

# Impact of Methods for Teaching Inferior Alveolar Nerve Block Anesthesia on Dental Students' Efficiency

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## ABSTRACT

**Aim:** Several methods are available for teaching local anesthesia (LA) administration to dental students. The aim of this study was to examine the effect of two teaching methods [student-to-student learning and peer-assisted learning (PAL)] on third-year dental students' efficiency in administering inferior alveolar nerve blocks (IANBs).

**Materials and methods:** After ethical approval, the study was conducted over three academic years (2016–2018). During the first year, the third-year dental students (control group) were taught IANB administration techniques using the student-to-student method. During the second year, a new group of third-year dental students (study group) were taught the IANB administration technique using two methods (student-to-student and PAL). All the students were assessed the following academic year (when the students became fourth-year students) by oral and maxillofacial surgery (OMFS) faculty using six evaluation items.

**Results:** According to the six evaluation criteria, the study group that was taught IANB using the student-to-student and PAL teaching techniques performed superior to their peers in the control group. Three of the six evaluation criteria were statistically significantly different between the two groups of students: recording the dental and medical history ( $p = 0.018$ ), recognizing the anatomy and the injection procedure ( $p = 0.004$ ), and assessing the success of the anesthesia ( $p = 0.026$ ).

**Conclusion:** Combining the student-to-student and PAL teaching techniques for IANB administration resulted in better student efficiency than using only the student-to-student technique.

**Clinical significance:** Peer-assisted learning is an effective teaching method that can be used to enhance the learning experience of dental students who are attempting to master IANB techniques.

**Keywords:** Anesthesia, Dental, Oral surgery.

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## INTRODUCTION

Achieving profound anesthesia is a crucial pillar in successful dental practice. It enables painless management, so that the patient's apprehension is minimized, which, in turn, enables the dentist to perform the required treatment with ease and precision. Therefore, teaching anesthesia administration techniques and pain control methods is regarded as an extremely important part of any undergraduate dental curriculum because it requires dental students to integrate the anatomical, pharmacological, and physiological information gathered throughout their education and apply them to manage a patient's pain and anxiety in a clinical setting.<sup>1-3</sup>

Teaching to administer local anesthesia (LA) at the undergraduate level can be challenging for both the trainer and the trainee.<sup>4</sup> On the one hand, the trainers have different teaching methods at their disposal and must choose the one that best suits the needs of the students. These teaching methods include demonstration on cadavers and dry human skulls and practice on simulation models and live human subjects who might be patients or fellow students (student-to-student) and peer-assisted learning (PAL).<sup>5-7</sup> Of all the teaching methods, the student-to-student method is the most commonly used teaching modality for LA administration.<sup>8</sup> Despite the moral, ethical, and legal issues concerning student-to-student injections in dental education, studies from the United States, Europe, and other parts of the world report widespread preferences for this method.<sup>1,6</sup> At the dental institution where this study was conducted, student-to-student LA administration is the standard of practice, especially for teaching inferior alveolar nerve block (IANB) administration. On the other

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hand, learning to administer LA is challenging for the trainee because it requires the integration of several basic concepts and their application in a clinical setting.

Peer-assisted learning is defined as the development of knowledge and skill through active help and support from people who are equal in status, not professional teachers, and from similar social groups.<sup>9</sup> It is a reciprocal process in which people help each other to learn and learning themselves by teaching.<sup>9</sup> Hence, PAL typically involves senior students arranging teaching sessions for

junior students.<sup>10</sup> Encouraging evidence from the UK suggests that surgical skills are an area of medical education that may benefit from PAL.<sup>11</sup> Peer-assisted learning is believed to be an effective and feasible method for teaching surgical skills in a controlled environment, and PAL improves confidence among medical and dental students. Therefore, the aim of this study was to examine the effects of two different teaching methods to administer LA, namely, the student-to-student and PAL methods, on third-year dental students' ability to administer IANBs.

## MATERIALS AND METHODS

Ethical approval was obtained from the institution's ethical review board (IRB 041-14). The study was conducted over a 2-year period with two groups of students; each group of students was assessed the following academic year (i.e., their fourth year of dental training) after a week of refreshment and practicing the standard IANB technique. All the students were evaluated by the oral and maxillofacial surgery (OMFS) faculty according to the following six evaluation criteria: dental and medical history record completion, vital sign registration, proper positioning of operator and patient, armamentarium preparation, anatomy and injection procedure, and LA success assessment. For each of these six criteria, the students were assigned one of three scores (incompetent, competent, or proficient), according to the rubric form in Table 1.

