buccal infiltration significantly better than 32% of lidocaine.
Yilmaz k et al 2018 (9)		Inferior alveolar nerve block, buccal infiltration	Lip numbness, initial access opening	Success rate of buccal infiltration 41.35% significantly higher compared to IANB 35.6%(P>0.05)	There is no difference between buccal infiltration 41.35% and IANB (p>0.05)
4.	Jamilah et al 2018 (5)	Gow-Gates, Inferior alveolar nerve block, Lingual infiltration	Lip numbness, initial access opening	Success rate of Gow gates 50% and Inferior alveolar nerve block is 42.5%(p<0.05)	IANB and Gow-Gates was comparable in mandibular molars with symptomatic irreversible pulpitis (P<0.05)

Sn.	Author	Technique	Method of Evaluation	Mean Value	Outcome
5.	Singha et al 2014	IANB, Buccal Infit ration	Lip numb ness , initial access opening	IANB success rate 37% buccal infiltration 62%	Success rate of IANB with buccal infiltration was higher compared to IANB 37%(p>0.05)
6.	Brandon et al 2014(10)	Inferior alveolar nerve block, supple mental buccal infiltration	Lip numbness, initial access opening	Success rate of IANB is 26% with supplemental buccal infiltration 62% and 37% for articaine (p<.05)	Buccal infiltration with articaine 62% was significantly more effective than lidocaine(p>0.05)
7.	Hengam eh et al 2013(11)	Inferior alveolar nerve block, Supplemental buccal injection	Lip numbness, initial access opening	Infiltration injection after an incomplete IANB by using lidocaine 29%. whereas articaine 71%(P<.001)	Success rate of articaine in IANB was 71(p<.001)
8.	Dou L et al, 2012(12)	IANB, Buccal infiltration, Lingual infiltration	Endodontic access cavity preparation	Buccal Infiltration 70% Buccal plus Lingual Infiltration 62.5%	No significant difference between two groups (p=0.478)
9.	Saravan an Poorni et al,2011(13)	Buccal infiltration, IANB	Endodontic access cavity preparation	IANB in 4% articaine 75% buccal infiltration 69.5% IANB in 2% lidocaine is 65.4%	Between this group no significant difference (p>0.05)
10.	Vivek Aggarw al et al ,2009(1 4)	IANB, Buccal infiltration, Lingual infiltration	Endodontic access cavity preparation	IANB Plus Lidocaine infiltration 66% (first molar)34% (second molar) IANB Plus articaine infiltration 64% (first molar) 36% (second molar)	Supplemental infiltration 4% articaine or lidocaine increased the success rate of IANB (P<0.05)
11.	Vivek Aggarw al et al ,2009	Gow-Gates, Vazirani-Akinosi	Endodontic access cavity preparation	Success rate of IANB 36%, Gow-Gates 52%, Vazirani-Akinosi 41%, Infiltration 27%	Gow-Gates increase the success rate 41%compared with IANB. (P>0.05)

Table 4: evidence of selected articles (2016)

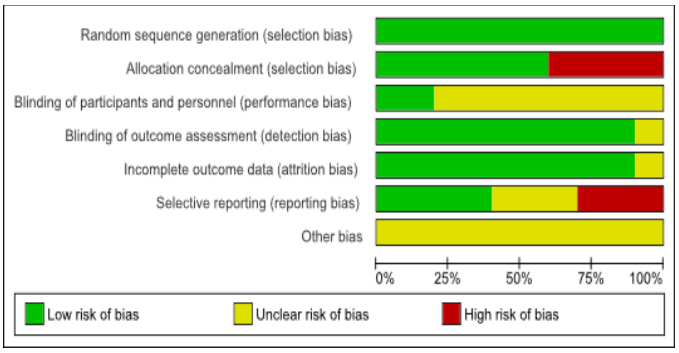
Sn.	Author	Year	Study Design	Level of Evidence
1.	Shahriar et al	2018	RCT	Level 2
2.	Michael et al	2018	RCT	Level 2
3.	Yilmaz et al	2018	RCT	Level 2

