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The efficiency of Articaine only buccal infiltration technique as alternative local anaesthesia technique to inferior alveolar nerve block

Samira Osailan

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Authors' Affiliation:
BDS, MSc, FDSRCSeng, PhD, Department of Oral & maxillofacial Surgery Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia

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ABSTRACT

Background: The Inferior Alveolar Nerve Block (IANB) and other nerve blocks are associated with an increased risk of nerve injury. Articaine-only infiltrations, which include buccal injections, are recently showing comparable effectiveness to Lidocaine IAN blocks for mandibular teeth, therefore reducing the need for an IAN block. The study aims to assess Articaine only infiltration (AOBIT) effectiveness in administering local anaesthesia for monotonous mandibular teeth extractions in adults. *Methods:* This research consist 172 patients, both male and female, varying in age from 18 to 75 years. In all 204 mandibular teeth in which 182 excessively decayed mandibular molars and 22 premolars were extracted. The local anaesthesia was given by a specialist OS and extraction was done by UG students under the super-vision of consultant. AOBIT effectiveness was assessed in contrast to the necessity for repeated Articaine infiltrations or rescue IANB with Lidocaine 2%. *Results:* From the total of 172 patients; 96 (55.8%) were males and 76 (44.2%) were females. Age range was from 18-75 years with the mean of 40 ± 13.7 years. depending only on the AOBIT, sufficient anaesthesia was obtained in 86.7 % of 172 patients and 204 teeth, In the remaining 13.3% of patients, a 'rescue' 2% Lidocaine IAN block is required. *Conclusion:* For normal adult mandibular tooth extractions, Articaine 4% alone (AOBIT) technique of buccal infiltration might be a good alternative to Inferior-Alveolar-Nerve-Block with Lidocaine 2%, success rate was remarkable and this technique could help in reducing nerve injuries due to IAN and lingual nerve blocks.

Keywords: Articaine-Only Buccal Infiltration Technique, IANB, Articaine, Local Anaesthesia.

1. INTRODUCTION

Injuries of nerve related to the administration of local anaesthesia (LA) can leave patients with lifelong neuropathic pain and may occur more frequently (Renton & Van der Cruyssen, 2020). Routine inferior dental IAN and other

nerve blocks are associated with an increased risk of nerve damage when compared with infiltrative techniques (Arrow, 2012). Articaine was manufactured in 1969, but it was not introduced in clinical dentistry until 1976. It bears few unique chemical characteristics like, amide that's the only local anaesthetic with a thiophene ring and no aromatic ring in its chemical structure, as well as the only frequently used amide local anaesthetic with an extra ester ring. It contains both buffered and nonbuffered formula. Studies proved there is no discernible buffered and nonbuffered formula in their efficacy as local anaesthic drugs (Shurtz et al., 2015). When compared to standard 2 percent Lidocaine, the advantages of utilizing 4 percent Articaine include reduced toxicity following unintended intravascular administration, quick onset of surgical anaesthetic, and greater penetration through periodontal tissues (Camiel et al., 2021; Decloux & Ouanounou, 2021).

Many scientists investigated the use of Articaine 4% buccal Infiltration techniques as supplementary to IAN block (El-Kholey, 2017), the results revealed that Inferior-alveolar-nerve-block injection combined with Articaine 4 percent buccal-infiltration was higher effective for anaesthesia of pulp in lower jaw teeth than IANB alone (Afkhami et al., 2021). Another paper compares the effectiveness of diverse local anaesthetic drugs. Studied the success rate of using Articaine 4% buccal infiltration to other 4% lidocaine and 4% prilocaine, the results revealed a substantial difference in success rates between articaine and lidocaine and prilocaine formulations, with Articaine 4 percent having a greater success rate (Aggarwal et al., 2019). The use of Articaine-only infiltrations, which include buccal injections, is currently signifying similar efficacy to Lidocaine IAN blocks for mandibular teeth, thus eliminating the necessity for an IAN block completely (Kumar, 2019; Majid & Muhammad, 2019; McIlvanna, 2020).

