Original Article

Dental Students' Preference with regard to Tactile or Visual Determination of Injection Site for an Inferior Alveolar Nerve Block in Children: A Crossover Randomized Clinical Trial

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Abstract

Objectives: Instruction of local anesthesia injection in an important part of dental education curricula. This study was performed to compare dental students' preference with regard to tactile or visual determination of injection site for an inferior alveolar nerve block (IANB) in children.

Materials and Methods: This crossover randomized clinical trial was conducted on dental students of Zahedan Dental School who took the first practical course of pediatric dentistry in the first academic semester of 2013-14 (n=42). They were randomly divided into two groups. During the first phase, group I was instructed to find the needle insertion point for an IANB via tactile method and group II was instructed to do it visually. In the second phase, the groups received instructions for the alternate technique. Both instructions were done using live demonstrations by the same instructor and immediately after instruction the learners practiced an IANB using the taught method. A five-point Likert scale questionnaire was then filled out by the students. The preference score was determined by calculating the mean of item scores. Data were analyzed using Mann-Whitney U and Wilcoxon Singed Rank tests in SPSS 19 at P=0.05 level of significance.

Results: Thirty-eight students completed the study. By using the visual method to perform an IANB, students gained a significantly higher mean preference score (P=0.020). There was a significant difference in the preference of male students (P=0.008).

Conclusions: Instruction of IANB by visual identification of needle insertion point is more desirable by students.

Keywords: Education; Anesthesia, Local; Pediatric Dentistry

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INTRODUCTION

Local anesthesia instruction is an important topic in undergraduate dental curricula [1]. It enables the students to integrate and practice what they have learned in anatomical, pharmacological and physiological sciences and manage pain and anxiety in the clinical setting [1,2]. During clinical skills training of local anesthesia, students practice commonly performed injections in human subjects [1]. However, it is clear that learning local anesthetic techniques is a complex and stressful process [3].

In particular, due to anatomical, developmental and behavioral considerations [4], delivering these injections in children is more stressful for dental students. Clinical skills of anesthesia injection in children are among the basic skills that students learn in pediatric dental courses. Among different local anesthesia techniques, IANB injection is most commonly performed [5]. In this technique, the parameters for accurate determination of injection site in the antero-posterior and vertical dimensions, the depth of needle penetration and aspiration are of great importance [6,7]. In IANB, touching the coronoid notch and paying attention to the occlusal plane are the standard measures to find the needle insertion point [8,9].

Since this method requires the presence of sufficient number of teeth to determine the

occlusal plane and also employs the non-working hand to locate the proper site of insertion, visual method may be proposed to find the needle insertion point. In the visual method, the site of needle insertion is at the tip of pterygomandibular triangle, which is the intersection of pterygomandibular raphe and the internal oblique ridge. It should be noted that the pterygomandibular raphe, the internal oblique ridge and the palatal arch form the pterygomandibular triangle [10].

In several studies, various aspects of local anesthesia education, including the effects of advanced anesthesia courses offered to undergraduate students [2,5], preclinical use of dental phantoms [3] and local anesthetic syringe ergonomics [6] have been investigated. Besides, in one study conducted in a Turkish dental school, opinions of undergraduate students regarding painless injections in children were addressed by Kuscu et al, [11]. In their study, a considerable increase in percentages of students who believed in the possibility of delivering painless local anesthesia in pediatric patients was found after longitudinal theoretical and practical educational programs. The previous researches lack information about the value of providing undergraduate students with simplified clinical instruction and training of block anesthesia in children and their preference with regard to available methods for this purpose. In an attempt to identify approaches to facilitate the instruction of IANB, and because undergraduate students need to learn how to do it efficiently as part of their routine practice as well as the importance of behavioral management in children, this study was designed to compare dental students' preference with regard to tactile or visual identification of needle insertion site for an IANB in children.

MATERIALS AND METHODS

The Research and Ethics Committee of Zahedan University of Medical Sciences reviewed and approved the study protocol (code: 6027). In this crossover randomized clinical trial (registered in www.irct.ir, IRCT201506106105N4), the sample size was calculated to be 42 subjects based on 90% power and type I error of 0.05. A total of 54 students enrolled in practical pediatric dentistry course 1 in the first academic semester of 2013-14 in Zahedan Dental School, Iran. The inclusion criterion was having no previous experience in performing IANB for children. Out of 54 individuals, 52 students met the inclusion criteria. Among them, 42 were selected using a table of random numbers.

