

## Original Article

## Evaluation of Success of Inferior Alveolar Nerve Block Technique Applied by Dental Students at Different Educational Levels

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## ABSTRACT

**Introduction:** Unfortunately, the most important consideration that is ignored in evaluation of the success rate of IANB technique is the teaching and learning of the correct injection technique in the academic atmosphere of universities and during the study period. Only a limited number of studies have evaluated this matter. Therefore, the present study was undertaken to evaluate the success rate of the IANB technique administrated by dental students in Tabriz University of Medical Sciences in order to promote the dental educational programs. **Materials and Methods:** The subjects in the present consisted of patients referring to the Department of Oral Maxillofacial Surgery, Tabriz Faculty of Dentistry, who required surgery in the lower jaw. The dental students evaluated in the present study consisted of the third-, fourth- and fifth-year students who were selected randomly. A total of 30 patients underwent a local anesthetic technique by the third-, fourth- and fifth-year dental students each. Anesthetic agent cartridges containing 1.8 mL of 2% lidocaine with adrenalin were used for the local anesthetic technique. The success of the anesthetic technique was analyzed 2 and 5 minutes after injection with the use of an electric pulp tester (EPT). In addition, the severity of pain was tested with the use of VAS. **Results:** there was no significant difference in the success rate of the IANB technique between male and female students. Comparison of the success rate of the IANB technique between the third-, fourth- and fifth-year dental students showed no significant differences in response to EPT, perception of pain and feeling of the dental explorer between the three groups of students. However, the frequency of the success rate of the IANB technique showed that the success rates were 86.3%, 93.3% and 83.3% for the third-, fourth- and fifth-year dental students, respectively. **Discussion:** the success of this technique has been reported to be low in references for some reasons. In this context, unfortunately the most important fact that is not taken into account in the evaluation of the reasons for the failure of the IANB technique is the teaching and learning of the correct technique in universities and during university studies and only a limited number of studies have evaluated it. **Conclusion:** Previous studies have reported a 70% success rate for the IANB technique administrated by dental students; however, the results of the present study showed a success rates >70 for this technique administered by the third-, fourth- and fifth-year dental students in Tabriz University of Medical Sciences. The discrepancy between the results might indicate the important role of proper education in decreasing the failure rate of this technique.

## INTRODUCTION

Anesthetic technique is one of the most important components of dental procedures. Of all the different anesthetic techniques in dentistry, inferior alveolar nerve block (IANB) technique is one of the most commonly used ones (1). IANB technique is used for anesthesia of mandibular teeth and is also referred to as standard mandibular nerve block and Hasted block technique (2). Unfortunately, IANB technique

has a relatively high rate of failure, with experimental studies reporting a failure rate of 70–75%.

Some of the main reasons for the high failure rate of the IANB technique include clinical aspects (anatomic variations in the location of mandibular foramen), intravenous injection of the anesthetic agent, presence of accessory branches, especially the mylohyoid nerve, use of an incorrect injection technique, deviation of needle during injection, etc (3).

Different techniques have been proposed to overcome such failures, including supplemental infiltration (4,5), administration of analgesics before the procedure (6), use of various anesthetic agents (7), intraosseous and intraligamental injections (8), repetition of the IANB technique (9) and increasing the volume of the anesthetic agent (10,11).

Unfortunately, the most important consideration that is ignored in evaluation of the success rate of IANB technique is the teaching and learning of the correct injection technique in the academic atmosphere of universities and during the study period, and only a limited number of studies have evaluated this. It is absolutely necessary for dental practitioners to be fully familiar with the exact technique of injection and local anesthesia in order to render effective dental treatments and decrease the side effects of injection. However, some dental practitioners do not apply the correct technique and this depends in their ability and experience (12,13).

To date, only a few studies have evaluated the importance of teaching and learning this technique in an academic manner. In 2008, Hussein Todashaki evaluated the success of senior dental students in Tehran University of Medical Sciences in the application of IANB, concluding that 70% of the injections carried out by these students was successful, with a 90% success rate for professors and postgraduate students in the Department of Oral and Maxillofacial Surgery, indicating a significant difference between the two groups (1).

For some reasons the success rate of the IANB technique is low in reference textbooks. Therefore, the present study was undertaken to evaluate the success rate of the IANB technique administrated by dental students in Tabriz University of Medical Sciences in order to promote the dental educational programs. Significant differences in success rates between different study groups would help decrease the difference through further practical education.

