SUCCESS RATES OF FIRST INFERIOR ALVEOLAR NERVE BLOCK ADMINISTERED BY DENTAL STUDENTS IN A PRIVATE UNIVERSITY - A CLINICAL STUDY

[1]Priadarsini. T, [2]Kathiravan Selvarasu

RUNNING TITLE: Inferior alveolar nerve block

Priadarsini.T
Undergraduate student,
Saveetha Dental College and Hospital, Saveetha University, Chennai.

Kathiravan Selvarasu,
Assistant Professor,
Department of Oral and maxillofacial surgery,
Saveetha Dental College and Hospital, Saveetha University, Chennai

Corresponding author:
Priadarsini.T
Undergraduate student,
Saveetha Dental College and Hospital,
Saveetha University, Chennai.

ABSTRACT:

AIM:
Inferior alveolar nerve block (IANB) of the mandible is commonly used in the oral cavity as an anaesthetic technique for dental procedures. It is important for a dental student to be familiar with the precise method for injecting and delivering local anaesthetics, so as to make the dental procedures more effective and to decrease the complications caused by the injection.This study will evaluate the success rate of the first IANB administered by dental students.

MATERIALS AND METHODS:
In this study, we evaluated dental students who practice under the guidance of their advisors. Dental students (n = 78) from Saveetha Dental college who had no physical issues related to the use of Lignocaine hydrochloride and adrenaline bitartate . The students were trained in the standard ways to locate the anatomical landmarks for IANB and were instructed how to judge the criteria of a successful IANB procedure.

RESULTS:
Most of the dental practitioners in this study (64/78 or 82.05%) used the method mentioned above to palpate and locate the anatomical landmarks. This method is easy to follow and helps the practitioner to locate the acceptable area for delivery of local anesthetic, which adds to the success of IANB. Moreover, 89.74% of the dental practitioners (70/78) were right-handed, so most of them injected on the right side. The onset was approximately 0-5 mins for nearly half of the dental practitioners in this study (41/78 or 52.56% for subjective and 39/78 or 50% for objective onset), with the use of Lignocaine Hydrochloride and Adrenaline Bitartate injection.

CONCLUSION: The only recorded factor that affected the success of local anesthesia was the skill of the dental practitioner. This reinforces the notion that local anesthetic injection, especially IANB, is a technique- sensitive procedure.

KEYWORDS: Inferior alveolar nerve, local anesthesia, Lignocaine, Success, Anatomical landmarks

INTRODUCTION:

Local anesthesia is widely used in dentistry when a dental procedure is expected to be uncomfortable or painful or if the patient cannot tolerate the pain. The advantages of local anesthesia are the anesthetic effect as well as the ability to make the patient more relaxed and less anxious during the dental procedure. Inferior alveolar nerve block (IANB) is commonly used to induce numbness in half of the lower lip, half of the lower teeth, and some areas of the oral mucosa of the mandible on the injected side. This anesthetic technique is used for dental procedures such as cavity preparation and endodontic treatment, and can be supplemented by buccal infiltration anesthesia, if necessary. [1]It is also extensively used for surgical treatments, such as periodontal surgery, dental

implantology, extraction, or impacted surgery and apicoectomy, where the use of buccal infiltration anesthesia is more extensive and caudal [2].

PHARMACOLOGY

What follows here is a brief synopsis of the pharmacology of local anesthetics. Dentists should be familiar with sources that provide more detailed information on this topic.[3-6]

Local anesthesia is induced when propagation of action potentials is prevented, such that sensation cannot be transmitted from the source of stimulation, such as a tooth or the periodontium, to the brain. Local anesthetics work by blocking the entry of sodium ions into their channels, thereby preventing the transient increase in permeability of the nerve membrane to sodium that is required for an action potential to occur.

Structurally, local anesthetics have specific fundamental features in common. These include a lipophilic group, joined by an amide or ester linkage to a carbon chain which, in turn, is joined to a hydrophilic group.