The aim of this manuscript is to evaluate if the AOBIT can be a useful alternative LA technique to IAN, lingual, long buccal blocks for routine extraction of mandibular teeth in adults.

2. MATERIALS AND METHODS

There were 172 adult patients attending undergraduate clinic at the Department of Oral Surgery in King's College Hospital or referred from acute dental care unit in the same hospital for extractions of excessively decayed mandibular teeth from May 2021-January 2022 were included in this study. Although the extraction was done by undergraduate dental students but local anaesthesia was given by four oral surgery specialists and later supervised extractions were done by UG students. The specialists' clinicians agreed to participate in this study.

Sample selection

Any patient above 18 years of age, who were scheduled for routine dental extractions under LA were included in the study. These extractions included fully erupted mandibular teeth extractions using forceps, elevators, and through root sectioning. The exclusion criteria were: patients under 18 years, extractions requiring flaps or buccal bone removal, or impacted third molars or presenting with spreading infection, and those who reported allergy to Articaine.

Technique

To ensure reliability, an appropriately trained oral surgery specialist was performing all AOBIT and student did tooth extraction under supervision. AOBIT effectiveness was judged in contradiction of the necessity for repeated Articaine infiltrations or rescue IANB with Lidocaine 2%. Using a conventional aspirating dental syringe with a 30 gauges and short needle, Articaine 4% (1.7ml cartridge) was given only via buccal infiltration Interdental papillary infiltration only from buccal approach while ensuring blanching of the lingual and buccal attached gingivae of the tooth to be extracted (Figure 1).

Figure 1 Demonstration of the Articaine buccal infiltration technique, which shows blanching of the lingual or palatal attached gingivae of the tooth to be extracted.

Following this, the effectiveness of local anaesthesia was evaluated using a sharp probe and the patient was asked verbally for his/her response to pain, then the extraction was initiated. If at any point the patient discerned pain during the extraction, a

repeated buccal infiltrative dose of Articaine 4% was provided. If the patient continued to feel pain, then a rescue IAN block with 2% Lidocaine (1.8 ml) was administered. The effectiveness of the infiltration technique was judged against the need for repeated or rescues inferior alveolar nerve block (IANBs), while also taking into account the difficulty of the extraction.

Data collection and analyses

The data was then collated onto an excel spreadsheet and analysed using the SPSS statistical software. Where data was categorical, appropriate Chi-square tests were carried out. Continuous and parametric data were assessed using the Analysis of Variance (ANOVA) tests and Students t-Tests; P values less than .05 indicated statistically significant results.

3. RESULTS

A total of 172 patients from different ethnic backgrounds with age range from 18-75 years were included in this study. Details of ethnicity could be explained as 58.1% were Affro-caribbean, 27.2% were caucasioan, 2.9% were Asian, 1.5% were from mixed backgrounds and 9.6% were from other ethnicities (Figure 2). A total of 204 mandibular teeth with 182 excessively decayed mandibular molars and 22 premolars were extracted in this study.

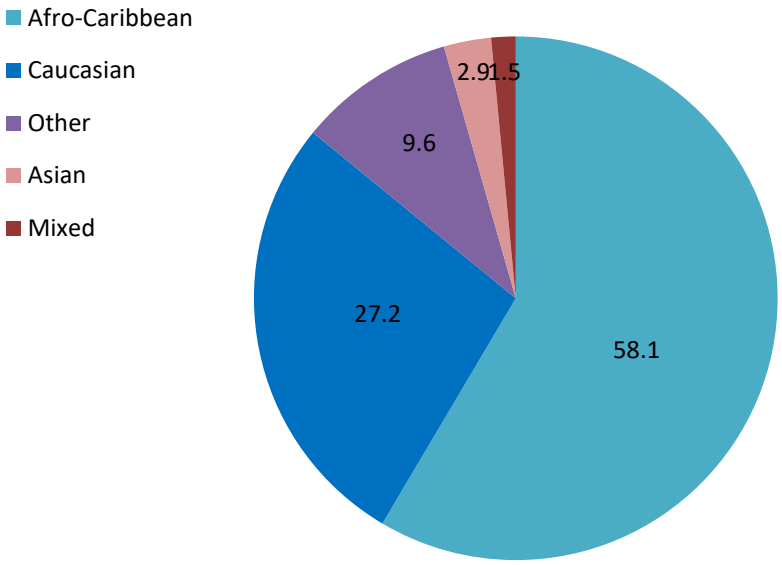

Figure 2 Ethnicity of patients involved in this study.