The first group of students (the control group) successfully completed the pain control and anesthesia course during the second semester of their third year of dental training. This group was taught the IANB administration technique using the standard student-to-student method under the supervision of the OMFS

faculty. In this learning method, the students practice the technique of IANB administration on each other while being supervised by OMFS faculty at a ratio of one supervisor for every four pairs of students (four clinics). The second group (the study group) also successfully completed the pain control and anesthesia course during the second semester of their third year of dental training, but this group was taught the IANB administration technique using two instructional methods, the traditional student-to-student method and the PAL method. The PAL method involves pairing the junior students with the sixth year (senior) students. Then the junior students practice performing IANB administration on patients while being supervised by the senior students at a 1:1 ratio. The OMFS faculty members were available at all times during the clinical sessions to supervise the learning process at a ratio of one instructor for every eight students (eight clinics). The LA and pain control skills of these senior sixth year students were assessed and evaluated during their fourth and fifth year of dental training, and they were deemed capable of administering anesthesia independently and managing any complications effectively. They were also deemed capable of instructing their fellow junior peers on the IANB technique.

Anesthesia administration was done for specific patients indicated for the extraction of mandibular posterior teeth. Exclusion criteria included impacted teeth, submerged teeth, limited mouth opening, periapical lesions larger than 1 cm, orofacial infections, medically compromised patients and patients unable to cooperate.

The study results were analyzed using IBM SPSS version 22 (SPSS, Chicago, IL). Simple descriptive statistics was used to define the characteristics of the study variables through counts and percentages for the categorical variables. To establish a relationship

**Table 1:** The rubric that is used for the assessment of IANB administration

<i>Procedure</i>	<i>Incompetent (I)</i>	<i>Competent (C)</i>	<i>Proficient (P)</i>
Dental and medical histories	Failure to properly take and record the medical and dental histories	Properly take and record medical and dental histories. Understanding the significance of each finding	Can understand and analyze the significance of each finding and is able to investigate further
Vital sign registration	Failure to know what the vital signs are and take them	Checking the blood pressure (BP), pulse rate (PR), and respiratory rate (RR) and understand their significance for safe local anesthesia and extraction procedures, avoiding any medical emergency	Ability to interpret the significance of any variation and know what investigations or medical consultations are needed to avoid medical emergencies
Operator and patient's positions	Failure to adjust the dental unit, illumination, suction, level and inclination of dental chair, level of occlusal plan, head rest, and operator's position relative to the required procedure	Good adjustment of dental unit, illumination, suction, level and inclination of dental chair, level of occlusal plan, head rest, and operator's position relative to the required procedure	Clearly understand the different positions, for each procedure, of both the dental chair and operator tools
Preparation of armamentarium for LA	Failure to prepare tray 1, cartridge syringe, proper needle, LA carpule	Tray 1, cartridge syringe, proper needle, LA carpule properly prepared	Ability to explain and justify the selection of the syringe, the needle, and LA carpule and understand each of the contents of the carpule
Injection procedure	Improper handling of the tissues and failure to choose the proper technique, locate the target point of injection, and withdraw the needle properly	Proper handling of tissues, successful choice of proper technique, properly locate the target point of injection and withdraw the needle	Ability to explain the choice of the proper technique and achieve the technique with a high level of performance
Assessment of success of anesthesia	Failure to understand and perform objective and subjective symptom testing	Successfully perform objective and subjective symptom testing and understand failure	Ability to explain the significance of each symptom as well as choose other options upon failure

IANB, inferior alveolar nerve block; LA, local anesthesia

between the categorical variables, this study used the Chi-square test. These tests were carried out with the assumption of a normal distribution. Lastly, a conventional  $p$  value ( $<0.05$ ) was selected as the criterion to reject the null hypothesis.

## RESULTS

Two hundred and sixty-nine students were involved in this research, 144 in the control group and 125 in the study group. The study group that was taught IANB using the student-to-student and PAL teaching techniques performed superior to their peers in the control group (who were taught IANB only using the student-to-student method), according to the six evaluation criteria. For all the six criteria items, more "proficient" students were found in the study group. For example, 55% of students in the study group achieved a proficient score for vital sign recognition compared to only 44% in the control group. However, only three of the six evaluation criteria were statistically significantly different between the two groups of students: recording the dental and medical history ( $p = 0.018$ ), recognizing the anatomy and the injection procedure ( $p = 0.004$ ), and assessing the success of the anesthesia ( $p = 0.026$ ). The assessment results of both groups of students according to the six evaluation items used by the OMFS faculty are presented in Table 2. The statistically significantly different results were especially evident among the students who achieved an "incompetent" score, as shown in Figures 1 to 3. For example, the number of students in the study group who obtained an incompetent score for the criteria of success of anesthesia assessment was 1 in the study group and 7 in the control group. No major patient complications were reported.