The onset and duration of action of local anesthetics are influenced by several factors such as

- pH of tissue
- pKa of drug
- Time of diffusion from needle tip to nerve Time of diffusion away from nerve
- Nerve morphology
- Concentration of drug
- Lipid solubility of drug

The most important factors affecting onset are pH of the tissue and pKa of the drug. The pH may drop in sites of infection, which causes onset to be delayed or even prevented. Proximity of the deposition of local anesthetic to the nerve can also be a factor, which is why infiltration is associated with rapid onset whereas the Gow-Gates block is relatively slow. Nerve morphology is a factor, in that the relatively thin pain fibres are usually anesthetized readily. Within limits, higher concentration and greater lipid solubility improve onset to a small degree.

The duration of action depends on the length of time that the drug can stay in the nerve to block the sodium channels. Local anesthetics cause vasodilatation, which leads to rapid diffusion away from the site of action and results in a very short duration of action intraorally when these drugs are administered alone.

Consequently, it is important for a dental students to be familiar with the precise method for injecting and delivering local anesthetics to make the dental procedures more effective and to decrease the complications caused by the injection. However, some dentists do not follow this technique, and this is dependent on their experience and aptitude. In 2001, Keetley and Moles [2] compared the success rates of IANB analgesia among 4 dentists and an experienced dentist. That previous study evaluated the factors that influenced local anesthetic administration, including the practitioner administering the anesthetic, sex and age of the patient, quadrant, reason for local anesthetic, and anesthetic outcome. However, no previous studies evaluated the first injection administered by dental students. Therefore, our study aimed to evaluate the success rate of the first IANB performed by dental practitioners with the goal of improving the dental academic program.

MATERIALS AND METHODS:

In this study, we evaluated dental students who practice under the guidance of their advisors. Dental students (n = 78) from Savetha Dental college were trained in the standard ways to locate the anatomical landmarks for IANB and were instructed how to judge the criteria of a successful IANB procedure. The inclusion criteria and exclusion criteria of the study are shown in Table 1. The data were recorded as described in the following section.

Palpation of anatomical landmarks

The dental students were advised to use the index finger for injection on the right side of the patient and the thumb for the left side. In the first step of this procedure, the finger palpates the buccal vestibule at the molar area and continues posteriorly until the external oblique ridge is located. Then, the finger is moved upward along the external oblique ridge, continuing to the anterior border of the mandible, posterior to the second molar. Next, the finger is moved downward to locate the coronoid notch (the deepest depression of the anterior border of the ascending ramus), which is located approximately 6-10 mm above the occlusal plane of the mandibular teeth. From the coronoid notch, the finger is moved medially past the retromolar triangle, then further down to locate the internal oblique ridge. Subsequently, the finger slides buccally to retract the soft tissues and is pulled back at the coronoid notch, such that the pterygomandibular raphe and pterygotemporal space are clearly observed for a depression before the IANB injection.

