

## MANDIBULAR LOCAL ANESTHETIC FAILURES: ARE WE TAKING THE CHALLENGE SERIOUSLY?

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### ABSTRACT

*The objective of this study was to evaluate the interest and appreciation among dental practitioners of the importance of refreshing their knowledge from the available literature regarding the most frequently performed procedure i.e administration of local anesthesia, applicable to all fields of dentistry.*

*A 2 component questionnaire was designed directed towards information regarding frequency and cause of failure of inferior alveolar nerve block in the participants' understanding, how frequent the participants refresh their knowledge from a reference book of local anesthesia and some technical questions regarding local anesthesia in mandible. The questionnaire was first pilot tested with 10 teaching faculty members and then distributed to 242 practicing dentists. Data were entered and analyzed using SPSS version 16. The relationship between the professional status with the rate of local anesthesia failure and interest in refreshing the knowledge were analyzed using Kruskal Wallis Test.*

*Only 15.3% participants claimed that they had never experienced failure of inferior alveolar nerve block. No significant relationship was found between the professional status and the frequency of failure of inferior alveolar nerve block.*

*It was concluded that 16.5% participants claimed that they often revise the anatomical landmarks and no significant relationship was found between the professional status and the interest of the participants in revision of anatomy.*

**Key Words:** *Inferior alveolar nerve block failure, Local anesthesia, Skeletal characteristics, Clinical audit, Undergraduate training, Knowledge of anatomy.*

### INTRODUCTION

Local anesthesia is an integral part of dentistry. The most important aspect of all oral and dental procedures is pain relief which is achieved intra-operatively by local anesthesia. In November 1884, William S. Halsted and Richard J. Hall first achieved neuroregional anesthesia in the mandible by injecting a solution of cocaine in the vicinity of the mandibular foramen.<sup>1</sup>

The ability to obtain consistently profound mandibular anesthesia has always been found very difficult<sup>2</sup> and extensive researches have been undertaken to find out the possible causes of local anesthetic failures in mandible particularly Inferior Alveolar Nerve Block (IANB). Causes of mandibular local anesthetic failures

identified in literature include anatomic variations, such as a bifid inferior alveolar nerve, retromolar foramen associated with accessory innervation, double or accessory mental foramen, the relation between the infiltration technique and bone density, accessory innervation in the case of the mylohyoid nerve and first cervical branches and the cross innervation of the incisors. In addition; inactivity of the local anesthetic solution in the presence of tissue inflammation, inactive anesthetic solutions, an incorrect technique, and subjective perception on the part of a particularly anxious patients have also been documented as possible causes of anesthetic failures in mandible.<sup>3,4,5</sup>

As per the curriculum set by Pakistan Medical and Dental Council, students of dentistry start administering local anesthesia from third year of their course<sup>6</sup> which becomes the major part of their practice for the rest of their career, no matter which specialty do they choose.

With surveys undertaken to calculate the success/failure rate of IANB and the understanding of reasons of failure to achieve adequate anesthesia at different levels of dental career, literature on regional anesthesia in faciomaxillary and oral surgery has emphasized on

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the importance of knowledge and clinical expertise under guidance to reduce discomfort and pain.<sup>7,8</sup>

The authors having a considerable experience in dentistry and being engaged in teaching at undergraduate level and supervising the house officers in the department of Oral & Maxillofacial Surgery, realized that despite all the anatomical causes documented in the literature for inferior alveolar nerve block failure, the main deficiency lies in recognizing the landmarks for administering the injection as well as knowing how to check the effectiveness of the local anesthesia administered. This deficiency was also found in many fellow practicing dentists, which leads to repeated injections; in turn leading to more traumas to soft tissue from the needle, pain due to incomplete anesthesia, more anxiety and therefore decreased patient cooperation during the procedure. Patient develops a fear of local anesthesia needle that again reduces patient cooperation in any dental procedure in future. It was also noticed that despite the fact that many fellow practitioners do experience LA failures, we mostly rely on the researches conducted abroad on this aspect but do not try to find our own shortcomings evident as the very limited local literature available on this aspect.