Dose of Articaine administration

All patients (172) received an initial dose of 4% Articaine which included 204 mandibular molars and premolars. A single administration of 4% Articaine alone achieved complete anaesthesia in 149 teeth, 55 had repeated shots of LA, 26 out of those 55 needed rescue IANB. (63.8%) cases, whereby the mean total dose required was 1.8 ml (Table 1). The mean initial dose of Articaine given via the AOBIT was 1.8 ml. A repeated dose of 4% Articaine was required before commencing the extraction in 55 teeth. So, in these cases, a repeated Articaine infiltration with a mean dose of 1.50ml was required. A rescue infiltration or block of 2% Lidocaine additional dose of 1.8 ml was administered in 26 patients to facilitate the extraction.

Table 1 Summary of the mean Articaine administration doses

LA administration		Mean (ml) [range]
Single dose of Articaine alone		1.87 [1.0-4.4]
Multiple	Initial Articaine	[0.7-4.4]
	Repeat Articaine	[0.5-6.6]
	Repeated Articaine	1.50 [0.2-2.0]
Articaine + Rescue IANB		3.37 [1.0-6.6]

Dose of Articaine in relation to general demographics of patients Articaine dose vs. gender and age

There was no significant difference between the number of males (n=15) and females (n=11) who required a rescue lidocaine injection/block (P>.05). The average total doses of Articaine administered were also not significantly different for the various patient age groups, as indicated in (Figure 3) (P<.05).

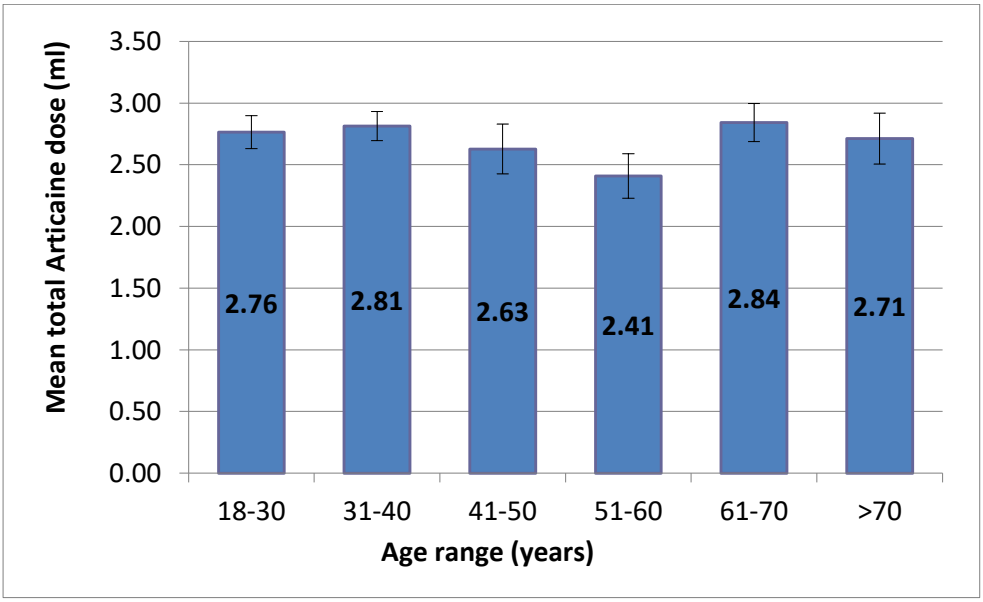

Figure 3 Summary of the mean total dose of Articaine given to patients across the various age groups (P>.05)

Efficacy of the AOBIT

Precise and detailed information regarding the AOBIT administration was available for 172 patients with 204 mandibular posterior teeth patients involved in this study. From these results, it was evident that sufficient anaesthesia was achieved in 149 of the 204 patients using the initial and repeated AOBIT, thus indicating an 86.7% success rate for the AOBIT including Initial (N=149) & repeated (N=55) doses. A rescue inferior alveolar nerve block with 2% Lidocaine was administered to 26 (13.3%) patients during the extraction (Figure 4).