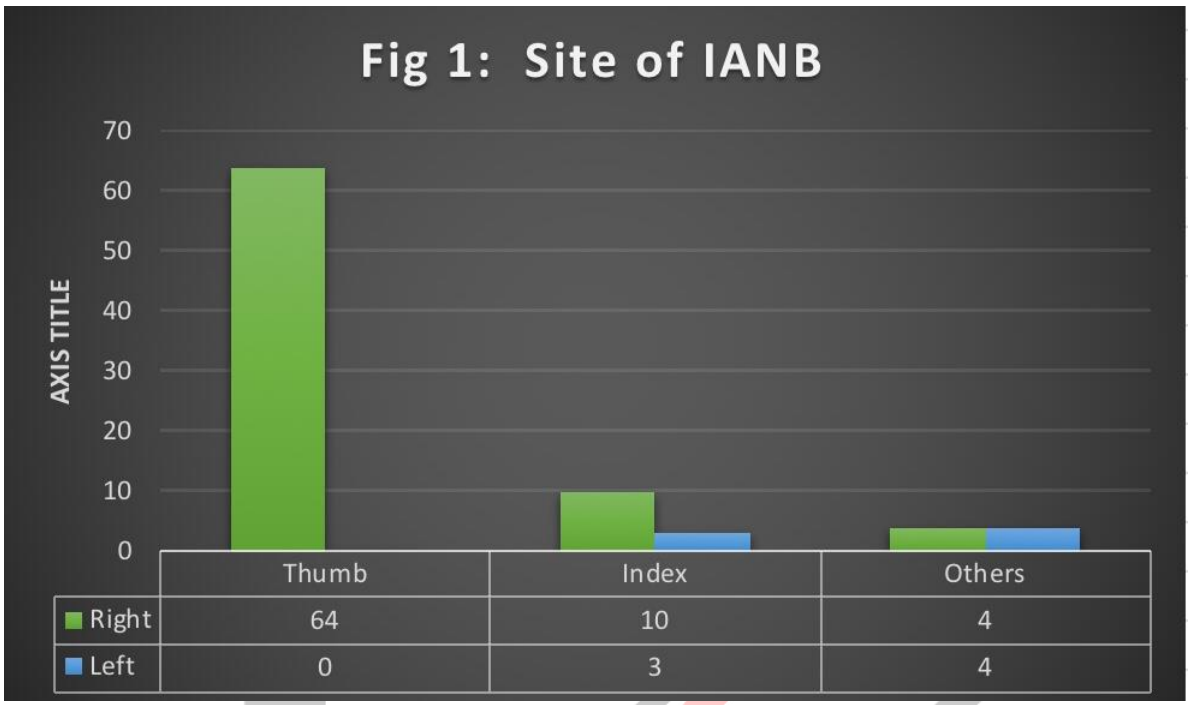
Standard IANB injection technique

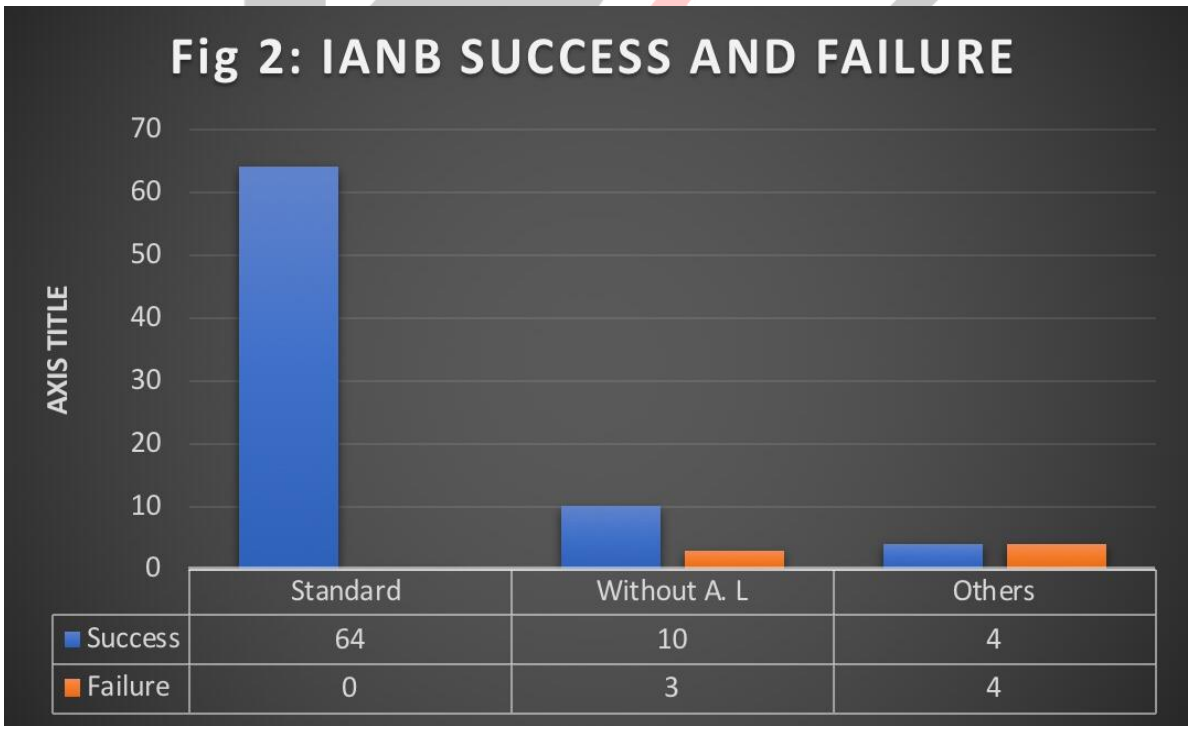
The standard IANB technique was followed [3-5]. The anesthetic was injected into the pterygomandibular space, while the axis of the syringe barrel was parallel and was placed on the occlusal surfaces of the mandibular teeth. The needle penetrated 2 cm into the soft tissue until it approximated the bone around the mandibular foramen, as detected by tactile sensation.