## MATERIALS AND METHODS

The subjects in the present consisted of patients referring to the Department of Oral Maxillofacial Surgery, Tabriz Faculty of Dentistry, who required surgery in the lower jaw. The dental students evaluated in the present study consisted of the third-, fourth- and fifth-year students who were selected randomly.

In a study by Madam et al, the reasons for the failure of the IANB technique were evaluated and 5 reasons were reported: pathological, pharmacologic, psychological and anatomic reasons as well as an incorrect technique by the dentist (14).

Only patients with near-normal pathological, pharmacologic and anatomic statuses were selected. The exclusion criteria consisted of drug and alcohol use, use of medications for psychological problems, infectious teeth and swelling in the area surrounding the teeth. The inclusion criteria and exclusion criteria of the study are shown in Table 1. The data were recorded as described in the following section. This study was approved by the Institutional Review Board of the Faculty of Dentistry, Tabriz University of medical science, with a certificate of Exemption (No. MU-DT/PY-IRB 2016/052.1812).

**Table 1.** The inclusion criteria and exclusion criteria of the study

Inclusion criteria	Exclusion criteria
1. The volunteer was in good health with no systemic diseases	1. Drug and alcohol use
2. The volunteer was willing to undergo IANB	2. The volunteer was not willing to undergo IANB (e.g., fear of needle injection)
3. The dental students have to correct practice in the IANB model	3. Lack of some data (incomplete data collection)
4. Volunteers with near-normal pathological, pharmacologic and anatomic statuses	4. The advisors did not accept the standard IANB injection
5. Complete data collection	5. Use of medications for psychological problems
6. The advisors accepted the standard IANB injection	6. Infectious teeth and swelling in the area surrounding the teeth

A total of 30 patients underwent a local anesthetic technique by the third-, fourth- and fifth-year dental students each.

Anesthetic agent cartridges containing 1.8 mL of 2% lidocaine with adrenaline 1:80,000 [1 cartridge = 1.8 ml] were used for the local anesthetic technique.

## 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

A 27-gauge needle (30 mm) and self-aspirating syringes with a local anesthetic solution (2% lidocaine with adrenaline 1:80,000 [1 cartridge = 1.8 ml]) were used. The standard IANB technique was followed. 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 (Figure. 1).

Only 1 anesthetic cartridge was permitted per dental student. 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 success of the anesthetic technique was analyzed 5 minutes after injection with the use of an electric pulp tester (EPT). In addition, the severity of pain was tested with the use of VAS.

The severity of the patients' pain was compared with the soft tissues on the contralateral side.

The VAS consisted of 10 degrees of pain feeling, including no pain, moderate pain and severe pain. No pain was deemed success and moderate pain and severe pain were deemed failure of the block technique.

Data were reported with descriptive statistics (mean  $\pm$  standard deviation and frequencies/percentages) and analyzed with SPSS 20.

ANOVA and post hoc tests were used to evaluate the success of the IANB technique administered by the third-, fourth- and fifth-years dental students; chi-squared test was used to evaluate the frequencies of success.

## RESULTS

Mann-Whitney test did not reveal any significant differences in the success rate of the IANB technique between male and female third-, fourth- and fifth-year dental students.

Wiener et al (2009) showed differences in preferences between male and female students in terms of the use of tools such as the syringe size and the type of the gloves; however, they did not evaluate the success rate of injections between

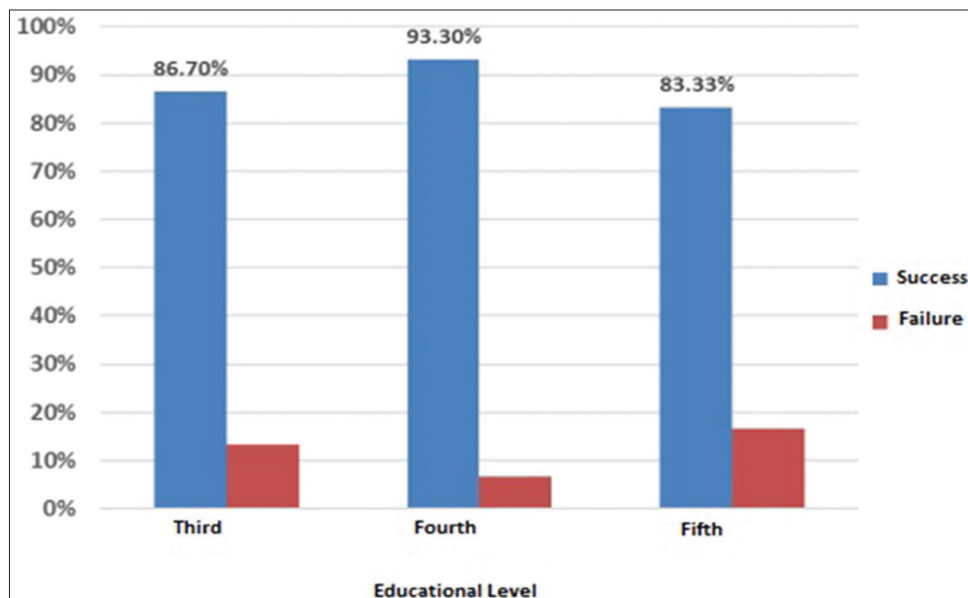
male and female subjects (16). In addition, in the present study, there was no significant difference in the success rate of the IANB technique between male and female students.