The objective of this study was to evaluate the interest of dental practitioners and the appreciation of the importance of refreshing their knowledge from the available literature regarding the most frequently performed procedure i.e administration of local anesthesia, applicable to all fields of dentistry.

## METHODOLOGY

A questionnaire (Annexure 1) consisting of two components was designed which was free of the respondent's identification preventing the privacy and enabling a true response.

Component 1 consisted of 4 questions addressing the type of practice, frequency of Inferior Alveolar Nerve Block (IANB) failure they experience in their practice, the respondents' understanding of the possible cause of IANB failure in their case and how often do they revise anatomy from a reference book of local anesthesia.

Component 2 consisted of 5 technical questions related to the areas anesthetized by blocking inferior alveolar, lingual, long buccal nerves, which anesthetic technique is used before extraction of lower second premolar and which needle length is required to administer inferior alveolar nerve block.

For assuring the clarity and reproducibility of the questionnaire, it was pilot tested with 10 teaching faculty members. After filling the questionnaire, the participants were asked if they were satisfied with the language and answer key to the technical questions and a consensus was found among all participants of the pilot study.

Questionnaires were filled by 242 practicing dentists irrespective of the type of practice and the subspecialty of dentistry. Data was entered and analyzed using SPSS version 16. The relationship between the professional status with the rate of local anesthesia failure and interest in refreshing the knowledge were analyzed using Kruskal Wallis Test.

## RESULTS

Details of the results can be seen from Table 1- 6. While comparing the frequency of failure in the three groups, highest percentage was found in full time general practitioners. In response to the technical questions in component 2, highest percentage of wrong answers was to the question regarding areas anesthetized by blocking inferior alveolar nerve. Kruskal Wallis Test showed no significant relationship of the level of practice with either frequency of failure or the interest in revision of anatomy.

## DISCUSSION

Out of 242 participants who completed the survey proformas of this study, 98 were general practitioners, 136 were involved in teaching and part time general practice and 8 in teaching only. Other studies to evaluate failure/success rate of Inferior Alveolar Nerve Block (IANB) have focused on just one group, either students/interns, specialists or general practitioners. We did not intend to focus on any specific group, subspecialty of dentistry or level of educational career because of

TABLE 1: PROFESSIONAL STATUS OF PARTICIPANTS

	Frequency	Percent	Valid Percent	Cumulative Percent
General practitioners	98	40.5	40.5	40.5
Part-time general practice	136	56.2	56.2	96.7
Only teaching	8	3.3	3.3	100.0
Total	242	100.0	100.0	

TABLE 2: PROFESSIONAL STATUS VERSUS FREQUENCY OF FAILURE OF INFERIOR ALVEOLAR NERVE BLOCK

		Often	Al-ways	Total number of participants	% of participants who often and always experience failure of IANB
Professional status	General practice only	25	4	98	29.5
	Teaching and part-time general practice	29	5	136	25
	Only teaching	0	0	8	0
Total		54	9	242	

TABLE 3: PARTICIPANTS VIEW OF THE MOST PROBABLE CAUSE OF FAILURE OF INFERIOR ALVEOLAR NERVE BLOCK IN THEIR CASES

	Frequency	Percent	Valid Percent	Cumulative Percent
0	1	.4	.4	.4
Could not recognize the landmarks	64	26.4	26.6	27.0
Not good at IANB technique	28	11.6	11.6	38.6
Patients perceive pressure as pain	85	35.1	35.3	73.9
Not sure about the cause	58	24.0	24.1	97.9
Did not answer	4	1.7	1.7	99.6
More than one causes	1	.4	.4	100.0
Total	241	99.6	100.0	
Missing System	1	.4		
Total	242	100.0		

TABLE 4: REVISION OF ANATOMY

	Frequency	Percent	Valid Percent	Cumulative Percent
Do not consider it necessary	20	8.3	8.3	8.3
Do not have time to revise	44	18.2	18.2	26.4
Sometimes	137	56.6	56.6	83.1
Often	40	16.5	16.5	99.6
Did not answer	1	.4	.4	100.0
Total	242	100.0	100.0	

