Preliminary Evidence Supports Modification of Retraction Technique to Prevent Needlestick Injuries

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A modified retraction technique was introduced into the DDS degree preclinical anesthesia course in 2011 with the goal of reducing needlestick exposure incidents. In numerous studies of dental exposures, injuries from dental anesthetic needles account for the highest proportion of all exposures. The purpose of this study was to assess the preliminary impact of a modified retraction technique on the incidence of blood and body fluids (BBF) exposure incidents associated with needles during injection. Data from evaluations of students from 2014 and 2015 were obtained and tracked to determine whether the modified retraction technique was “excellent,” “clinically acceptable,” or “clinically unacceptable.” Data were collected to determine if the patient perceived the modified retraction technique as “comfortable” or “correctable when addressed” to help improve student technique for future injections. Likewise, data from the blood-borne exposure database where all information related to BBF exposures is recorded were reviewed and the information separated by year and class. This study presents preliminary data only and because of the small sample size does not lend itself to validation by statistical analysis. However, the technique effectively removes the operator’s hand from the field during injection, reducing the risk of accidental intraoral needlestick to the nondominant hand of the operator.

Key Words: Dental anesthesia; Health care quality improvement; Dental injection technique.

Occupational exposures to patients’ blood and body fluids (BBF) are well documented in dentistry.^{1–4} Types of BBF exposures include splashes to the mucous membranes of the eyes, nose, and mouth; percutaneous injuries; and contact of the nonintact skin of the dental health care professional.^{4–7} In numerous studies of dental exposures, sticks with dental anesthetic needles account for the highest proportion of all types of exposures.^{2,4–12} More specifically, the hand retract-

ing mucosa is the most likely hand to endure the injury.^{13–15} Traditionally, the scientific literature describes the use of the finger of the nondominant hand to retract the mucosa and reveal the injection site during delivery of a dental injection.^{15–20} At the authors’ institution, needlesticks accounted for 37% of all exposure incidents over a 10-year period. A modified retraction technique was introduced into the preclinical anesthesia course in 2011 with the goal to reduce needlestick exposure incidents.

The purpose of this study is to assess the preliminary impact of a modified retraction technique on the incidence of BBF exposure incidents associated with needles during injection.

Received November 5, 2015; accepted for publication February 8, 2016.

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Anesth Prog 63:192–196 2016

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ISSN 0003-3006/16
SSDI 0003-3006(16)

METHODS

The retrieval of data received institutional review board exemption 10-41.5 from the institutional committee review board. Within the local anesthesia curriculum, dental students learn basic and advanced dental injection technique over the course of a 3-year curriculum. These injections include, but are not limited to, infiltrations, posterior superior alveolar block, inferior alveolar nerve block, anterior superior alveolar block, and Gow-Gates. Dental students are given over 15 hours of course curriculum dedicated to learning basic techniques and fundamentals of local anesthesia. During the initial anesthesia rotation dental students participate in hands-on learning. While participating in hands-on learning, students are instructed in the safety standards regarding assembly and disassembly of a dental syringe and proper disposal of syringe needles and anesthetic cartridges. Emphasis on the 1-handed uncapping and recapping techniques and use of the needle cap holder in clinical cassettes began in the early 2000s.

Modified retraction was implemented as part of the hands-on portion of the course beginning in 2011. In the modified technique, the students are instructed to palpate with their fingers, both intraorally and extraorally. In addition, they visually identify landmarks and the injection site on their patient first. Students then remove their hand from the mouth, retract the tissue using a mouth mirror, and proceed with delivery of the dental injection (Figure 1). Two of the criteria that contribute to the overall course grade established in 2014 are the evaluation from supervising instructors regarding successful application of the technique and the comfort of the patient during retraction of the buccal mucosa with a mouth mirror. In previous years, criteria were evaluated but not descriptively identified in the assessment forms tracked for this study. Therefore, we do not have relevant data from 2011 to 2013.

Students can receive an evaluation of “excellent” if they provide appropriate retraction during delivery of anesthesia or “clinically acceptable” if behaviors are easily correctable, such as impinging on tissue or retraction that is too lightly applied. A “clinically unacceptable” evaluation is given if the injection is painful to the patient, the student’s hand is unstable, the syringe handling is unsafe, or there is risk of injury to the student or patient.

