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ORIGINAL ARTICLE

A Simplified Single-Penetration Technique of IANB (MK Technique) for Mandibular Anesthesia

Monica Kommineni[1] · Phani Kumar Kuchimanchi[2] · Ganesh Koneru[2] ·
Suresh Sanikommu[3]

Abstract

Introduction Owing to the anatomical basis established on the detailed course, distribution and innervations of buccal nerve in the literature, we believe that an effective and extensive buccal nerve block could be achieved when the nerve is anesthetized proximal to its branching point which relates to anteromedial aspect of ramus (retromolar fossa). Though several techniques of inferior alveolar nerve block (IANB) including few single-penetration approaches were already well reviewed and practiced, pitfalls remained in terms of achieving adequate retromolar soft tissue anesthesia, as well as undermining the very importance of contacting the bone and the orientation of the bevel. We propose a simplified single-penetration technique aligning almost similar to conventional technique and its well-adopted landmarks, but still obviating the need for a separate penetration for long buccal nerve anesthesia.

✉ Phani Kumar Kuchimanchi
raghu8099@gmail.com

Monica Kommineni
monicakommineni96@gmail.com

Ganesh Koneru
ganeshkoneru@gmail.com

Suresh Sanikommu
drsureshjvv@gmail.com

[1] Sibar Institute of Dental Sciences, Takkellapadu, Guntur District, Andhra Pradesh 522 509, India

[2] Department of Oral and Maxillofacial Surgery, Sibar Institute of Dental Sciences, Takkellapadu, Guntur District, Andhra Pradesh 522 509, India

[3] Department of Public Health Dentistry, Vishnu Dental College, Bhimavaram, West Godavari District, Andhra Pradesh 534202, India

Aim To study the efficacy of a simplified single-penetration technique for mandibular anesthesia.

Objectives To study the adequacy of the simplified IANB technique in minimizing the number of penetrations required to achieve buccal nerve anesthesia decreasing patient's pain and discomfort when IANB is performed and the ease of adaptability across the operators.

Materials A 25-gauge 42-mm needle, local anesthesia with adrenaline—2% lignocaine HCl (1:80,000), 2.5-ml syringe, observation form.

Method Study 1—A sample size of 120 cases, in oral surgery department of our college, with 60 patients in Group I (control) where patients received anesthesia through conventional IANB and 60 patients in Group II (experimental) where patients received anesthesia through simplified IANB. Both the groups are again subdivided into group A (single operator) and group B (multiple operators). Study 2—20 bilateral mandibular impacted third molar in oral surgery department of our college, with right side (control—conventional technique) and left side (experimental—simplified single-penetration technique). VAS data are recorded in the excel sheet.

Results The success rate of the simplified technique is quite comparable to the conventional groups. The mean pain and discomfort score in simplified technique was 3.08 which is relatively lower when compared to mean value in conventional technique which was 6.88. The difference was statistically significant.

Conclusion Simplified technique minimizes the number of penetrations, which substantially decreases patient's pain and discomfort levels not only during injection, but also during surgical procedures on mandibular posterior region because of extensive and profound buccal nerve territorial anesthesia.

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Introduction

Extraction of teeth from mandibular second premolar to third molar requires long buccal anesthesia along with inferior alveolar nerve block and lingual nerve blocks. Long buccal nerve is anesthetized in same penetration in few techniques like Fischer 1, 2, 3 technique, Gow-Gates technique and Vazirani–Akinosi technique described for mandibular dental anesthesia [1].

Most commonly used mandibular anesthesia includes open mouth techniques like inferior alveolar nerve block: alternative technique [2], classical inferior alveolar nerve block (direct and indirect techniques), Halsted block (conventional IANB), method of Clarke and Holmes, technique of Angelo Sargenti, extra oral mandibular nerve block, Fischer 1, 2, 3 technique while the least adopted techniques are the "A. R. T." (anterior ramus technique) mandibular block [3], Gow-Gates and closed mouth technique by Akinosi–Vazirani [4]. Except in Gow-Gates, Fischer 1, 2, 3 and Akinosi–Vazirani, in all the other techniques, a separate injection for buccal nerve anesthesia is needed. The separate second penetration for long buccal is observed to provoke pain and discomfort to patient [1].