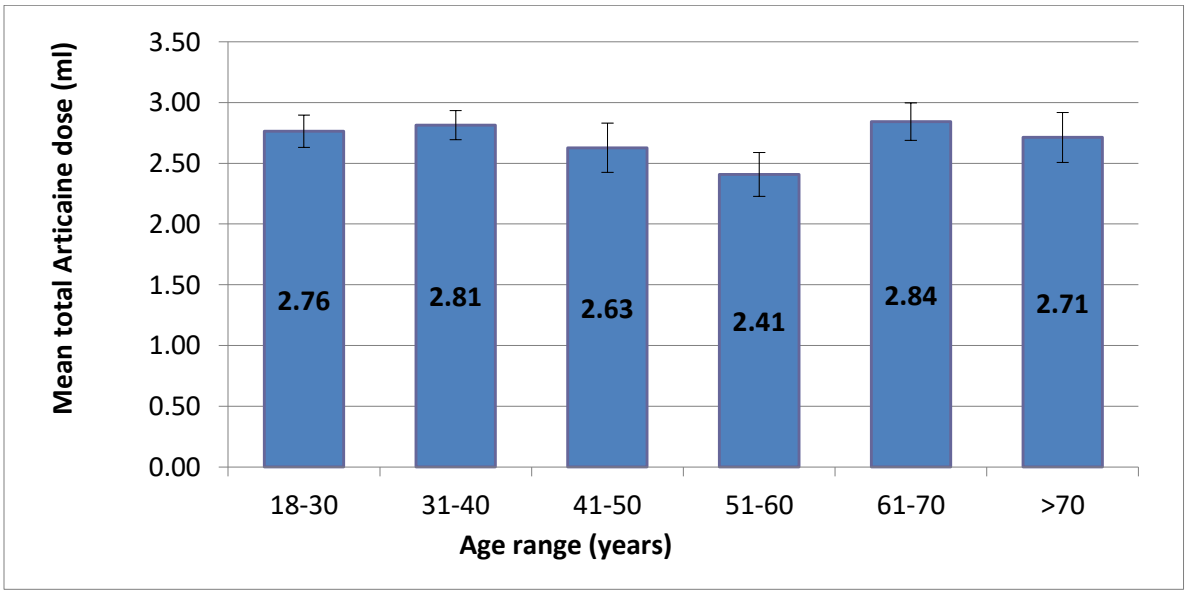

Figure 4 Summary of the mean total dose of Articaine given to patients across the various age groups (*P*>.05)

Efficacy of Articaine for extraction of mandibular posterior teeth

When evaluating extraction of mandibular molars conventionally anaesthetized using 2% Lidocaine IAN blocks, the AOBIT provided adequate anaesthesia in 149 (86.7%) of cases without any rescue Lidocaine IAN blocks (Table 2).

Table 2 Summary of the types of LA administered for mandibular molar extractions grouping

LA administration		Frequency (%)
Articaine alone	Single dose of Articaine	86 (57)
	Articaine + repeat dose	18 (12)
	Articaine + repeated	16 (11)
Articaine + rescue IANB	Articaine initial + rescue IANB	14 (9)
	Articaine initial + repeat + rescue IANB	14 (9)
	Articaine initial + repeated + rescue IANB	2 (1)
	Rescue IANB alone	2 (1)

The remaining 55 teeth (13.3%) of mandibular molars extracted required a rescue IANB, of which 26 of cases had repeated Articaine infiltration that was followed by the rescue IANB. When assessing the number of doses of Articaine that patients required during mandibular molar extractions, only 57% were successfully carried out using the single initial dose of Articaine alone (Figure 5).

