

Effects of a Training Needle on Dental Hygiene Student Anxiety

Diana Aboytes, RDH, MS; Christina Calleros, RDH, MS

Abstract

Purpose: The purpose of this pilot study was to assess whether practicing with a cotton-tipped applicator as compared to a new training device had an effect on the anxiety levels of dental hygiene students prior to administering and receiving their first intraoral injection for local anesthesia.

Methods: This pilot study used a convenience sample of senior dental hygiene students from an entry-level Bachelor degree dental hygiene program. Participants completed a pre-test survey after watching a video demonstrating the inferior alveolar nerve block (IANB) injection technique to determine anxiety levels regarding administering and receiving an intraoral injection. Test and control groups were randomly assigned; and participants either received a dental syringe with an attached training needle device (test) or a cotton tip applicator (control). Both groups completed a post-test survey following a 15 minute practice session. Descriptive statistics were performed and Chi-square tests were used to determine significance.

Results: Pre-test results showed that 91% of the participants (n=23) reported having anxiety regarding administering or receiving an intraoral injection in one or multiple areas. Chi-square tests determined no statistical significance ($p = 0.125$) between the test and control groups in the post-test surveys.

Conclusion: Dental hygiene students demonstrated decreased anxiety levels regarding administering and receiving an intraoral injection regardless of the assigned practice device in this pilot study. While use of a training needle was not shown to be superior at reducing anxiety in novice student operators when compared to a cotton tipped applicator, it may be a useful device for teaching local anesthesia administration techniques.

Keywords: clinical education, dental hygiene students, local anesthesia, training devices

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Introduction

The ability to effectively administer local anesthesia is an essential clinical skill required for pain management in dentistry. Extensive knowledge of head and neck anatomy including muscles, nerves, arteries and veins is required for developing this skill. Dentists and dental hygienists complete head and neck anatomy education during prerequisite coursework in addition to dedicated courses in the dental education curriculum.^{1,2}

Anxiety is defined as a painful or overwhelming sense of apprehension and uneasiness of mind usually over an impending or anticipated event.³ It has been noted extensively in the literature that both administering and receiving local anesthetic injections are sources of anxiety for dental students^{4,5}, and can be attributed to a multitude of factors. In the pre-clinical training sessions, the administration of local anesthesia is introduced using a student-to-student

model.^{1,4} Students as well as educators have reported mixed feelings regarding the ethical use of student peers as training models in addition to promoting anxiety among students.^{5,6}

A possible source for this anxiety may be the student's heightened awareness of potential complications.⁶ While administration of local anesthesia has a history of being safe and effective, it is not completely risk free.^{1,6-8} Inability to see internal structures and the close proximity of critical nerves and blood vessels add to the legitimacy of anxiety experienced by those administering and receiving intraoral injections.⁶ Complications associated with intraoral injections range from minor, such as soreness at the site of needle penetration, trismus, and hematomas; to more serious risks such as permanent paresthesia, and ophthalmic developments such as esotropia and diplopia.⁷⁻¹⁰

Research has shown that anxiety can also negatively impact academic performance.^{11,12} Administration of local anesthesia for pain control in patient care is a critical component of both dental and dental hygiene curricula. Anxiety reduction measures may have a positive impact on student performance and require further exploration.

A newly patented training needle device (Safe-D-Needle;™ Brentwood, TN) is currently available for use by dental and dental hygiene educators.¹³ This modified dental needle replicates a standard dental anesthetic needle but has a smooth spherical ball at the tip. This ball encapsulates the tip and bevel of the needle, allowing for non-invasive safe practice. Among the claimed benefits of this device is decreased student anxiety during the learning process for the administration of a local anesthetic.¹³

The purpose of this pilot study was to assess whether practicing with a cotton-tipped applicator as compared to a new training device had an effect dental hygiene students' anxiety levels prior to administering and receiving their first intraoral injection for local anesthesia.

Methods

Study and approval was granted by the University of New Mexico's Human Research Protection Office (HRPO). A randomized descriptive design utilizing a convenience sample was used for this pilot study. Upon completion of the didactic portion of a local anesthesia course, senior dental hygiene students (n=24) from the baccalaureate degree dental hygiene program at the University of New Mexico were recruited to participate. Exclusion criteria was failing to pass the didactic portion of the course. All students successfully passed the didactic portion and were eligible to enroll in the

voluntary study. There was no penalty for non-participation however, incentive to participate was offered in the form of extra credit. Informed consent was obtained by all participants and they were assigned a study number for comparison of the pre- and post-test survey results. All participants began the study by watching a 9-minute instructional video on the inferior alveolar nerve block (IANB) injection.¹⁴ The video demonstrated proper technique, including fulcrum establishment, correct site of penetration and proper angulation. Following the video, participants completed the anonymous pre-test survey consisting of six questions; responses were limited to yes or no. Survey questions were adopted and modified from three published research studies regarding student perceptions of local anesthesia.^{2,6,15} Participants were asked questions regarding didactic course preparation and anxiety associated with administering or receiving intraoral local anesthesia injections. Anxiety in response to possible adverse outcomes was also explored.