TABLE 5: RESPONSE OF PARTICIPANTS TO COMPONENT 2 OF THE QUESTIONNAIRE

Questions	Wrong answer (%)	Correct answer (%)	Did not answer (%)	Total
Areas anesthetized by blocking IAN	69	29.8	1.2	100
Areas Anesthetized by blocking Lingual nerve	23.6	74.8	1.7	100
Areas anesthetized by blocking LBN	31.4	67.4	1.2	100
LA technique required for removal of lower second premolar	60.3	39.3	0.4	100
Needle length required for IANB	55	44.6	0.4	100

TABLE 6: LEVEL OF PRACTICE VERSUS FREQUENCY OF FAILURE AND REVISION OF ANATOMY (BY KRUSKAL WALLIS TEST)

Grouping Variables	Test Statistics	
		Level of practice
Frequency of Failure	Chi-Square	3.054
	df	3
	Asymp.Sig	.383
Revision of Anatomy	Chi-Square	3.033
	df	4
	Asymp.Sig	.552

the fact that dental practitioners start administering inferior alveolar nerve block from the third year of their educational session and continue it throughout their professional career.<sup>6</sup>

In this study, 15% participants claimed that they never experienced failure of IANB. Out of remaining 85% who did experience failure of inferior alveolar nerve block, 33.4% participants were from general practice and 48.3% were from general practice and teaching both. Keelty and Moles in their audit into the success rate of inferior alveolar nerve block in general dental practice found a success rate of 91.9%.<sup>7</sup> Diaz and González<sup>8</sup> while evaluating undergraduate performance in dental anesthesia found a 50% success rate. Ajarmah et al in their study found a 93.6% success rate of the same procedure performed by six different dentists from different specialties using 4% Articain.<sup>9</sup>

The studies mentioned above were observational studies actually observing the LA failures under set criteria but with limited number of participants such as 4 with Keelty et al, 131 with Diaz et al and 6 with Ajarmah et al. In contrast the present study had 242 participants at different levels of dentistry increasing its validity. The shortcoming in the current study was that the frequency of failure reported by the participants can only be considered a subjective estimation, as the terms never, sometimes, often and always cannot calculate the actual number of anesthetic failures. It is suggested that anesthetic failures should be recorded and monitored in teaching institutions as well as in private clinics. The purpose not being criticizing the practitioner but to improve the quality of knowledge and skills of the practitioner and hence the quality of patient care.

In this study, 35% participants regarded inferior alveolar nerve block failure as patient's perception of

pressure as pain, 26% have difficulty recognizing the landmarks, 11.6% accepted that they are not good at inferior alveolar nerve block technique, while 24% were not sure about the cause. Keelty et al<sup>7</sup> while discussing the possible reasons for failure of inferior alveolar nerve block identified by the participants as being unable to locate anatomical landmarks like pterygomandibular raphe, inability to find a bony landmark with the needle, inability to direct the needle satisfactorily due to tough tissue in the pterygomandibular space, large tongue unable to rest passively, difficult anatomy where posterior teeth have been lost and alveolar resorption has been excessive and needle curved due to excessive manipulation within the tissues. In the study by Al Hindi and Rashed<sup>10</sup> anatomical variations were attributed to inferior alveolar nerve block failure by 66% participants whereas 32.4% participants attributed it to wrong technique.

As many researches investigating the frequency and causes of IANB have emphasized on the anatomical consideration in relation to local anesthesia and that failure to achieve adequate IANB depends highly upon understanding and recognizing the anatomical landmarks<sup>11</sup>; participants of this study were asked how often do they refresh their knowledge from a reference book of local anesthesia, the most reliable, easiest and least time consuming way for this purpose. 8.3% participants did not consider it necessary, 18.2 could not find time for this purpose, 56.6% responded positively to the option of consulting a reference book sometimes and 16.5% responded that they often revise the anatomy. We were not able to find any study focusing on participants' own interest in refreshing their knowledge regarding this procedure. In the Component 2, we had 69% incorrect responses regarding the method of checking the effectiveness of inferior alveolar nerve block, 23.6% incorrect responses concerning lingual nerve block and 31.4% incorrect responses concerning long buccal nerve block.