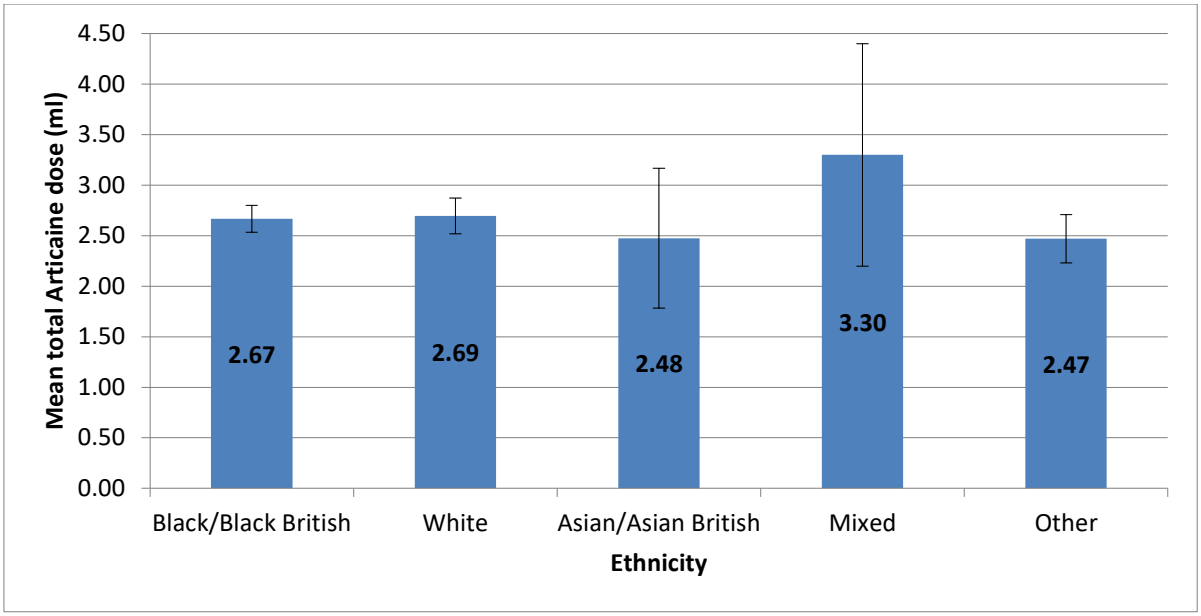

Figure 5 Summary of the mean total dose of Articaine administered across the various ethnic groups (P>.05).

4. DISCUSSION

The provisional results of this audit on Articaine only buccal infiltration technique (AOBIT) are promising and clinician friendly as well, as indicated by an 86.7% success rate in achieving adequate anesthesia for routine extractions for mandibular molars and premolars. The success of IAN blocks using 2% Lidocaine was estimated to be anywhere between 39-91%, depending on operator experience (Keetley & Moles, 2001; Parirokh et al., 2010). This indicates that the AOBIT is potentially as reliable in achieving anesthesia to conventional Lidocaine blocks. This could possibly be due to its simple technique via direct introduction in proximity to the tooth apex and its greater tissue penetrating abilities when compared with 2% lidocaine. Moreover, this has anaesthetized the lingual gingiva from buccal approach without the need of long buccal nerve was a unique advantage of this technique. Similar study was done on maxilliary teeth (Reed et al., 2012).

Whilst this study provides a much needed evidence base to support the AOBIT practice, the limitations of this audit must be recognized which included was using VAS to assess patient pain scale. For better assurance of results a positive control group could have been used by using same side on the same patient by giving IAN block which would provide the highest level of evidence in comparing these LA techniques (Wells & McCaffery, 2004). AOBIT was only applied to routine exodontia in this audit. Whether AOBIT would be applicable for more complex extractions or for surgical removal of wisdom teeth remains to be established in future studies. Application of the AOBIT techniques to other procedures than extraction of teeth such as Root canal treatment or

deep restoration (Verma, 2014). Many dentists and implantologists practice through routinely using this technique for their daily clinical practice (Lima et al., 2013).