After explaining the aim of study to students and parents of children, written informed consent was obtained from all participants. Allocation of subjects to the two groups was performed as follows: the titles of groups I and II were written on pieces of paper and put in envelopes with the same appearance (21 each). Each student chose one envelope and was accordingly assigned to one of the two groups (Fig.1). One dental student recruited the participants, assigned them to the groups and supervised them.

First phase

Group I was trained to perform IANB injection using the tactile method to determine the needle insertion point. Group II was instructed the procedure using the visual method to find the needle insertion point. Each dental student, immediately after training, performed block injection using the corresponding method for a child who needed dental treatment under IANB.

Students were then asked to mention their preference while using the method. Students' responses were recorded using a five-point Likert scale (1=Totally disagree, 2=Disagree, 3=No opinion, 4=Agree, 5=Totally agree). The self-reported questionnaire was adapted from previous studies [3,6] and its validity and reliability were confirmed (Cronbach's alpha coefficient=81%).

Second phase

The second method was instructed to the groups.

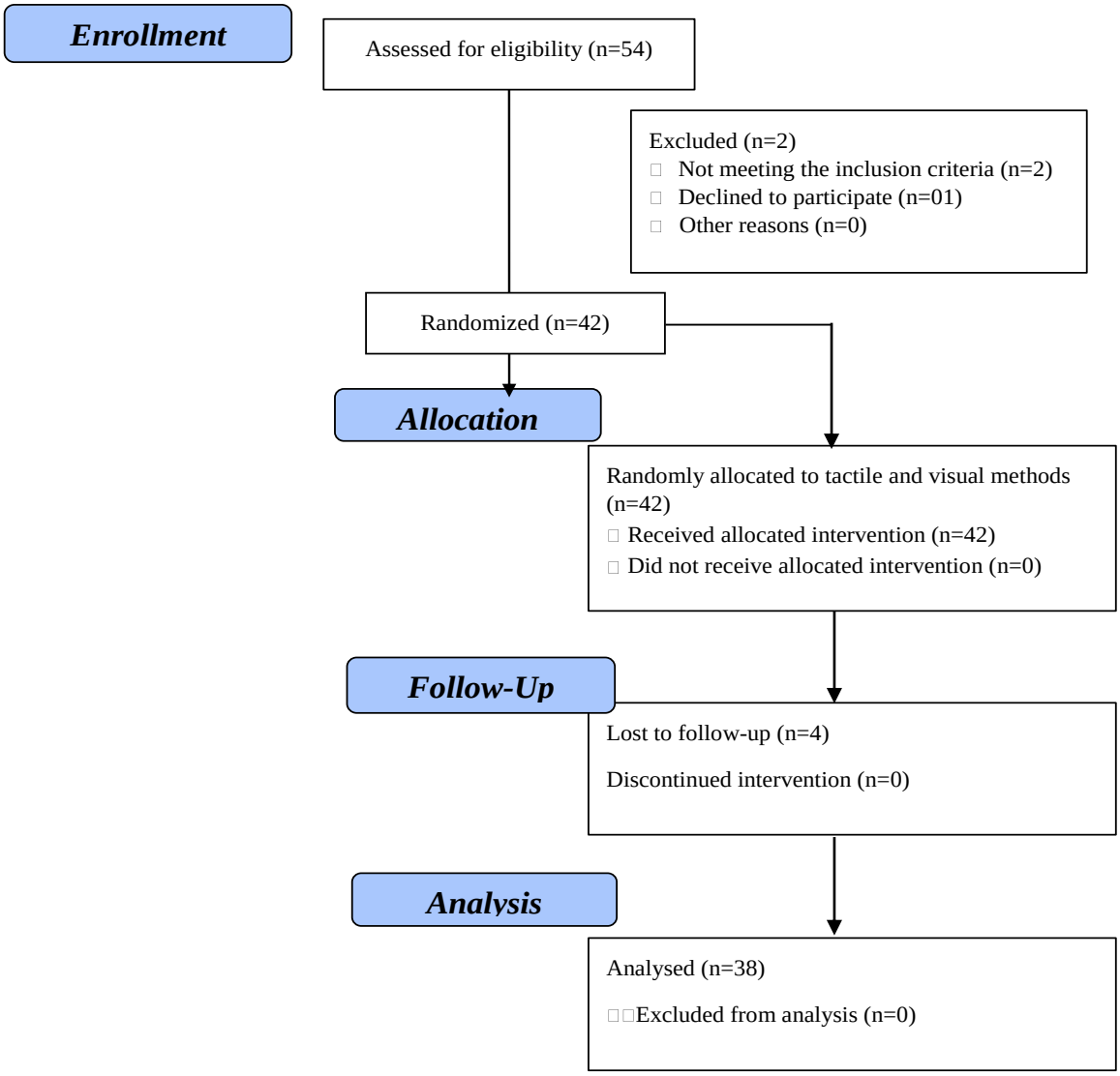

Fig. 1: Participants' flow diagram

As in the first phase, the injection was performed by each leaner and the questionnaires were completed. In both phases, live demons-tration was performed on a child who was in need of treatment in groups consisting of three students each. All students were instructed by the same instructor (experienced pedodontist) in the Department of Pediatric Dentistry of Zahedan Dental School. Recruitment was done in September 2013 at the start of academic semester. Both phases were performed in a period of two consecutive weeks. The examiner was blind to the type of educational method delivered. To perform IANB using tactile method to locate the needle insertion point, the child was asked to open his or her mouth maximally.

The tip of the thumb was positioned on the coronoid notch, the middle finger rested on the posterior border of ramus, and with the bevel of needle parallel to the bone, the needle was inserted between the internal oblique ridge and the pterygomandibular raphe. The syringe barrel relied on lower primary molars on the opposite side of the mouth and directed parallel to the occlusal plane. A small amount of anesthetic solution was injected before advancement deeper into tissue. Then, the needle was advanced until bone contact was sensed. The needle was slightly withdrawn, aspiration was performed, and the solution was slowly injected (Fig. 2). In order to

Fig. 2: Performing IANB using tactile method to find needle insertion point

Fig. 3: Pterygomandibular triangle: the visible lower tip was considered as the correct point of needle insertion

perform local anesthesia using visual method to determine the point of needle insertion, the child was requested to open his/her mouth as much as possible.