Participants were randomly assigned to either the control group or the test group. The control group was given a cotton-tipped applicator to practice the technique for the administration of the IANB. A cotton tip applicator was chosen as students are encouraged to use an applicator to visualize and rehearse injections prior to using a dental anesthetic syringe and needle.^{7,16} The test group was given a standard dental syringe with the training needle attached and asked to practice the same IANB technique (Figure 1). No further instruction was given after students were assigned to their respective groups. Both groups practiced with the assigned device for fifteen minutes. At the conclusion of the 15-minute practice session, participants completed a post-test survey assessing their anxiety levels associated with administering or receiving local anesthesia injections as well as regarding possible adverse outcomes. Survey results were exported to Microsoft Excel and descriptive statistics were analyzed for all questions.

Figure 1. Syringe with Training Needle and Cotton Tip Applicator



Figure 2. Pre-test Anxiety Responses in Combined Test and Control Groups (n-23)

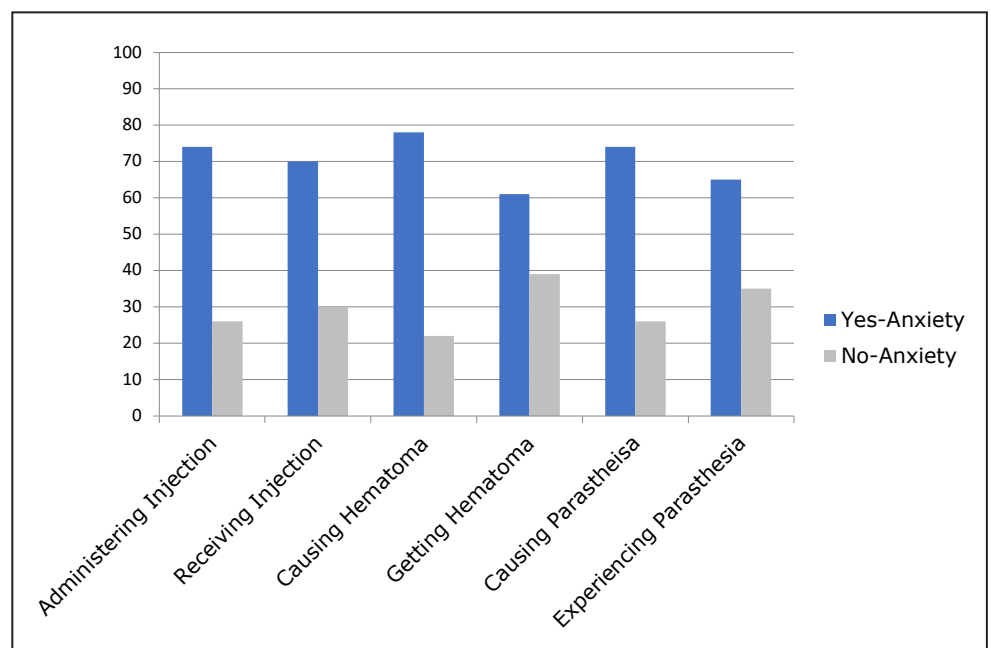
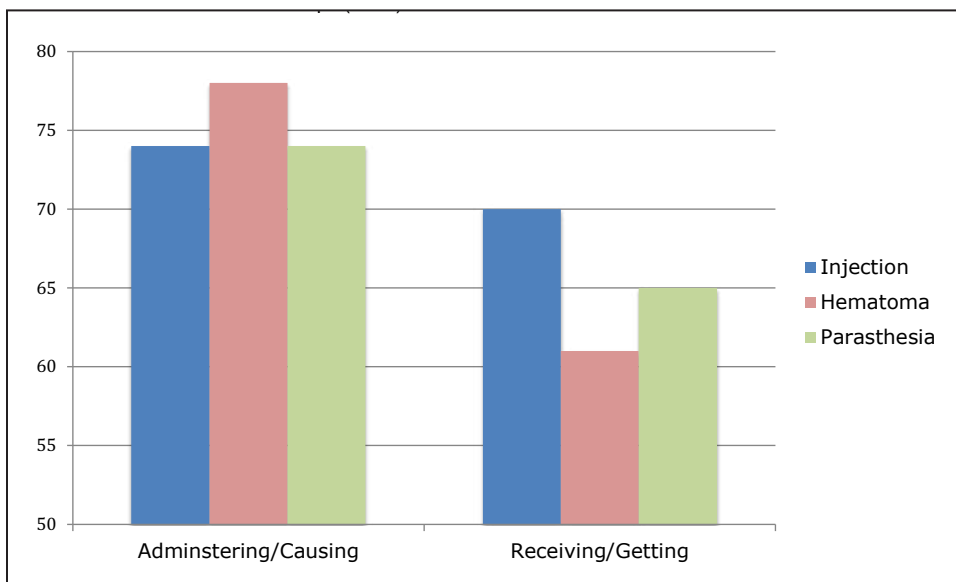