A recent study reports that age of 10 years may indicate poorer response for restoration of molar teeth using infiltration LA techniques in dentistry (Salomon et al., 2012). Interestingly another study reports that using infiltration dentistry is less likely to put children off subsequent dental visits (Ram et al., 2012). However, evidence for this practice remains sparse and further studies are required (John G Meechan, 2011). AOBIT for paediatric dentistry has been explored in a recent study on restoration of posterior molars in 57 children randomly allocated in several study groups (Arrow, 2012). The control group Lidocaine IANB provided a success rate of 100%. When comparing buccal infiltration techniques with either Lidocaine or Articaine and the overall relative success of 71%:64% (P>.05).

The researchers concluded that using IANBs resulted in a greater success rate and less unpleasant therapy. When given by buccal infiltration, there was no statistically significant difference in local anaesthetic success between Articaine and Lidocaine (Kanaa et al., 2009). It must be acknowledged that exodontia requires significantly less anesthesia compared with some restorative procedures, particularly those involving 'hot' pulps and endodontic procedures. A recent study assessing pulpal anesthesia in healthy mandibular first molars reported similar pulpal anesthesia rates for Lidocaine IANBs and AOBIT (Meechan et al., 2011). The same team reported on a prospective randomized study, evaluating restorative treatment of mandibular molars with pulpitis, requiring additional 'top up' LA in addition to an IANB with 2% Lidocaine in 182 patients. Their conclusion was that Articaine buccal infiltration with additional intraosseous Lidocaine was a superior 'top up' LA technique compared with repeated Lidocaine IANBs (Mohammad D Kanaa et al., 2012). Thus, further studies are required to assess the appropriateness of the AOBIT technique for endodontics and teeth with pulpitis.

Some clinicians may express reservations about a technique that requires top up block LA in over 10% of cases, with concern about causing unnecessary discomfort to patients. In this audit only 13% of patients required additional block injections and there is no doubt these are the most dreaded and uncomfortable injections for patients. It is a common problem having to 'top up' LA for dental procedures and as long as the patients' expectations are managed, and they are given in control to specify they are in discomfort and need additional LA, most patients accept this for routine dentistry (Appukuttan, 2016). The advantages of this technique include evasion of deep painful block injections, avoidance of prolonged numb tongues and palates after routine care and minimizing nerve injuries which are not insignificant side effects but in fact the biggest challenge to dental practioners (Juodzbalys et al., 2011).

Avoidance of LA associated nerve injuries are paramount as they are untreatable and 25% remain permanent and are significantly more common than previously thought (Renton et al., 2010). Several studies have shown that IANB injections with any agent carry a risk of Inferior alveolar and lingual nerve damage (Malamed, 2006; Pogrel et al., 2003; Smith & Lung, 2006). Their incidence may be increased by greater concentrations of anaesthetics or by repeated nerve blocks given at the same appointment (Gaffen & Haas, 2009; Hillerup & Jensen, 2006).

Recent studies have highlighted the neurotoxicity of the higher concentration agents to nerve tissues thus adding weight to the debate for their avoidance for routine use for IANBs (Søren Hillerup et al., 2011). These injuries can lead to severe and debilitating lifelong neuropathic pain (Borzan & Meyer, 2009), which can also have important medico-legal implications (Tara Renton, 2010). In addition to avoiding potential nerve injuries the AOBIT also avoids the prolonged lingual anesthesia and in many cases mental paresthesia associated with routine IANBs. The patients in this audit reported increased comfort of the AOBIT compared with conventional IANB technique as described by the patients, pre and post-operatively. The reduced discomfort with AOBIT could be due to the minimal depth of tissue penetration and its greater reliability.