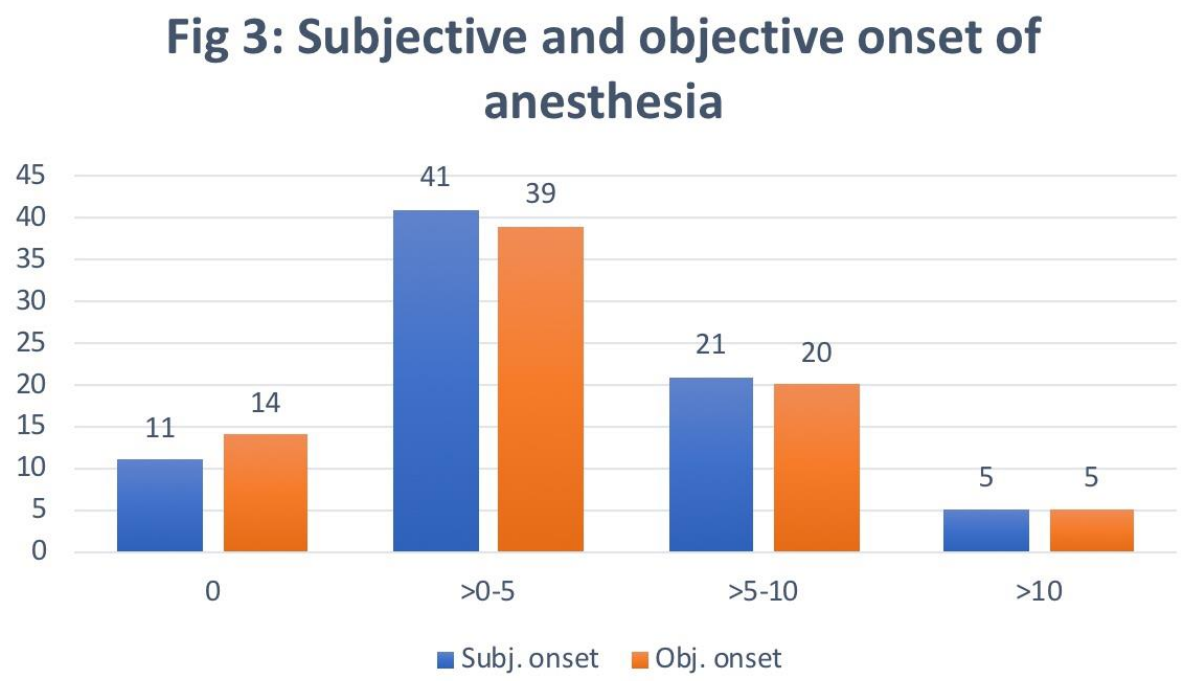
We evaluated the landmarks located, side of injection, finger used for retraction, injection position, and parallelism of the dental syringe to the lower occlusal plane. The subjective and objective onsets, duration of anesthesia, and associated complications were also noted, and the pain score was evaluated by using a visual analog scale (VAS). The success of the IANB procedure was evaluated by stimulating the labial mucosa attached around the lower canine tooth on the injected side with a sharply tipped dental explorer

[6,7]. If the area was successfully anesthetized, the probing did not elicit any pain stimulus. Only one anesthetic cartridge was permitted per dental practitioner.
The subjective onset of anesthesia in the patient after drug delivery was recorded at 4 time points: no numbness, 0 min; good onset, more than 0 to 5 min; acceptable onset, more than 5 to 10 min; and subjective onset failure, more than 10 min. The duration was divided into each group every 60 minutes, and 0 minutes represented an absence of numbness.