We proposed a modification of conventional IANB, similar to Fischer 1, 2, 3 technique, which obviates the need for a separate injection for buccal nerve anesthesia. After trying various techniques clinically and studying the reasons for either delayed onset or failure of anesthesia, we narrowed at Fischer 1, 2, 3 for being far more simpler and accurate single-penetration technique retaining the conventional landmarks, with problem being the needle deflection as the technique per se is anterograde. We modified this into a retrograde deposition pattern targeting IANB first with BRIT followed by lingual and long buccal on the way withdrawing and swinging barrel and simultaneously nullifying needle deflection to a greater extent. The current study was conducted to evaluate the efficacy of the technique and the ease of adaptation between various groups of operators (beginners and experienced operators).

Basis of the Study

Anatomical Course and Distribution of Buccal Nerve

The knowledge of the course and distribution of buccal nerve is of a great importance in this technique. After releasing the anterior deep temporal nerve, the long buccal nerve descends behind the superior head of the lateral pterygoid muscle and then turns laterally between two heads of this muscle. At this point, nerve releases the fibers that enter the lateral pterygoid muscle. The buccal nerve turns sharply downward to descend on the outer surface of the inferior head of lateral pterygoid and temporal muscles and often closely attached to the fascia of temporalis muscle. The nerve may even pass through the substance of temporal muscle near its anterior border. At the anterior border of the tendons of the temporal muscle, long buccal nerve here exchanges fibers with branches of facial nerve. Singly, the branches of buccal nerve perforate the buccinator muscle and reach the mucous membrane of the cheek. Almost the entire mucosa of the cheek is supplied by the buccal nerve, with the exception of a poster superior area, which may receive sensory fibers from the gingival branch of the superior alveolar nerves. The buccal branches of the superior alveolar nerve and the buccal nerve itself are in reciprocal relation. Often the buccal nerve participates in the nerve supply of a small area of buccal gingival in the distal part of the upper jaw. Branches of the posterior superior alveolar nerves, on the other hand, may supply a larger area of the cheek and may, in rare cases, even replace the buccal nerve [5].

An anatomical study on buccal nerve distribution reveals that in some cases some twigs from the buccal nerve were given to the posterior part of the buccal mucosa. These twigs branched from the main trunk of the nerve before it perforated the insertion of the tendon of the temporalis. On superficial examination, the buccal nerve appeared to give branches only to the buccal mucosa. However, detailed fine dissection, after removal of the mandibular bone and reflection of the periosteum and gingival flap downwards, revealed that these twigs ran to and supplied the lower buccal gingivae above the mandibular insertion of the buccinator. In contrast, no twigs were seen traveling beyond the insertion of the buccinator toward the gingivae in the maxilla. Anteriorly, in all cases, the main trunk of the buccal nerve is divided into two branches (toward the upper and lower lips) and, along its course, gave fine twigs to the buccal mucosa after passing through the layer of facial musculature proximal to the modiolus. At the angle of mouth, the buccal nerve formed a plexus with the facial nerve, the inferior orbital

nerve and the mental nerve. Buccal nerve terminal branches thereafter ran deep to these three nerves (Fig. 1). The furthest distribution of the buccal nerve branches to the lips extended to approximately half of lateral side of the lips in two cases and, in the other 10 cases, it is extended.

These findings indicate that the posterior buccal mucosa is innervated by the buccal nerve, and the mucosa of the fauces is innervated by the buccal nerve and other adjacent nerves, for example, the glossopharyngeal nerve. It is therefore important clinically, when giving a buccal nerve block, to anaesthetize the nerve proximal to the branching point of the twigs to the posterior buccal mucosa and gingivae. If the buccal nerve is blocked distal to its passage through tendon of the temporalis, the posterior buccal gingivae, buccal mucosa and part of the mucosa of the fauces may not be anaesthetized [6].