5. CONCLUSION

The investigator of this study recommends Articaine only buccal infiltration technique (AOBIT) for routine extractions as an effective and acceptable local anaesthesia technique, and an alternative to ID and other nerve blocks. In addition, it is expected that the AOBIT carries a lower risk of nerve injury when compared with block injections. Its simple technique via direct administration in proximity to teeth and has greater patient comfort and it may increase success rates when compared with blind administration during IANB's. Hence, this may consequently reduce the incidence of LA-related nerve injury in dentistry if applied where possible.

Ethical approval

The research proposal was approved by the Ethical Committee of Human Research at the School of Dentistry-KAU, in Jeddah, Saudi Arabia with Ethical approval number (018-0128).

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This study has not received any external funding.

Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Afkhami F, Pirmoazen S, Ardestani A, Fard MJK. Comparative evaluation of anesthetic efficacy of inferior alveolar nerve block and inferior alveolar nerve block plus buccal or lingual infiltration using articaine in mandibular molars with irreversible pulpitis: a preliminary prospective randomized sing. Quintessence Int (Berl) 2021; 52(9):820–6.
2. Aggarwal V, Singla M, Miglani S, Kohli S. Efficacy of articaine versus lidocaine administered as supplementary intraligamentary injection after a failed inferior alveolar nerve block: a randomized double-blind study. J Endod 2019; 45(1):1–5.
3. Appukuttan DP. Strategies to manage patients with dental anxiety and dental phobia: Literature review. Clin Cosmet Investig Dent 2016; 8:35–50.
4. Arrow P. A comparison of articaine 4% and lignocaine 2% in block and infiltration analgesia in children. Aust Dent J 2012; 57:325–33.
5. Borzan J, Meyer RA. Neuropathic Pain. Encycl Neurosci 2009; 749–57.
6. Camiel R, Roh S, Lottinger C. Management of Local Anesthetic Complications. In: Applied Head and Neck Anatomy for the Facial Cosmetic Surgeon. Springer; 2021; 53–62.
7. Decloux D, Ouanounou A. Local anaesthesia in dentistry: A review. Int Dent J 2021; 71(2):87–95.
8. El-Kholey KE. Anesthetic efficacy of 4% articaine during extraction of the mandibular posterior teeth by using inferior alveolar nerve block and buccal infiltration techniques. J Maxillofac Oral Surg 2017; 16(1):90–5.
9. Gaffen AS, Haas DA. Retrospective review of voluntary reports of nonsurgical paresthesia in dentistry. J Can Dent Assoc 2009; 75(8):579.
10. Hillerup S, Bakke M, Larsen JO, Thomsen CE, Gerds TA. Concentration-Dependent Neurotoxicity of Articaine: An Electrophysiological and Stereological Study of the Rat Sciatic Nerve. Anesth Analg 2011; 112(6). Available from: https://journals.lww.com/anesthesia-analgesia/Fulltext/2011/06000/Concentration_Dependent_Neurotoxicity_of.18.aspx
11. Hillerup S, Jensen R. Nerve injury caused by mandibular block analgesia. Int J Oral Maxillofac Surg 2006; 35(5):437–43.
12. Juodzbalys G, Wang H-L, Sabalys G. Injury of the Inferior Alveolar Nerve during Implant Placement: a Literature Review. J Oral Maxillofac Res 2011; 2(1):1–20.
13. Kanaa MD, Whitworth JM, Corbett IP, Meechan JG. Articaine buccal infiltration enhances the effectiveness of lidocaine inferior alveolar nerve block. Int Endod J 2009; 42(3):238–46.
14. Kanaa MD, Whitworth JM, Meechan JG. A prospective randomized trial of different supplementary local anesthetic techniques after failure of inferior alveolar nerve block in patients with irreversible pulpitis in mandibular teeth. J Endod 2012; 38(4):421–5.
15. Keetley A, Moles DR. A clinical audit into the success rate of inferior alveolar nerve block analgesia in general dental practice. Prim Dent Care 2001; 8(4):139–42.
16. Kumar MM. Evaluation of Clinical Efficacy of 4% Articaine with 1:100,000 Epinephrine for Surgical Removal of Impacted Maxillary Canine. Ragas Dental College and Hospital, Chennai; 2019.
17. Lima JLJ, Dias-Ribeiro E, Ferreira-Rocha J, Soares R, Costa FWG, Fan S, Sant'ana E. Comparison of buccal infiltration of 4% articaine with 1: 100,000 and 1: 200,000 epinephrine for extraction of maxillary third molars with pericoronitis: a pilot study. Anesth Prog 2013; 60(2):42–5.
18. Majid OW, Muhammad ZA. Effectiveness of Articaine Buccal infiltration anesthesia for mandibular premolar extraction: a randomized, double-blind, placebo-controlled clinical trial. J Oral Maxillofac Surg 2019; 77(9):1784–9.
19. Malamed SF. Nerve injury caused by mandibular block analgesia. Int J Oral Maxillofac Surg Denmark 2006; 35: 876–7; author reply 878.
20. McIlvanna E. Is blocking with Articaine better than Lidocaine? BDJ Student. 2020; 27(3):40–2.
21. Meechan JG, Jaber AA, Corbett IP, Whitworth JM. Buccal versus lingual articaine infiltration for mandibular tooth anaesthesia: a randomized controlled trial. Int Endod J 2011; 44(7):676–81.
22. Meechan JG. The use of the mandibular infiltration anesthetic technique in adults. J Am Dent Assoc 2011; 142:19-24.
23. Parirokh M, Satvati SA, Sharifi R, Rekabi AR, Gorjestani H, Nakhaee N, Abbott PV. Efficacy of combining a buccal