RESULTS:
Seventy eight (78) IANB analgesic procedures were performed in this study and the results from the IANB procedures of seventy eight dental practitioners were used for data analysis. The side of injection and the finger used to check for retraction are shown in Fig. 2. The right side was used for injection by 70 dental practitioners. Only 4 dental practitioners injected the local anesthetic in the incorrect patient position. Four dental practitioners handled the barrel of the syringe incorrectly, without placing it parallel to the occlusal plane of the mandibular teeth. The subjective and objective onset periods according to the ranges described in the previous section are shown in Fig. 3. The complications found in this study were one case each of numbness at the ear, sharp tongue pain, hyperventilation.







DISCUSSION:

Most of the dental practitioners in this study (64/78 or 82.05%) used the method mentioned above to palpate and locate the anatomical landmarks. This method is easy to follow and helps the practitioner to locate the acceptable area for delivery of local anesthetic, which adds to the success of IANB. Moreover, 89.74% of the dental practitioners (70/78) were right-handed, so most of them injected on the right side. This also affected the finger that the dental practitioners used to retract the subject's cheek before the injection. Dental practitioners who injected on the right side tended to use the left index finger to retract the cheek, while dental practitioners who injected on the left side were more likely to use the left thumb for retraction. The simplest explanation for the different preferences for using the finger or thumb is that the practitioner used the digit that was more convenient.After IANB the remaining local anesthetic was further used for buccal nerve block. More anesthetic was provided if the dental practitioners had no remaining local anesthetic for the buccal nerve block. The onset was approximately 0-5 mins for nearly half of the dental practitioners in this study (41/78 or 52.56% for subjective and 39/78 or 50% for objective onset), with the use of Lignocaine Hydrochloride and Adrenaline Bitartate injection. This finding is consistent with that of the study by Kambalimath et al., who reported a subjective onset of 1.35 min and an objective onset of 2.12 min [8]; other studies reported onsets of 4.2 ± 2.8 min [9], 149.5 ± 14.29 sec [10], 53.03 sec (0.93min) [11], and 1.66 ± 0.13 min [12].

The inferior alveolar nerve (IANB) block is the most frequently used technique for mandibular treatment. Inferior alveolar nerve block is the most commonly used nerve block in the surgical and endodontic procedures of mandibular teeth. Sometimes, there may occur failures in IANB due to various reasons, such as anatomical variations, bifid inferior alveolar nerve and increased bone density in elderly patients. The mylohyoid nerve may have a sensory component and, hence, may give accessory innervations. Other causes of the IANB failure include contralateral innervations of the anterior teeth, pulpitis/ apical periodontitis, and patients' anxiety and fear. Other than surgical and endodontic procedures, IANB is quite important for procedures, such as periodontal surgery, dental implantology, and apicoectomy.[2] Even the experienced clinician might face failure of IANB at times, with the failure rate ranging from 15 to 20%.[1]It not only involves the patients' comfort and feel-good notions, but also the dentists' name and fame, as a successful and patient-friendly deliverer, that make anesthesia delivery so important. The patients rate the dentists based on previous experience of painless procedures.[13] The problems and their impacts faced by students during their learning/training period may haunt them throughout their life. If not adequately solved in time, their performance gets impaired, which, in turn, affects their career opportunities and openings in an undesirable manner, in addition to hampering their day-to-day service accomplishments. Thus, teaching the right technique of IANB and also the alternative techniques of classical IANB during their formative period of learning is most imperative in order that they achieve the cherished goal of not only successful deliverance, but also a bright prospectus in the professional career ahead.Difficulty experienced in obtaining satisfactory anesthesia after (IANB), remains a common clinical problem. Following factors contribute to anesthetic failure.[14-17]

Operator dependent

- Choice of technique and solution
- Poor technique

Patient dependent

- Anatomical
- Pathological
- Psychological

Anomalous anatomical variants and anatomical relations constitute the principal cause of inferior alveolar nerve anesthesia failure. A double or bifid inferior alveolar nerve represents a possible cause of failure in inferior alveolar nerve block.[18] In 0.4% of cases the inferior alveolar nerve presents two or even three trajectories through accessory foramina containing small sensory nerve fibers. Some patients, particularly those of advanced age, present an increased bone density in the mandibular teeth, thus leading to deficient anesthesia when using periapical in-filtration techniques.[19]