The responses to the question concerning the local anesthesia technique required to remove a lower second premolar, were 60% incorrect. The review article by Reed et al<sup>12</sup> addresses in detail the technical considerations in local anesthesia. In this survey we found that dental practitioners lack in some basic knowledge regarding mandibular anesthesia techniques. This combined with lack of interest in reviewing literature may also be a contributing factor in local anesthesia failures. Yadav and Kumar<sup>13</sup> in their review article, while relating the local anesthetic failures to anatomical variations, also emphasized on the lack of knowledge and inexperience being responsible for

local anesthetic failures particularly inferior alveolar nerve block.

Lastly, responses to the question regarding the length of needle required for IANB were 55% incorrect. The length of needle used for inferior alveolar nerve block is important because of the desired depth of penetration to be 20-25mm and for the prevention of needle breakage. To prevent needle breakage, it is recommended that it should not be inserted up to the hub, which is the weakest part of a dental anesthesia needle. A needle length of 32mm enables a dentist to follow these recommendations.<sup>14,15</sup>

A number of researches have been examined to find out the causes of inferior alveolar nerve block failure, which have mainly focused on the practitioners understanding of the possible cause. These studies have emphasized on the anatomical landmarks and variations but we failed to find out any research that focuses on objectively evaluating the practitioners' efforts towards overcoming their deficiency in knowledge in this subject. Just as some technical questions have been used for objective assessment of the participants in the current study, Vijayalakshmi and Kumar<sup>16</sup> in order to objectively evaluate knowledge of students in local anesthesia in terms of dosage and complications, used a self-prepared questionnaire consisting of multiple choice questions.

In a prospective, questionnaire-based survey of 181 dentists carried out in Lahore and Karachi cities, serious shortcomings in the practice and training of safe and effective LA were noticed and improvements in training of local anesthesia at under-graduate, post-graduate and continuing professional development levels were emphasized.<sup>17</sup>

Canellas et al<sup>18</sup> used 3D models for teaching anesthetic block to undergraduate students and evaluated participants' responses. 100% participants of their study considered review of anatomy with the use of anatomical models before teaching the techniques of local anesthesia as a valid and useful method. In addition, 100% students felt confident of being able to perform these techniques in patients during the clinic. As a result their teachers observed greater ability of students in achieving higher rate of success of the block, and less anxiety during performance of anesthetic techniques.

Kevin Kwicien in his article emphasizes that with more focused training, skill refinement and the ability to change strategies when needed, dentists could win this war against inferior alveolar nerve.<sup>19</sup>

Present study suggests that out of so many causes of failure of this integral aspect dentistry, the most important is the practitioner's own interest in overcoming the failures. Putting the blame on the anatomical variations or the patients' anxiety does not serve the purpose of achieving a pain free surgical field. We need to monitor our failures and overcome them with improving knowledge and skills. The study was conducted with the idea that although majority of dental practitioners do experience LA failures but no refresher courses are conducted to fulfill this deficiency. In contrast, it has been found that many universities and institutes abroad do recognize the importance of this aspect and refresher courses for dental practitioners are being conducted.<sup>20,21</sup>

It is recommended that at institutional level as well as in private clinics, a record should be maintained of the LA failures. Continuing dental education courses should be conducted by teaching dental professional specially those working in Oral Surgery. An audit of LA failures and of professionals attending/not attending continuing medical/dental education (CME/CDE) activity will enable us to make improvements in this system.

## CONCLUSIONS

It was concluded that local anesthesia techniques be taught and practiced with the use of anatomical models at the undergraduate level before allowing the students to attend the patients moreover, in dental professionals should have refresher courses.

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#### CONTRIBUTIONS BY AUTHORS

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| <b>1 Ayesha Basit:</b>  | Principal Investigator. Research proposal, Data entry, Literature review and Manuscript writing. |
| <b>2 Sadia Mahmood:</b> | Helped in data collection and literature review.   |
| <b>3 Maham Naeem:</b>   | Helped in data collection and analysis.  |
| <b>4 Dr Shaz Khan:</b>  | Data collection.   |