The needle was inserted at the tip of the pterygomandibular triangle and the procedure was continued as described above (Fig.3). After using topical gel (TOPEX, Sultan Healthcare IND. Co., Hackensack, USA), 2% lidocaine with 1/80000 epinephrine solution (Persocaine-E, Darou Pakhsh Ind. Co., Tehran, Iran) was injected using 35mm, 27-guage needle (C-KJECT, CK Dental Ind. Co., Bucheon, Korea) with an Anthogyr syringe (Sterilife, Anthogyre Co., Sallanches, France).

The children who received the IANBs were seven to nine years old, in need of dental treatment in the mandible, in groups III and IV of Frankel's classification during pretreatment behavioral assessment [8], physically and mentally healthy, with no history of previous dental treatment, no emergency or dental pain and without any known allergy to anesthetic solution. Also, IANB recipients had sufficient teeth to determine the occlusal plane and clearly visible pterygomandibular triangle landmark. Afterward, 5^{th} and 6^{th} year dental students performed dental treatments for children.

Statistical Analysis

Student's preference score was determined by calculating the mean of scores assigned to items. The data were analyzed using SPSS 19 software (SPSS Inc., Chicago, IL, USA) at P=0.05 level of significance. Independent samples t-test and chi-square test were used to confirm that the groups were matched in terms of age and sex distribution, respectively.

The preference of students based on their sex regarding the two methods of needle insertion was compared by the Mann-Whitney U test. Wilcoxon Singed Rank test was also used to compare the preference of students with regard to needle insertion point determination after delivering the two methods of IANB in the same population.

RESULTS

Of the 42 individuals enrolled, a total of 38 students participated in the survey and filled out the questionnaires (76 questionnaires). The mean age of the participants was 23.33±0.82 years (23.31±0.59 years in group I and 23.16±0.60 years in group II). The sample comprised of 18 (47.37%) females and 20 (52.63%) males; 36.84% (n=7) of the participants in group I and 57.89% (n=11) of the participants in group II

Table 1: The frequency and percentage (values in parentheses) of dental students' responses to each item

	Items*	1	2	3	4	5
Tactile Method	1- I felt comfortable and in control while performing anesthesia.	0 (0.0)	0 (0.0)	0 (0.0)	28 (73.68)	10 (26.32)
	2- My hand did not shake.	0 (0.0)	2 (5.26)	2 (5.26)	20 (52.63)	14 (36.85)
	3- It was easy to find the insertion point.	0 (0.0)	2 (5.26)	8 (21.05)	12 (31.58)	16 (42.11)
	4- I felt bone contact with the mandibular ramus.	0 (0.0)	0 (0.0)	0 (0.0)	34 (89.47)	4 (10.53)
	5- I do not think that I will need supervision next time.	0 (0.0)	0 (0.0)	4 (10.53)	16 (42.11)	18 (47.36)
Visual Method	1- I felt comfortable and in control while performing anesthesia.	0 (0.0)	0 (0.0)	0 (0.0)	18 (47.37)	20 (52.63)
	2- My hand did not shake.	0 (0.0)	0 (0.0)	4 (10.53)	10 (26.31)	24 (63.16)
	3- It was easy to determine the insertion point.	0 (0.0)	2 (5.26)	0 (0.0)	14 (36.85)	22 (57.89)
	4- I felt bone contact with the mandibular ramus.	0 (0.0)	0 (0.0)	0 (0.0)	22 (57.89)	16 (42.11)
	5- I do not think that I will need supervision next time.	0 (0.0)	0 (0.0)	2 (5.26)	14 (36.85)	22 (57.89)