Comparison of the success rate of the IANB technique between the third-, fourth- and fifth-year dental students showed no significant differences in response to EPT, perception of pain and feeling of the dental explorer between the three groups of students. Hussein Todashaki et al reported that 70% of injections administered by the 10th-term dental students was successful, which increased to 90% for professors and postgraduate students in the Department of Oral and Maxillofacial Surgery. However, in the present study, the frequency of the success rate of the IANB technique showed that the success rates were 86.3%, 93.3% and 83.3% for the third-, fourth- and fifth-year dental students, respectively. (Figure 1)

## DISCUSSION

Achieving local anesthesia is very important in dentistry. Of all the different techniques for local anesthesia, the IANB is one of the most commonly used techniques. However, the success of this technique has been reported to be low in references for some reasons. In this context, unfortunately the most important fact that is not taken into account in the evaluation of the reasons for the failure of the IANB technique is the teaching and learning of the correct technique in universities and during university studies and only a limited number of studies have evaluated it. Therefore, the present study was undertaken to evaluate the success of the IANB technique administered by dental students in Tabriz University of Medical Sciences in order to improve the educational program of dental students to improve the success rate.

In the present study, the third-, fourth- and fifth-year dental students administered the IANB technique to 90 patients. The results showed no significant differences in response to EPT, feeling of the dental explorer and pain perception in the



**Figure 1.** Comparison of frequency of the success rate of the IANB technique showed that the success rates between different educational level

IANB technique between the third-, fourth- and fifth-year dental students. In addition, the success rates were >70% in all the three groups of students.

Madam et al reported 5 reasons for the failure of IANB technique: pathological, pharmacologic, psychological, anatomic and the incorrect technique used by the dentist (14).

An attempt was made in the present study to select patients that were near-normal from pathologic, pharmacologic and anatomic points of view. In this context, exclusion criteria consisted of drug and alcohol use, use of medications for psychological problems, presence of infectious teeth, and presence of swelling around the teeth. Therefore, the most important reason for the failure of the technique was a lack of skill of the dental students.

To date no acceptable reason has been suggested for the failure of the IANB techniques for lower molars. However, the central core hypothesis can explain a higher rate of failure of the anesthetic technique of incisors compared to molars.

Ghavimi et al (2015) showed success rates of 93.5% and 71% for the IANB technique with and without panoramic radiography guide, respectively (15). In the present study, all the injections were carried out without radiographic guidance.

Husseini Todashaki reported a success rate of >70% for injections carried out by 10th-term dental students, which increased to 90% for the professors and postgraduate students in the Department of Oral and Maxillofacial Surgery, indicating a significant difference between the two groups (1).

However, in the present study, the frequency of the success rate of the IANB technique showed success rates of 86.3%, 93.3% and 83.3% for the third-, fourth- and fifth-year dental students, respectively. The lower success rate of the fifth-year dental students in this study might be attributed to the students' inaccuracy and small sample size.

In the present study there was no significant difference in the success rates of the injections between male and female students in the third-, fourth- and fifth-year dental students. Wiener et al (2009) reported differences in the preferences for the use of tools in terms of the syringe size and glove type between male and female students; however, they did not compare the success rates of male and female dental students (16).

## CONCLUSION

Previous studies have reported a 70% success rate for the IANB technique administered by dental students; however, the results of the present study showed a success rates >70 for this technique administered by the third-, fourth- and fifth-year dental students in Tabriz University of Medical Sciences. The discrepancy between the results might indicate the important role of proper education in decreasing the failure rate of this technique. The present study was undertaken to evaluate the success rate of the IANB technique administered by the dental students in Tabriz University of Medical Sciences, aiming to promote the dental educational program, in order to decrease the failure rate of this local anesthetic technique. Based on the results of the present study,

it is suggested that larger sample sizes be evaluated, the students' skills in relation to other local anesthetic techniques be evaluated and the success rate for each educational level be evaluated in terms of gender.