Data from patient evaluations were also reviewed to identify whether the modified retraction technique was perceived as comfortable. Gaining the perspective of the patient identified any nuances to help improve the student’s technique upon patient comfort during future delivery of anesthesia. Patients are asked to provide feedback regarding the retraction method and can

Figure 1. Delivery of mandibular block injection using modified retraction technique.

choose from perceptions of the retraction as “comfortable,” “correctable when addressed,” or also “painful and concerned that provider is not providing safe technique.” An example of “correctable when addressed” refers to the angulation or placement of the mirror used by the provider prior to the injection.

Likewise, data from the blood-borne exposure database where all information related to BBF exposures are recorded were reviewed and the information separated by year and class. Intraoral needlestick injury is identified if the reported injury occurred inside the patient’s mouth. Furthermore, the description can include using finger to retract while delivering local anesthesia. Extraoral needlestick injuries can occur during assembly or breakdown of anesthetic syringe. Also, uncapping and recapping can be classified into this category. For each class year, the number of total needlesticks and the number of intraoral versus extraoral needlesticks were separated. This was done to determine if the modified retraction technique resulted in a reduction in intraoral needlesticks during anesthetic delivery.

RESULTS

Anesthesia technique of 163 students was evaluated during the anesthesia hands-on course in 2014. Of the 316 injections evaluated, 286 were said to be “excellent,” 29 were “clinically acceptable,” and 1 was “clinically unacceptable.” Upon receiving injections using the mirror retraction technique, 296 patients rated the retraction “comfortable” and 20 stated “correctable when addressed.” There were no evaluations by patients stating that the mirror retraction was perceived as “painful” or resulted in “concern for safety.”

Anesthesia technique of 140 students was evaluated during the hands-on course in 2015. Of the 280

Table 1. Results of the Evaluations Identified During the Modified Injection Technique

Year	Total Injections	Excellent	Clinically Acceptable	Unacceptable
2014	316	286	29	1
2015	280	231	49	0

injections evaluated, 231 were said to be “excellent” and 49 were “clinically acceptable.” Upon receiving injections using the mirror retraction technique, 263 patients rated the retraction “comfortable” and 17 stated “correctable when addressed.” There were no evaluations by patients stating that the mirror retraction was perceived as “painful” or resulted in “concern for safety” (Tables 1 and 2).

Prior to the introduction of the modified retraction technique, blood-borne exposure reports indicate 6 intraoral needlesticks from 2008 to 2009, 9 intraoral needlesticks from 2009 to 2010, and 13 combined in 2010 and 2011 (5 intraoral and 8 extraoral needlesticks; Figure 2). Data from the blood-borne exposure reports indicate 20 needlesticks were reported in 2011–2012. Out of those reported, 15 were found to be extraoral and 5 were intraoral. The following year 15 needlesticks were reported, 6 that were extraoral and 9 that were intraoral. From 2013 to 2014, 12 needlesticks were reported, all occurring outside of the mouth (Figure 3). This was the first year in which no intraoral needlesticks were reported since the institution began collecting needlestick reports in the late 1980s.

DISCUSSION

In evaluation results from 2014, where students used the modified technique, 91% of students were identified as providing “excellent” or appropriate retraction, and 9% were deemed “clinically acceptable.” According to the patient’s perception, 94% rated the retraction technique as “comfortable” and 6% of patients indicated the technique was “correctable when addressed.”

In evaluation results from 2015, where students used the modified technique, 83% were identified as providing “excellent” or appropriate retraction technique and 17% were evaluated as “clinically acceptable.” The patients’

Table 2. Results of the Patient Questionnaire Regarding Acceptability of the Modified Injection Technique

Year	Total Injections	Comfortable	Correctable When Addressed
2014	316	296	20
2015	280	263	17

Figure 2. Number of intraoral and extraoral needlesticks for the 3 years prior to the introduction of the modified retraction technique for injections.

perception remained favorable, as 94% of patients responded as receiving “comfortable” retraction and 6% stated “correctable when addressed.”

None of the injections provided were perceived by patients as “painful and a safety concern.” The single student evaluated as clinically unacceptable was perceived by the patient to be “correctable when addressed.”

A review of the institution’s blood-borne exposure reports revealed a reduction of intraoral needlesticks, which appears to correlate with the modified retraction technique. The authors believe further study is needed to confirm this correlation. Needlesticks are rare events in oral health care.^{21,22} As such, statistical models to confirm direct relationship between modified technique and reduction of intraoral needlesticks are not possible with the small numbers in this study.