The Technique

Landmarks:

1. Anterior border of ramus—coronoid notch
2. Deepest point of pterygomandibular raphe
3. Occlusal plane
4. Opposite premolars of mandible

Target areas:

1. Mandibular foramen on medial side of ramus
2. Pterygomandibular space
3. Retromolar fossa

The technique used in this study is a simplified inferior alveolar nerve block technique. The simplified IANB used in this study includes the following steps:
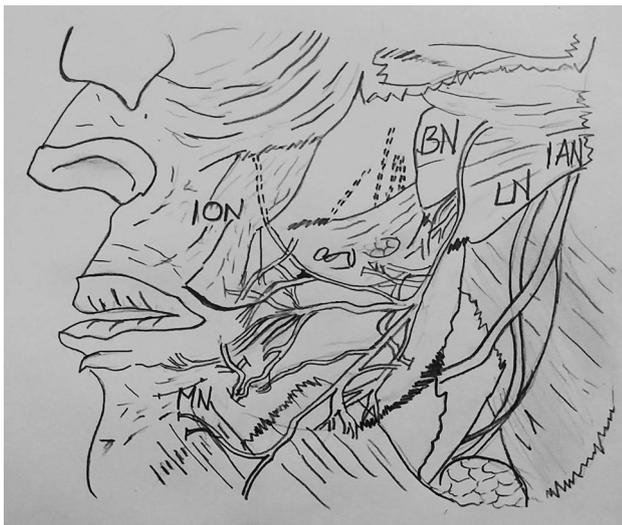

Fig. 1 Buccal nerve distribution

1. A 25-gauge-long needle (42 mm) is penetrated at deepest point of pterygomandibular raphe from the opposite mandibular premolar, where bone is contacted at 3/4th of its length above the mandibular foramen and where inferior alveolar nerve traverses in the pterygomandibular space before entering the mandibular canal. The needle is retrieved slightly to avoid subperiosteal injection. At this position, 1.2 ml of local anesthetic solution is deposited after confirming for negative aspiration to avoid intravascular injection (Fig. 2).
2. Then, the barrel is redirected to same side withdrawing half of the needle. This minimizes deflection, ensuring that half the length of the long needle still inside the pterygomandibular fossa 0.8 ml of local anesthetic solution is injected for lingual nerve block (Fig. 3).
3. Finally, the needle is swung to original position (as in IANB) withdrawing the needle to just one-fourth of its length; 0.5 ml of local anesthetic solution is deposited between buccinator muscle and anteromedial aspect of ramus posteromedial to the tendinous insertion of temporalis. Just before the needle is withdrawn completely from the site of penetration, we targeted long buccal nerve in retromolar fossa area (Fig. 4).

Aims and Objectives

- Aim is to study the efficiency of a simplified single-penetration technique for mandibular anesthesia.
- The objective of the study is to prove the adequacy of the simplified IANB technique in minimizing the patient's pain and discomfort while studying the adaptability of the technique (mean variation between beginners and experienced).

Fig. 2 Demonstration of targeting inferior alveolar nerve in pterygomandibular space

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Fig. 3 Demonstration of targeting lingual nerve by withdrawing half the length of long needle and swinging barrel of the syringe onto same side simultaneously

Fig. 4 Demonstration of long buccal nerve block as it is targeted in retromolar fossa

Materials

The materials used are 25-gauge 42-mm needle, 2% local anesthetic solution (2% lignocaine HCL) with adrenaline of 1:80,000 dilution, 2.5-ml luer lock syringe, diagnostic instruments (mouth mirror and straight probe), observation form for recording symptoms.

Method

Ethical approval for the study was obtained from institutional ethical committee. We included the patients deemed fit for procedures under local anesthesia and patients requiring mandibular procedures under inferior alveolar nerve block anesthesia including extractions, impactions and alveoloplasties. We excluded the patients deemed not fit for procedures under local anesthesia (with or without adrenaline).

The study 1 consists a total of 120 patients with 60 patients in each group of Group I (control) and Group II (experimental). Consent was obtained from each patient involved in the study. Both control group and experimental group are subdivided into group A and group B. Group A, 30 patients, received local anesthesia by a single operator, and the 30 patients in group B received local anesthesia through multiple operators (i.e., trained group of doctors). The efficiency of the block was checked in all the groups by evaluating subjective symptom which is numbness of cheek and objective signs which are the presence/absence of pain on probing in buccal vestibule/periodontal pockets of molar/retromolar area. The pain and discomfort levels of the patients who received the blocks were recorded using visual analogue scale (VAS).