* Item responses were assessed using a five-point Likert scale (1=Totally disagree, 2=Disagree, 3=No opinion, 4=Agree, 5=Totally agree).

were females. In terms of age and sex, no significant difference was observed in the two groups. The frequency of students' responses to the items of self-assessed questionnaire is presented in Table 1. As shown in Table 1, none of the respondents totally disagreed with any item. Also, in both methods, during IANB injections, the frequency of agree/ totally agree responses were the highest.

The mean scores of the respondents on the five items, overall preference, and the preference of males and females regarding the applied method are displayed in Table 2. Despite the higher mean scores of all items in favor of visual method, comparison of the mean scores of self-reported responses to each item in the two methods revealed no significant difference except for the statement "I felt bone contact with the mandibular ramus (P=0.036)".

Totally, all dental students rated their preference to be greater than 2.5 (score 2.5 indicated no opinion). The range of preference score was 3.8-4.6 in tactile method and 3.6-5 in visual method. However, for local anesthesia injection using the visual method of needle insertion point determination, students gained a significantly higher mean overall preference score (P= 0.020). Statistical analysis did not show any significant difference in preference of females (P=0.582); however, there was a significant difference in the preference of males (P=0.008). Additionally, regarding the visual method, males showed a greater preference score than females (P=0.036); but, regarding the tactile method, there was no significant difference between males and females (P=0.218).

DISCUSSION

Local anesthesia administration is among the basic skills to learn in dentistry [2, 12]. In clinical instruction, dental students practice local anesthesia injections on humans, commonly a peer student. However, it is an educational rite of passage in dentistry, as advocated by many authors [1,11,13]; this mode of instruction is not practical to prepare students for treatment of pediatric patients. Moreover, delivery of injection especially in children gives learners a sense of insufficiency and causes some distress in them [3,14]. Therefore, additional critical skills such as behavioral approaches and identification of anatomic landmarks are required

Table 2: Dental students' preference about the two methods of needle insertion point determination

	Items	Preference		P-value
		Tactile Mean (SD)	Visual Mean (SD)	
1	I felt comfortable and in control while performing IANB.	4.27 (0.45)	4.53 (0.52)	0.119
2	My hand did not shake.	4.21 (0.79)	4.53 (0.70)	0.143
3	It was easy to locate the insertion point.	4.10 (0.94)	4.47 (077)	0.205
4	I felt bone contact with the mandibular ramus.	4.10 (0.31)	4.42 (0.51)	0.036*
5	I do not think that I will need supervision next time.	4.37 (0.68)	4.53 (0.61)	0.466
Overall preference		4.20 (0.23)	4.43 (0.37)	0.020*
Preference of females		4.26 (0.25)	4.27 (0.34)	0.582
Preference of males		4.17 (0.22)	4.65 (0.32)	0.008*
P for preference based on sex		0.218	0.036*	

*P<0.05

to facilitate learning of anesthesia injection in children [1,11].

In other words, one fundamental component of anesthesia teaching is to facilitate learning, which has often been overlooked [12,15]. The instructors should pay more attention to this issue. The current method of instruction of IANB to dental students is to find the needle insertion point [8,9]. But to the best of authors' knowledge, in practice, a consensus has not been reached on the method of instructing dental students to easily find the needle insertion point. Several studies have been conducted to assess the efficacy of anesthesia teaching modalities [3,6,14,16-18]. The results of the current study revealed a significant difference in the overall preference regarding the two methods in favor of visual method. It is quite interesting that only male respondents had a significantly higher preference in favor of visual identification of needle insertion site. Although the findings did not reveal the visual method to be superior to the tactile method in females, the authors believe that visual method is valuable in learning injection skills.

In the visual method, a simple instruction to find the correct site of injection by using pterygo-mandibular triangle landmark was used. The data revealed that this landmark, as an indicator of proper site of injection, would make it easier to deliver an IANB. This is in accordance with the statement that easy methods of instruction are preferred to teach practical skills [19]. The authors argue that simplified instruction enhances professional confidence, motivation and finally preference as perceived by students. The higher preference score means more relaxed administration of anesthesia and higher precision and concentration.