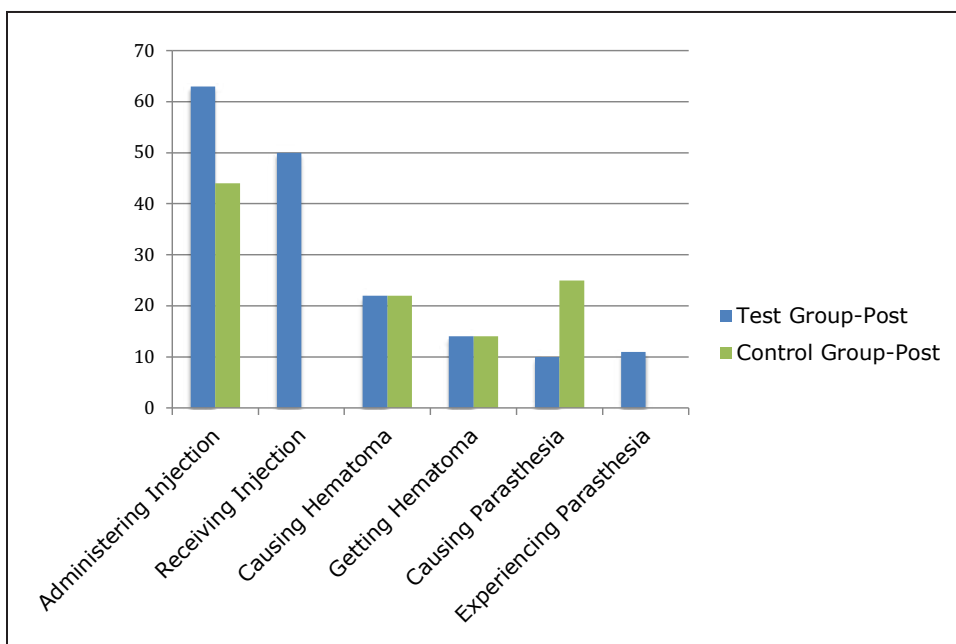
Figure 3. Pre-test Complication Concerns” Administration versus Receiving Combined Test and Control Groups (n=23)



didactic portion of the course. Subjects in both groups reported anxiety to both giving (74%) and receiving (70%) a local anesthesia injection. The majority of subjects also indicated they had anxiety about causing and receiving a hematoma and parasthesia. Combined control and test group responses to the pre-test are shown in Figure 2.

Pre-test responses from all participants indicated more anxiety regarding administering the injection versus being the recipient of the injection. Other identified areas of anxiety were causing a hematoma (78%) or causing parasthesia (78%). Trends in the differences in anxiety between causing a complication versus receiving one are illustrated in Figure 3.

Figure 4. Post-test Reductions in Anxiety



Pre-test and post-test questions were evaluated individually. When comparing pre- and post-test responses of participants indicating anxiety, the test group yielded a 63% decrease in anxiety toward administering anesthesia and a 50% decrease about receiving anesthesia from a classmate. Decreases in the test group were also reported in regards to both causing (22%) and receiving a hematoma (14%). Slight decreases were observed and in the test group in regards to causing or experiencing parasthesia.

Results of the control group yielded similar results. The control group produced a 44% decrease in anxiety about administering their first injection, but no decrease in anxiety was acknowledged regarding receiving an injection. Equal results between the groups were reported in regards to both causing and receiving a hematoma. No decreases were seen in anxiety in relationship to experiencing parasthesia; and a negligible decrease was reported regarding causing parasthesia. Anxiety levels in the post-test groups are shown in Figure 4.

Chi-square tests using a Yates correction were used to compare pre- and post-test results in addition comparing differences between the test and control groups.

Results

Twenty-three subjects (n=23) participated in the study. Participant demographics were 22 female students and 1 male; ranging in age from 21 to 49 years with a median age of 27.3 years. Following randomization, the test group consisted of 12 participants and 11 in the control group.

Pre-test descriptive statistics revealed that all participants (n=23) prepared to begin the clinical aspect of the course following the

Chi-square tests were used to evaluate changes in anxiety among the test and control groups. No statistical significance was

found between the groups for any question except for “anxiety receiving your first local anesthesia injection.” ($p = 0.036$). Because the small sample size could produce an approximation error, Yates Chi-squared correction for continuity was used resulting in p -value of 0.125, not statistically significant. The Chi square analysis with Yates correction for continuity is shown in Table I.