infiltration with an inferior alveolar nerve block for mandibular molars with irreversible pulpitis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010; 109(3):468–73.
24. Pogrel MA, Schmidt BL, Sambajon V, Jordan RCK. Lingual nerve damage due to inferior alveolar nerve blocks: a possible explanation. J Am Dent Assoc 2003; 134(2):195–9.
25. Ram D, Amir E, Keren R, Shapira J, Davidovich E. Mandibular block or maxillary infiltration: does it influence children's opposition to a subsequent dental visit? J Clin Pediatr Dent 2012; 36(3):245–9.
26. Reed KL, Malamed SF, Fonner AM. Local anesthesia part 2: technical considerations. Anesth Prog 2012; 59(3):127–37.
27. Renton T, Adey-Viscuso D, Meechan JG, Yilmaz Z. Trigeminal nerve injuries in relation to the local anaesthesia in mandibular injections. Br Dent J 2010; 209(9):E15.
28. Renton T, Van der Cruyssen F. Diagnosis, pathophysiology, management and future issues of trigeminal surgical nerve injuries. Oral Surg 2020; 13(4):389–403.
29. Renton T. Prevention of iatrogenic inferior alveolar nerve injuries in relation to dental procedures. Dent Update 2010; 37(6):350–2, 354–6, 358-60.
30. Salomon E, Mazzoleni S, Sivolella S, Cocilovo F, Gregori D, Giuca MR. Age limit for infiltration anaesthesia for the conservative treatment of mandibular first molars. A clinical study on a paediatric population. Eur J Paediatr Dent 2012; 13(3 Suppl):259–62.
31. Shurtz R, Nusstein J, Reader A, Drum M, Fowler S, Beck M. Buffered 4% Articaine as a Primary Buccal Infiltration of the Mandibular First Molar: A Prospective, Randomized, Double-blind Study. J Endod 2015; 41(9):1403–7.
32. Smith MH, Lung KE. Nerve injuries after dental injection: a review of the literature. J Can Dent Assoc 2006; 72(6):559–64.
33. Verma G. Dental Extraction Can Be Performed Safely in Patients on Aspirin Therapy: A Timely Reminder. ISRN Dent 2014; 2014:1–11.
34. Wells N, Mc Caffery CP and M. Improving the Quality of Care through Pain Assessment and Management. Patient Saf Qual An Evidence-Based Handb Nurses 2004