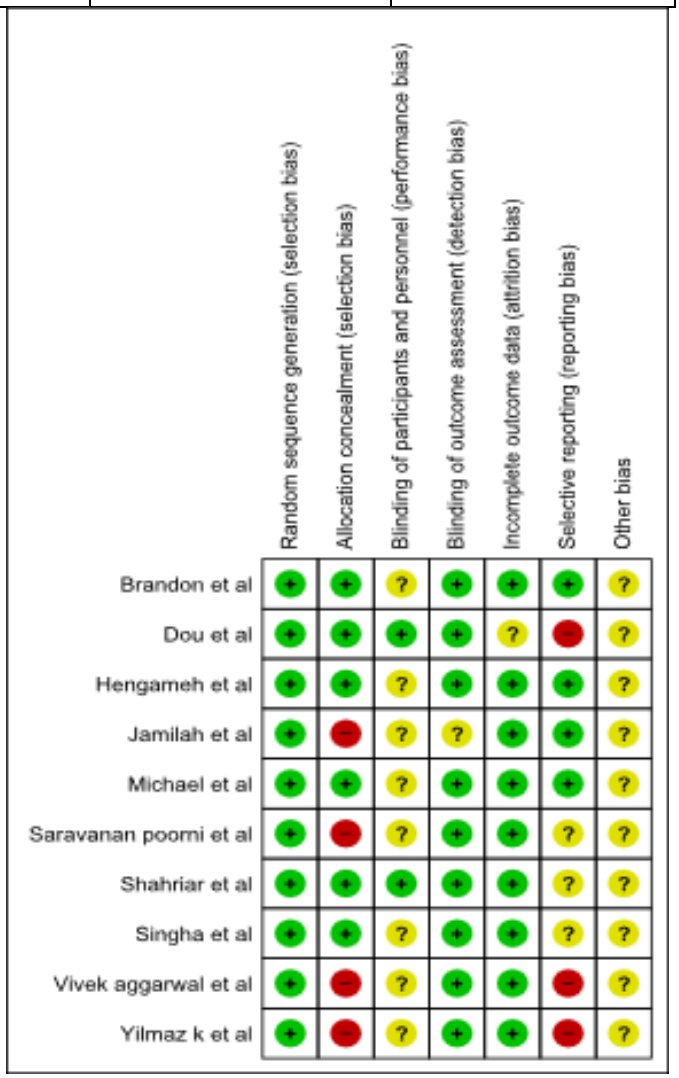
4.	Jamilah et al	2018	RCT	Level 2
5.	Singha et al	2014	RCT	Level 2
6.	Brandon et al	2014	RCT	Level 2
7.	Hengameh et al	2013	RCT	Level 2
8.	Dou et al	2012	RCT	Level 2
9.	Saravanan Poorni et al	2011	RCT	Level 2
10.	Vivek Aggarwal et al	2009	RCT	Level 2
11.	Vivek Aggarwal et al	2009	RCT	Level 2

Risk of Bias in Included Studies

The assessment for the four main methodological quality items is shown in the table. The study was assessed to have a 'high risk' of bias if it did not record a 'Yes' in three or more of the four main categories, 'Moderate' if two out of four categories did not record a 'Yes' and 'Low' if randomization assessor blinding and complete ness of follow – up were considered adequate.

Graph 1: risk of bias – major criteria.





Discussion

Before starting any endodontic procedures, the primary goal is to achieve and maintain profound pulpal anesthesia as it helps to decrease patient anxiety and improves the operator working and efficiency.(15) Lidocaine hydrochloride most com monly used local anesthesia from its introduction due to efficacy, low

allergenicity, and minimal toxicity through clinical use and research. Despite the gold standard properties, numerous studies and research have advocated the use of articaine hydrochloride as a better anesthetic agent, based on its enhanced anesthetic potency, which is 1.5 times effective than that of lidocaine, with faster onset and more success rate.(13)

There are several difficulties in obtaining pulpal anesthesia in mandibular molars include insufficient local anesthesia, poor technique (e.g., Limited mouth opening, improper needle angulation), anatomy (e.g., accessory nerve supply and variation on location of mandibular foramen based on age), pathology (e.g., trismus, infection, inflammation), pharmacology (e.g., Alcoholic patients, chronic narcotic drug abuse), and psychology (e.g., psycho logical fear, anxious patients, apprehension). Periapical pathology(activation of inflammatory mediators decrease in the success rate of anesthetic efficiency in patients with irreversible pulpitis)(10,16,17)

Alternatives to conventional IAN include Buccal In filtration, Periodontal injections, intraosseous, Intraligament, computer-aided injections, needle free injections, and electronic dental anesthesia. Banger Ter et al recently stated that supplemental intraosseous (IO) anesthesia (94.77%) and PDL injection (49.78%) were the most commonly administered supplemental techniques in day-to-day practice among US dentists. (16)

The success rate for IANBs with an intrafilamentary injection was 75%, and for IANBs with a buccal injection, it was 65.6%. For IANBs alone, the success rate was 28.1%.(7) Shahriar Shahi et al in 2018 has found that success rate of supple mental Intrafilamentary injections in anesthetizing pulp for endodontic procedures has been reported to be 50 to 96%. Intraligamentary injection is achieved by injecting anesthesia under pressure. (18) The success rate of combining IAN block with buccal infiltration is 65.4%, which was higher than then plain IAN block with both 1.8 mL is 14.80% and 3.6 mL of the same anesthetic solution is 39.3%. (11,19,20)

Compared to other methods inferior alveolar nerve block is easier to learn due to the numerous trace able landmarks. Even though positive aspiration is higher inferior alveolar nerve block clinically hematoma formation is lower compared to other methods. Thus, it is safer for clinical applications. Although not all articles reported statistically significant difference between the various techniques. They do however; report is higher level of anesthetic efficacy with classic inferior alveolar nerve block.

Conclusion

Based on this review, most of the articles included showed a better anesthetic efficacy of the classic inferior alveolar nerve block compared to the mandibular anesthesia techniques. However due to various variables like type of local anesthesia, experience of the operator and familiarity with the individual techniques it is possible to conclude that classic inferior alveolar nerve block along with Intra ligamentary infiltration is In fact superior than the Inferior nerve block alone.

Hence, more properly designed randomized clinical trials are needed to evaluate the anaesthetic efficacy of inferior alveolar nerve block with various mandibular nerve block.

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