## DISCUSSION

Achieving adequate and efficient LA forms the basis for painless dental treatment. Therefore, LA and its various aspects are the essential building blocks of any dental curriculum.<sup>1</sup> The various

aspects of LA include a thorough knowledge of the regional anatomy, the various injection techniques, the different anesthetic drugs, and the possible complications and their management.<sup>4</sup> The need for appropriate instructional methods and adequate training opportunities must be constantly balanced with the requirements for a safe and stimulating learning environment.<sup>8,12</sup> Several studies have been conducted to evaluate the efficacy of LA teaching modalities.<sup>1,5-10,13</sup>

Friel et al. published a review of the available literature regarding PAL as a teaching method for undergraduate medical students and noted paucity in the application of PAL for basic clinical skills and patient management.<sup>14</sup> Therefore, the purpose of this study was to compare our standard IANB administration teaching method, which is the student-to-student method, to the PAL method.

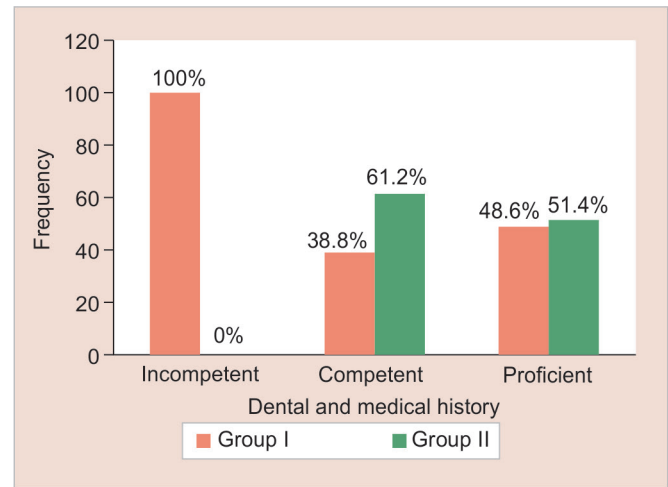
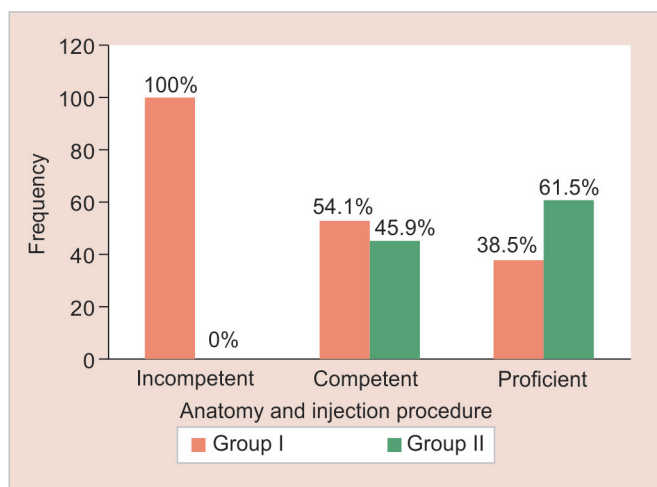


Fig. 1: Student performance with regard to recording dental and medical history

Table 2: Results of IANB administration technique evaluation for both groups of students

Variables		Total	Group		p value
			Control group GI, n (%)	Study group GII, n (%)	
Total		269	144 (53.5)	125 (46.5)	N/A
Dental and medical history recording	Incompetent	5	5 (100.0)	0 (0.0)	0.018 <sup>a</sup>
	Competent	85	33 (38.8)	52 (61.2)	
	Proficient	179	87 (48.6)	92 (51.4)	
Vital sign registration	Incompetent	4	1 (25.0)	3 (75.0)	0.426
	Competent	84	43 (51.2)	41 (48.8)	
	Proficient	181	81 (44.8)	100 (55.2)	
Operator and patient properly positioned	Incompetent	2	0 (0.0)	2 (100.0)	0.319
	Competent	88	44 (50.0)	44 (50.0)	
	Proficient	179	81 (45.3)	98 (54.7)	
Armamentarium preparation	Competent	54	20 (37.0)	34 (63.0)	0.120
	Proficient	215	105 (48.8)	110 (51.2)	
Anatomy recognition and injection procedure	Incompetent	4	4 (100.0)	0 (0.0)	0.004 <sup>a</sup>
	Competent	122	66 (54.1)	56 (45.9)	
	Proficient	143	55 (38.5)	88 (61.5)	
Success of anesthesia assessment	Incompetent	8	7 (87.5)	1 (12.5)	0.026 <sup>a</sup>
	Competent	95	48 (50.5)	47 (49.5)	
	Proficient	166	70 (42.2)	96 (57.8)	