The study 2 consists a total of 20 patients who have underwent procedures requiring bilateral mandibular blocks, where 20 right side blocks are Group I (control) and 20 left side blocks Group II (experimental). Consent was obtained from each patient involved in the study. Both control group and experimental group patients received local anesthesia by multiple operators (i.e., trained group of doctors). The efficiency of the block was checked in all the groups by evaluating subjective symptom which is numbness of cheek and objective signs which are the presence/absence of pain on probing in buccal vestibule/periodontal pockets of molar/retromolar area. The pain and discomfort levels of the patients who received the blocks were recorded using visual analogue scale (VAS).

Results

Study 1

Table 1 represents symptoms indicative of onset of local anesthesia. Results are compared between males and females, anesthetized by single operator or multiple operators, following conventional technique and simplified technique. In single-operator category, all male and female subjects, who were anesthetized following conventional technique, reported satisfactory symptoms, whereas in simplified technique, 81% males and 93% of females reported satisfactory symptoms of onset of anesthesia. However, difference in the proportion of respondents who reported satisfactory symptoms with conventional and simplified techniques is not statistically significant. Multiple-operator category, all the subjects, irrespective of gender and technique, reported satisfactory onset of symptoms.

Table 1 Symptoms of onset of local anesthesia

Administrator	Gender of subjects	Technique		Symptoms		Total	Chi-square test p
				Satisfactory	Not satisfactory		
Single operator	Male	Conventional	Count	15	0	15	0.12
			%	100.0%	0.0%	100.0%	
		Simplified	Count	13	3	16	
			%	81.2%	18.8%	100.0%	
	Female	Conventional	Count	15	0	15	0.48
			%	100.0%	0.0%	100.0%	
		Simplified	Count	13	1	14	
			%	92.9%	7.1%	100.0%	
Multiple operators	Male	Conventional	Count	18	0	18	*
			%	100.0%	0	100.0%	
		Simplified	Count	10	0	10	
			%	100.0%	0	100.0%	
	Female	Conventional	Count	12	0	12	*
			%	100.0%	0	100.0%	
		Simplified	Count	20	0	20	
			%	100.0%	0	100.0%	

*No statistics are computed because combined is a constant

Table 2 shows patient pain and discomfort level, as measured on a visual analogue scale, in patients anesthetized by using simplified and conventional techniques. The number of patients is the same in both the techniques. The mean patient pain and discomfort level score in simplified technique was 3.08 which was relatively lower when compared to mean value in conventional technique which was 6.88. The difference was statistically significant. The median value is higher in conventional technique when compared to simplified technique.

Study 2

Table 3 shows distribution of respondents according to pain and discomfort level category on visual analogue scale. More than half of the subjects in the simplified technique group reported pain score of 3 on VAS, and none reported beyond 3, whereas 40% each of the respondents reported pain scores 6 and 7. The difference in the proportion of respondents among different categories of VAS

is highly significant as analyzed by Chi-square test ($p = 0.0001$).

Table 4 shows certain descriptive statistics of patient pain and discomfort scores. While the maximum pain and discomfort levels reported by the subjects in modified group is 3, the subjects in conventional group reported a minimum score of 6. The statistical difference in the range of pain and discomfort level scores is very highly significant between the groups, as indicated by Moses test ($p = 0.0001$). The median scores of pain and discomfort level reported by subjects in simplified and conventional groups were 3 and 7, respectively. The difference in median score is highly significant, as analyzed by independent sample median test ($p = 0.0001$). Mean pain and discomfort level score in modified group was 2.65 (SD = 0.49), whereas that in conventional group was 6.80 (SD = 0.77). The difference in mean scores is highly significant as analyzed by Mann–Whitney U test. Thus, subjects in simplified technique group reported remarkably

Table 2 Patient pain and discomfort levels of patients in simplified and conventional groups

	Technique	N	Mean*	SD	Median
Patient pain and discomfort level	Simplified	60	3.08	0.645	3
	Conventional	60	6.88	0.825	7

*Mann–Whitney U test: $p = 0.001$ (statistically significant); VAS 1–4: mild or very low pain; VAS 5–8: moderate pain

Table 3 Patient pain and discomfort levels on VAS scale in conventional and modified technique groups