In this audit of inferior alveolar nerve blocks, the only recorded factor that could be shown to affect the chance of a successful local analgesic was the operator. This reinforces the notion that successful analgesia is technique-sensitive. The implications of this are that training should continue through a dentist's vocational training year and beyond. A regular audit of success rates would help practitioners to determine whether their technique was improving as they would expect or not. The greater success rate of Inferior alveolar nerve block by the dental students was not unexpected.. There is also the possibility that the greater success of more experienced dentists is provided by other confounding variables. It is said that dentists 'get to know their patients' and this helps in, for example, providing successful Inferior alveolar nerve block analgesia for their patients. This may be true. An established practitioner may have a large group of patients who place increased trust in their dentist, having built a relationship over a number of years. There is potential at least for some degree of placebo effect on success. However it is unlikely that this would extend to the patient continuing with surgery or extractions if analgesia was not successful. Perhaps patients 'get to know their dentist', the point being that if a dentist provides unsuccessful analgesia on several occasions the patient is likely to seek treatment elsewhere. This may lead to a certain amount of self-selection with more established practitioners treating a group of patients on whom IANBis successful. If this were true then there would also be a group of patients who sought treatment with a new dentist. The least experienced dentists in this study were new to the practice and were treating a higher proportion of patients who were new to the practice. There is the possibility that some of these patients were from a different self-selected group, namely who had found IANB unsuccessful in the past. Meecham1 put forward the case for using a 'blunderbuss' approach for patients who had experienced failed anaesthesia in the past. The rationale is that it is more difficult to gain patients' trust if they have been hurt in the past. The blunderbuss approach is to use IANB and buccal infiltration from the onset with the possible addition of a second IANB higher up the mandibular ramus. This may be because it is easier to move the needle painlessly in tissue and palpate the bony landmarks. Also a higher needle position was employed on all repeat injections. Factors identified by dentist 5 that helped predict an unsuccessful IDB were:

- Unable to locate anatomical landmarks—especially the pterygomandibular raphe.
- Unable to find a bony landmark with the needle.
- Unable to direct the needle satisfactorily due to tough tissue in the pterygomandibular space.
- Awkward tongue. Either excessively large or due to lifting posteriorly. Some patients seem unable to allow the tongue to rest passively.
- Difficult anatomy where posterior teeth have been lost and alveolar resorption has been excessive.
- Needle curved when withdrawn. This is usually a sign that the dentist has struggled to manipulate the needle within the tissues. It is interesting that some practitioners seem reticent to provide IANBanalgesia using other techniques whenever they can. Although dentists cite infiltration analgesia as more comfortable than IDB analgesia, there is evidence to show that patients do not perceive any difference.[20]

We observed each of the following complications in one case: numbness at the ear, sharp tongue pain and non-severe hyperventilation. Other IANB failures were also found in our study, including complete absence of numbness or delayed subjective and objective onset of anesthesia. We found that correctly performing IANB injection by following the standard technique could prevent incorrect local anesthetic injection and post- operative complications, and this finding is relevant to both dental education and patient practice. [21] According to Keetley and Moles [2], the skill of the dental practitioner is one of the key factors associated with anesthesia failure; however, we found many other influential factors in this study, such as the advisors, dental practitioner, injection technique, and patient.

CONCLUSION:

Inferior alveolar nerve block is an important feature of general dental practice. This article gives an insight into the possible success rates to be encountered by general dental practitioners when they administer IANB. The only recorded factor that affected the success of local anesthesia was the skill of the dental practitioner. This reinforces the notion that local anesthetic injection, especially IANB, is a technique- sensitive procedure.