This sense of control itself leads to better performance during dental treatment. Identification and use of anatomic landmarks is important in proper local anesthesia administration and has been proposed as a method to promote clinical aspects of anesthesia instruction to undergraduate students [1,3,14]. One study on human cadavers also emphasized the role of landmark recognition [20]. In a previous study [14] on the effects of a preclinical model on local anesthesia instruction, anatomical limitations of pterygo-mandibular landmark recognition in models previously used in other studies [3,17] were resolved with special attention to a realistic representation of landmarks. In the mentioned study conducted by Said Yekta et al, [14] 85% of trainees performed the mandibular block anesthesia properly and competently by using this landmark on a preclinical training model.

Empirically, it could be also interpreted from a cognitive aspect of learning as discussed by Hossaini [1] and Marei and Al-Jandan [18]. It means that during block injection practice, learners focus more on the technical domains rather than to be engaged with their previous knowledge. Moreover, they need to rely less on issues such as behavioral management and simultaneously appreciate comfort, competence and satisfaction. Finally, through this cognitive enhancement, the learners can overcome their learning problems.

Anesthetic injections in children are challenging for some general practitioners and are concerning for some parents. Interestingly, when the injection is performed by the use of visual method to find the pterygomandibular triangle tip as the site of needle insertion, parents witness the skills of the practitioner and better trust in his/her expertise. It hence creates a relaxing environment for the parents. On the other hand, anesthesia administration as recommended in text books by using the tactile sense [8,9] to find the needle insertion point has minimal risks [1] but the authors believe that the learners' decision to use the visual method can result in better control during the injection and may lead to less unexpected events. However, undetectable pterygomandibular triangle landmark may discourage some practitioners to use this method. Nevertheless, tip of this landmark remains an essential marker to guide correct insertion of the needle.

Although a shift to "totally agree" with all items was observed in the visual method, this shift was statistically significant only for the statement 4 "I felt bone contact with the mandibular ramus." Of course, it is somewhat unexpected that the respondents overwhelmingly rated themselves as "totally agree" with the statement 4 when administering anesthesia by the visual method in comparison to tactile method. The difference between this statement and others may be attributed to the nature of question. Students expressed that they better felt bone contact in the visual method, which verifies and confirms the correct site of injection; thus, this method may be preferred for instruction of IANB injection.

In relation to gender, during administration of IANB injection by visual method, it was seen that the preference score was greater among males than females, which may be due to the fact that males are more convinced by the new clinical skills trainings compared to females. Although both male and female students were unexperienced, females are more interested in using the classic tactile method to determine the needle insertion point and may have some difficulties in adapting to new approaches. This argument also explains lack of a significant difference between males and females in tactile method. This study also had some limitations. Its first limitation was its small sample size, which may be responsible for not finding a significant difference between the two methods in four out of five items. Also, limited number of participants raises a concern that the findings may not be generalizable. Although there was no way around this, by evaluating each learner in both phases this limitation was resolved to some extent. One limitation of this study design was that the students who delivered anesthesia earlier could share their opinions with peers. Thus, the preference of some respondents might have been influenced by fellows as well. However, the duration of study was two weeks. Therefore, the likelihood of this confounding factor seems to be minimized. Analysis of the methodology also showed strengths that must be taken into account. In the dental curriculum applied in Zahedan Dental School, students perform their first injection on children in their fourth academic year. Presence of only fourth year unexperienced students that could serve as controls against the confounding effect of previous experience, was a strength of this study. In fact, preference was almost due to their personal experience. Keeping this in mind, upper grade students might already

have some experience about block injection before the study. Moreover, to eliminate the effect of sequence of instruction of methods on the preference score, participants were divided into two groups with different sequence of instruction of methods. Also all participants only had to watch the live demonstration once and were allowed to perform an IANB after that.

The same instructor supervised the students during their practice. It played an important role in preventing distress and maintaining a stress-free environment for learners. Additionally, the students were ensured about the confidentiality of their answers. Large-scale multicenter studies pertaining to injection training outcomes are recommended to obtain more specific findings on this topic.

Although this study was conducted to answer a specific research question of student preference, the question of superiority cannot be answered since, apart from the standpoint of clinical skills instruction, further researches regarding the effect of this instruction on pain of children and also success of IANB are warranted.

CONCLUSION

Although the present study had some limitations, students' self-assessment was noteworthy. According to the students' ratings, they preferred the visual method to locate the site of needle insertion. The data also suggest that instructors need to emphasize on locating the pterygomandibular triangle tip in the visual method as the indicator of accurate site of needle insertion.

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