Technique		Patient pain and discomfort levels on VAS*					
		2	3	6	7	8	Total
Simplified	Count	7	13	0	0	0	20
	% Within technique	35.0%	65.0%	0.0%	0.0%	0.0%	100.0%
Conventional	Count	0	0	8	8	4	20
	% Within technique	0.0%	0.0%	40.0%	40.0%	20.0%	100.0%
Total	Count	7	13	8	8	4	40
	% Within technique	17.5%	32.5%	20.0%	20.0%	10.0%	100.0%

*Chi-square test, $p = 0.0001$

Table 4 Patient pain and discomfort levels on VAS scale in conventional and simplified technique groups

Technique	N	Patient pain and discomfort levels on VAS				
		Minimum*	Maximum*	Median**	Mean***	SD
Simplified	20	2	3	3.00	2.65	0.489
Conventional	20	6	8	7.00	6.80	0.768

*Independent samples Moses test, $p = 0.0001$

** Independent samples median test, $p = 0.0001$

***Mann–Whitney U test, $p = 0.0001$

lesser pain and discomfort levels compared to those in conventional group.

Discussion

Ever since the inception, various modifications of IANB have been proposed to address the limitations of each technique in terms of accuracy and ease of reproducibility of the technique, complex anatomy, number of penetrations and other local complications. One common objective of all the endeavors in simplifying the technique of IANB has been to minimize patient's pain and discomfort during the procedure while achieving the maximum anesthetic effect. The most commonly practiced open mouth techniques for IANB are conventional IANB and Gow-Gates. Despite documented evidence of high success rate of Gow-Gates technique and 15–20% of failure rate of conventional technique [7], Gow-Gates technique remains as the second choice while conventional technique is adopted as the first choice [8]. Few significant disadvantages of the Gow-Gates technique like slower onset of anesthesia, which can take from 5 to 7 min and lack of definitive anatomical landmarks, make it a difficult choice for IANB [9]. Though the literature suggests that there are no significant differences in pain on injection among conventional and Gow-Gates techniques [10, 11], the latter technique minimizes patient pain and discomfort as the need for a second penetration for buccal nerve anesthesia is obviated. However, few

authors fervently oppose the widespread use of Gow-Gates Technique for a variety of reasons [12].

The considerations for any nerve block technique are definitive landmarks. Targeting long buccal nerve within retromolar fossa in fact delivered profound buccal anesthesia all the way posteriorly till anterior faucial pillar (blocking even the very first few twigs of long buccal nerve [6] aiding in utmost comfort of soft tissue manipulation during transalveolar extractions, especially in distoangular impaction with reasonable time of onset of anesthesia and no or minimal complications. So, in the current study a modification to the conventional IANB is similar to Fischer 1 2 3, but differs being retrograde minimizing needle deflection, and therefore, reducing onset time is made to achieve regional mandibular anesthesia in a single penetration. The technique adopted in this study has been described under methodology. Irrespective of gender, the simplified technique used in this study was well performed by multiple operators, i.e., trained group of interns and postgraduates, but there was a slight decrease in the proportion of respondents who reported satisfactory symptoms when the technique was performed by single operator who was just a beginner. In fact, bulky cheeked patients with ptotic buccal fat pad accounted for misappropriating depth of needle penetration into retromolar fossa lead to failure of IANB, but gave a profound and extensive buccal nerve anesthesia which formed the very basis of targeting buccal nerve more proximal in its course as a single-penetration technique. Overall performance of simplified technique by skilled persons was significantly effective, and mastering is

quite easy (Table 1). Subjects in this simplified technique reported significantly lower levels of pain and discomfort compared to conventional group, as indicated by mean and median scores of pain on a visual analogue scale. Lower pain and discomfort levels improve the ability of the patients to cooperate with the operator aiding in effective execution of surgical procedure (Table 4).

Conclusion

Simplified technique achieved better onset and extent of long buccal nerve anesthesia than the conventional technique while following the same landmarks as + that in conventional technique. It also significantly reduced patient's pain and discomfort levels compared to conventional technique not just during injection, but also during surgical procedure. This single-penetration technique (retrograde) can thus be a modified Fischer 1 2 3 (anterograde) with minimal needle deflection; thus, there are rapid onset and very minimal failures of achieving anesthesia.

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