REFERENCES:

[1] Baart JA, Brand HS. Local anaesthesia in dentistry. London, Blackwell Publishing Ltd. 2009, p 192.
[2] 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: 139-42.
[3] Malamed SF. Handbook of local anesthesia. 4th ed. St. Louis: Mosby; 1997.
[4] Yagiela JA. Local anesthetics. In: Yagiela JA, Neidle EA, Dowd FJ, editors. Pharmacology and therapeutics for dentistry. 4th ed. St. Louis: Mosby; 1998. p. 217-34.
[5] Yagiela JA. Local anesthetics. In: Dionne RA, Phero JC, Becker DE, editors. Pain and anxiety control in dentistry. Philadelphia: W.B. Saunders; 2002. p. 78-96.
[6] Haas DA, Carmichael FJ. Local anesthetics. 6th ed. In: Roschlau WHE, Kalant H, editors. Principles of medical pharmacology. New York: Oxford; 1998. p. 293-302.

[7] Hendy CW, Smith KG, Robinson PP. Surgical anatomy of the buccal nerve. Br J of Oral Maxillofac Surg 1996; 34: 457-60
[8] Kambalimath DH, Dolas RS, Kambalimath HV, Agrawal SM. Efficacy of 4% Articaine and 2% Lidocaine: A clinical study. J Maxillofac Oral Surg 2013; 12: 3-10
[9] Moore PA, Boynes SG, Hersh EV, DeRossi SS, Sollecito TP, Goodson JM, et al. The anesthetic efficacy of 4 percent articaine 1:200,000 epinephrine: two controlled clinical trials. J Am Dent Assoc 2006; 137: 1572-81
[10] Colombini BL, Modena KC, Calvo AM, Sakai VT, Giglio FP, Dionisio TJ, et al. Articaine and mepivacaine efficacy in postoperative analgesia for lower third molar removal: a double-blind, randomized, crossover study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; 102: 169-74.
[11] Sierra RA, Delgado ME, Berini AL, Gay EC. Comparative study of the anesthetic efficacy of 4% articaine versus 2% lidocaine in inferior alveolar nerve block during surgical extraction of impacted lower third molars. Med Oral Patol Oral Cir Bucal 2007; 12: 139-44.
[12] Gregorio LV, Giglio FP, Sakai VT, Modena KC, Colombini BL, Calvo AM, et al. A comparison of the clinical anesthetic efficacy of 4% articaine and 0.5% bupivacaine (both with 1:200,000 epinephrine) for lower third molar removal. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008; 106: 19-28.
[13] Kohler BR, Castellón L, Laissle G. Gow-Gates technique: a pilot study for extraction procedures with clinical evaluation and review. Anesth Prog 2008 Spring;55(1):2-8.
[14] Sicher HI, Tandler J. Anatomía para Dentistas. 2ª ed. Barcelona: Editorial Labor; 1950.
[15] Rucci FS, Pippa P, Boccaccini A, Barbagli R. Effect of injection speed on anaesthetic spread during axillary block using the orthodonal two-needle technique. Eur J Anaesth 1995; 12: 505-11.
[16] Vinckier F. What is the cause of failure of local anesthesia? Rev Belge Med Dent 2000; 55: 41-50.
[17] Wong MK, Jacobsen PL. Reasons for local anesthesia failures. J Am Dent Assoc 1992; 123: 69-73.
[18] Singh,V.,Sekha,M.R.M.,Prasy,M.E.Knowledge, attitude, and practice block survey on two different technique of giving inferior alveolar nerve. Journal of Pharmacy Education and Research.6(10)2016; 313-315.
[19] Baskaran,R.N.R,Pradeep,S.Recent advancement of local anasthesia advancement to recent advancement of local anaesthesia administration. Research Journal of Pharmacy and Technology. 2016;9(10):1761-1764.
[20] Matthews R, Ball R, Goodley A, Lenton J, Riley C, Sanderson S, et al. The efficacy of local anaesthetics administered by general dental practitioners. Br Dent J 1997;182:175-8.
[21] Santhosh Kumar, M.P.Paresthesia following local anesthetic administration in dentistry. International Journal of Pharma and Bio Sciences.2015:6(3);112-116.

GRAPH LEGENDS:

FIGURE 1: Site of Inferior alveolar nerve block
FIGURE 2: Inferior alveolar nerve block success and failure
FIGURE 3: Subjective and Objective onset of anesthesia.