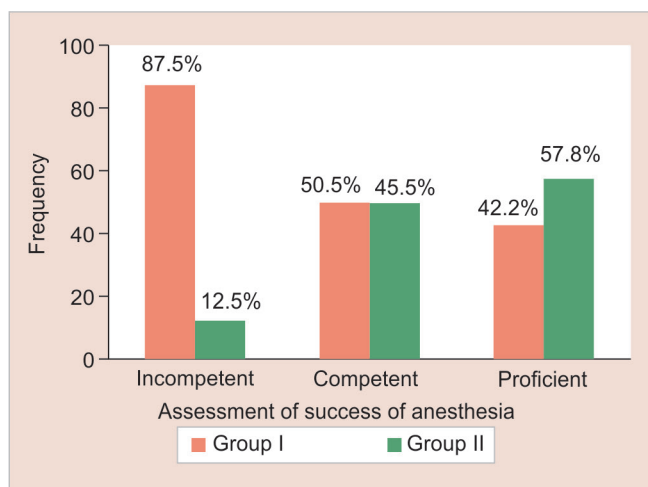
IANB, inferior alveolar nerve block <sup>a</sup>Significant using Chi-square test @  $<0.05$  level



**Fig. 2:** Student performance with regard to anatomy recognition and inferior alveolar nerve block injection procedure

Students over two consecutive academic years were included in the study and they were divided into study and control groups. The students were evaluated on the basis of six criteria, three of which were found to be statistically significantly different between the two groups of students. Dental and medical history recording was one factor in which the study group outperformed the control group; nearly zero students received an incompetent score in the study group. This might have been a direct result of PAL and its positive feedback on students. Vital sign registration score, on the other hand, were also different between the two groups of students, with more of the study group achieving a proficient score, but the differences were not statistically significant. These results are in concordance with those of Silbert et al.<sup>15</sup> who stated that PAL is an effective supplementary teaching method.<sup>11</sup> This may be due to individual variations among the students, such as absence. We believe this single result is not a reflection of the overall effectiveness of the PAL teaching method. The two evaluation factors, proper operator and patient positioning and preparation of the armamentarium, were comparable between the two groups of students (i.e., there was no statistically significant difference). This may be due to the students' solid grasp and familiarity with these two criteria and the multiple demonstrations they received from the OMFS faculty. Anatomy recognition, the injection procedure, and assessment of the LA success were factors that were positively influenced by the PAL technique. Fewer students scored incompetent and more students scored proficient in the study group. This may be attributed to early exposure to actual patients and the possible effects of anxiety reduction and self-confidence enhancement that are thought to result from PAL teaching methods.

Peer-assisted learning which is defined as "people from similar social groupings, who are not teachers, helping each other to learn and learning themselves by teaching" was first introduced in higher education by Topping.<sup>16</sup> This cooperative and collaborative teaching method has since become an integral teaching strategy for medical specialties at different stages, from preclinical medicine in subjects such as anatomy and physiology to a number of clinical skills and technical procedures.<sup>17</sup> Its implementation is also varied from the number of tutors to the gap in the level of education, so that tutors may be from the same academic level (same year PAL) or of higher level (cross-year PAL).<sup>18</sup> Irrespective of the technicalities, a general agreement is that PAL teaching method offers many advantages



**Fig. 3:** Student performance with regard to assessing the success of inferior alveolar nerve block

to both the tutors and the tutees, which include, among others, enhanced knowledge, professionalism, empathy, communication skills, leadership skills, self-esteem, self-confidence, self-evaluation clinical reasoning, and even reduced stress.<sup>11,17,19,20</sup> One interesting explanation for the numerous advantages of PAL is based on the theory of "social and cognitive congruence" between tutor and tutee.<sup>17</sup> Social and intellectual similarities between the students and their peer tutors create a safe and relaxed environment that facilitates informal and friendly communication.<sup>17</sup> Bugaj et al. argue that this understanding between student and peer tutor compensates the lack in knowledge and expertise of the faculty instructor.<sup>17</sup>

The limitation of this study was using PAL in combination with the standard IANB administration teaching method (student-to-student). Future studies should compare the two teaching methods independent of each other to further attest the efficiency of PAL. Future studies may include examining the effects of PAL teaching method on other clinical procedures and other student cohorts such as postgraduate students. Also, enlisting the assistance of interns in the teaching and learning processes may be a fruitful future project.

## CONCLUSION

In comparison to the traditional student-to-student teaching methods, the combination of student-to-student and PAL teaching techniques for IANB administration resulted in more proficient students and less incompetent students in most IANB technique evaluation criteria.

## CLINICAL SIGNIFICANCE

Peer-assisted learning is an effective teaching method that can be used to enhance the learning experience of dental students who are attempting to master technical skills such as IANB administration.

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