In conclusion, the results of the present study indicate that the dental curriculum at Tabriz University of Medical Sciences is enhancing between educational levels in coverage of techniques that can be employed when an IANB is indicated.

## REFERENCES

1. Hoseinitodashki H, Rahmati A. Success rate of 10<sup>th</sup> semester dental students of Tehran University of Medical students in infra alveolar nerve block injection technique. *jdm*. 2008; 21 (4):285-289 Nasser Nooh, WalidA. Abdullah. Incidence of complications of inferior alveolar nerve block injection. *Journal of medicine and Biomedical Sciences* 2010; May:52-56.
2. Mohammad SF. Techniques of mandibular anesthesia. In: Malamed SF; local anesthesia 5<sup>th</sup> ed. Mosby 2004; 14: 244.
3. Aggarwal V, Jain A, Debipada K. Anesthetic efficacy of supplemental buccal and lingual infiltrations of articaine and lidocaine following an inferior alveolar nerve block in patients with irreversible pulpitis. *J Endod* 2009; 35: 925-9.
4. Foster W, Drum M, Deader A, Beck M. Anesthetic Efficacy of Buccal and Lingual Infiltrations of Lidocaine Following an Inferior Alveolar Nerve Block in Mandibular Posterior Teeth. *Anesth Prog* 2007; 54: 163-169.
5. Aggarwal V, Singla M, Kabi D. Comparative evaluation of effect of preoperative oral medication of ibuprofen and ketorolac on anesthetic efficacy of inferior alveolar nerve block with lidocaine in patients with irreversible pulpitis: a prospective, double-blind, randomized clinical trial. *J Endod* 2010; 36: 375-8.
6. Claffey E, Reader A, Nusstein J, Beck M, Weaver J. Anesthetic efficacy of articaine for inferior alveolar nerve blocks in patients with irreversible pulpitis. *J Endod* 2004; 30: 568-71.
7. Hargreaves KM, Keiser K. Local anesthetic failure in endodontics: mechanisms and Management. *Endod Topics* 2002; 1: 26-39.
8. Aggarwal V, Singla M, Kabi D. Comparative evaluation of anesthetic efficacy of GowGates mandibular conduction anesthesia, Vazirani-Akinosi technique, buccal plus lingual infiltrations, and conventional inferior alveolar nerve anesthesia in patients with irreversible pulpitis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010; 109: 303-
9. Paula Cristina, Brunetto et al. Anesthetic Efficacy of 3 Volumes of Lidocaine with Epinephrine in Maxillary Infiltration Anesthesia. *Anesth Prog* 2008; 55: 29-34.
10. Camarda AJ A prospective clinical patient study evaluating the effect of increasing anesthetic volume on inferior alveolar nerve block success rate. *Quintessence Int* 2007; 38(8): e521-6.

11. Aggarwal V, Singla M, Miglani S, Kohli S, Singh S. Comparative Evaluation of 1.8 mL and 3.6 mL of 2% Lidocaine with 1:200,000 Epinephrine for Inferior Alveolar Nerve Block in Patients with Irreversible Pulpitis: A Prospective, Randomized Single-blind Study. *J Endod* 2012; 38: 753–756.
12. Wali M Prospective, randomized single-blind study of the anesthetic efficacy of 1.8 and 3.6 milliliters of 2% lidocaine with 1:50,000 epinephrine for inferior alveolar nerve block, Drum M, Reader A, Nusstein J *J Endod* 2010; 36(9):1459-62.
13. Vreeland DL, *J Endod*, An evaluation of volumes and concentrations of lidocaine in human inferior alveolar nerve block. Reader A, Beck Meyers Weaver J 1989; 15(1):6-12.
14. Gautam A, Sonal G, Arjun D. Failure of inferior alveolar nerve block. *J Am Dent Assoc* 2002; 133(7):843-846.
15. Ghavimi M, Anezafati S, Arta S, A, Ghoreishizadeh A, Sadeghilar N, The Success Rate of Inferior Alveolar Nerve and Mandibular Foramen Anesthesia with and without Panoramic Radiograph *Medical Journal of Tabriz University of Medical Sciences and Health Services* Vol. 37, No. 3, Aug. – Sep. 2015, Pages: 40-43.
16. Wiener RC, Crout RJ, Sandell J, Howard B, Ouassa L, Wearden S, et al. Local anesthetic syringe ergonomics and student preferences. *J Dent Educ* 2009; 73(4):518-22.