Discussion

Anxiety can manifest itself physically resulting in a variety of signs and symptoms including dizziness, alterations in visual acuity and tremors or shaking of the extremities.¹⁷ These particular physical effects can alter a student’s ability to safely administer an intraoral local anaesthetic.^{11,12} For example, an unsteady hand or changes in visual acuity increase the possibility of inadvertent contact with other extraoral and intraoral structures contaminating the needle prior to penetration and/or resulting in soft tissue injury to non-target tissues.

Cognitive interference brought about by anxiety may result in missed steps or incorrect verbalization of the administration technique to instructors or clinical examiners.¹¹ The ability to verbalize the key steps in the administration process are critical to student performance and patient safety. For example, failure to properly aspirate may result in deposition of local anesthetic solution into the vascular system.

Decreased student anxiety levels can potentially benefit all individuals involved in the education and administration of local anesthesia. Lowering anxiety levels may help to counteract the physical manifestations of anxiousness by allowing for a steady hand, ensuring visual clarity and improving overall injection techniques; which can ultimately lead to improved academic performance. Improvements in overall performance outcomes may contribute to alleviating general concerns regarding the student-to-student teaching model.

In this pilot study, participants demonstrated decreased anxiety regarding administering intraoral local anesthesia injections which could ultimately contribute to improved academic performance. Producers of a training needle advocate that use of this device can decrease operator anxiety and provide unlimited practice opportunities, that contribute to enhanced competency and increased patient safety.¹³ While there were no statistically significant differences in decreased anxiety between the test and control groups (training needle and cotton-tipped applicator); the use of some type of practice device can be beneficial in teaching the administration of local anesthesia.

Research with medical students has shown that how a student practices is just as valuable as the amount of time spent practicing.¹⁸ Deliberate practice, a theory on skill acquisition and the attainment of expertise, is designed to maximize improvement and performance.¹⁸ Essential aspects of deliberate practice states that focused, well defined tasks, coupled with repetitive practice, motivation, self-reflection, and feedback yields a level of expertise.¹⁸ Students are taught to properly hold the dental syringe, establish a stable fulcrum, recognize the correct bevel orientation of the needle and identify the point of penetration. Performing these tasks with a training needle device attached directly to the dental syringe provides type of realistically focused, safe approach of deliberate practice. The attributes of the training device’s ball encapsulate needle, allows learners to practice techniques without the risk of inadvertently harming the patient and the novice clinician gains the opportunity to practice needle recapping techniques without the risk of injury.

A limitation of the study was the small sample size of 23 students. Therefore, the pilot study results cannot be generalized to all dental hygiene student populations learning to administer local anesthesia. Another limitation was that nearly all the subjects

Table I. Post-test Changes in Anxiety Levels Chi-squared analysis with Yates correction

Question	Chi Square	Degrees of freedom	p value	Yates Chi-square	Yates p value
Do you have anxiety about <i>administering</i> your first local anesthesia injection?	0.554	1	0.4566	.066	0.798
Do you have anxiety about <i>receiving</i> your first local anesthesia injection?	4.364	1	0.0367	2.347	.0125
Do you have anxiety about <i>causing</i> a hematoma?	0.000	1	1.000	0.032	0.571
Do you have anxiety about <i>getting</i> a hematoma?	0.000	1	1.000	0.583	0.445
Do you have anxiety about <i>causing</i> paresthesia?	0.562	1	0.454	0.013	0.909
Do you have anxiety about <i>getting</i> paresthesia?	0.714	1	0.398	0.045	0.832

were female. Research has shown differences in the attitudes of men versus women regarding the administering and receiving of local anesthesia, with female students reporting more anxiety than their male counterparts.¹⁹ In addition, the survey questions were not validated prior to the study and participants could only self-report the mere presence or absence of anxiety and not describe the exact level of severity. At the time of this study, there were no reports in the literature for the use of the training needle. Future research should be performed on this device and the learning needs of dental hygiene for the administration of intraoral injections for local anesthesia.

Conclusion

Dental hygiene students demonstrated decreased anxiety levels regarding administering and receiving an intraoral injection regardless of the assigned practice device in this pilot study. While use of a training needle was not shown to be superior at reducing anxiety in novice student operators when compared to a cotton tipped applicator, it may be a useful device for teaching local anesthesia administration techniques. Anxiety continues to remain a challenge for learning local anesthesia administration skills. Further research is needed to evaluate effective ways to decrease anxiety associated with this skill.

Diana Aboytes, RDH, MS is an assistant professor; **Christina Calleros, RDH, MS** is an assistant professor; both are in the Department of Dental Medicine, University of New Mexico, Albuquerque, NM.

Corresponding author: Diana Aboytes, RDH, MS; DAboytes@salud.unm.edu

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