Using a modified retraction technique “comfortably and appropriately” on patients, while also reducing the risk of needlestick exposures, advances injury prevention for DCHPs without compromising patient care. Clinical

Figure 3. Total intraoral and extraoral needlesticks for the 3 consecutive years during which the modified technique was introduced.

injuries to dental students are reported mostly from needlesticks, and risks associated with injury from a needlestick due to traditional retraction methods using a finger have raised concern.^{23–26}

Reports in the scientific literature support the need for change. These studies have illustrated the significant consequences of needlesticks, including physical injury, need for postexposure prophylaxis, and the high cost of postexposure management.^{27,28} The lack of currently available engineered safety devices creates a compelling argument to evaluate safer work practices.²⁹ New equipment, technologies, and techniques should continue to be explored and, where effective, implemented.^{30–34} Although the use of finger retraction may allow for a better feel of anatomical landmarks, the preliminary preparation learned prior to delivery of anesthesia helps to identify the appropriate injection site for the dental health care professional. Introducing an easily learned modified technique allows dental health care professionals to reduce their risk of experiencing an intraoral needlestick.^{15,30,35,36} Although more data are needed, this technique may improve injection safety. The authors are currently collecting and analyzing additional data to determine if there is a decrease in efficacy of mandibular block injections using this modified retraction technique.

CONCLUSION

This study presents preliminary data only and because of the small sample size does not lend itself to validation by statistical analysis. However, the technique effectively removes the operator's hand from the field during injection, reducing the risk of accidental intraoral needlestick to the nondominant hand of the operator.

REFERENCES

- Leggat P, Ureporn K, Smith DR. Occupational health problems in modern dentistry: a review. *Ind Health*. 2007;45:611–621.
- Askarian M, Malekmaka L. The prevalence of needle stick injuries in medical, dental, nursing and midwifery students at the university teaching hospitals of Shiraz, Iran. *Indian J Med Sci*. 2006;60:227–232.
- Kotze MJ, Labuschagne W. A method of determining the presence of blood in and on a dental needle after the administration of local anesthetic. *J Am Dent Assoc*. 2014;145:557–562.
- Szymańska J. Occupational hazards of dentistry. *Ann Agric Environ Med*. 1999;6:13–19.
- Leggat P, Smith D. Prevalence of percutaneous exposure incidents amongst dentists in Queensland. *Aust Dent J*. 2006;51:158–161.
- Alamgir H, Cvitkovich Y, Astrakianakis G, Yu S, Yassi A. Needlestick and other potential blood and body fluid exposures among health care workers in British Columbia, Canada. *Am J Infect Control*. 2008;36:12–21.
- Molinari J. Infection control: its evolution to the current standard precautions. *J Am Dent Assoc*. 2003;134:569–574.
- Chang HS, Su CY, Yen AMF, Huang CF. Factors affecting occupational exposure to needlestick and sharps injuries among dentists in Taiwan: a nationwide survey. *PLoS One*. 2012;7:1–7.
- Gatto MRA, Bandini L, Montevocchi M, Checchi L. Occupational exposure to blood and body fluids in a department of oral sciences: results of a thirteen-year surveillance study. *Sci World J*. 2013;2013:1–7.
- Hughes A, Davies L, Hale R, Gallagher JE. Adverse incidents resulting in exposure to body fluids at a UK dental teaching hospital over a 6-year period. *Infect Drug Resist*. 2012;5:155–161.
- Younai F, Murphy D, Kotelchuck D. Occupational exposures to blood in a dental teaching environment: results of a ten-year surveillance study. *J Dent Educ*. 2001;65:436–448.
- Di Bari V, De Carli G, Puro V, Preclinica R. Occupational exposure to blood and body fluid in a department of oral sciences: how to improve safety in dental care workers. *ScientificWorldJournal*. 2014;2014:906585.
- Makary M, Al-Attar A, Holzmüller C, et al. Needlestick injuries among surgeons in training. *N Engl J Med*. 2007;356:2693–2699.
- Elliott S, Keeton A, Holt A. Medical students' knowledge of sharps injuries. *J Hosp Infect*. 2005;60:374–377.
- David H, Aminzadeh K, Kae A, Radomsky S. Instrument retraction to avoid needle-stick injuries during intraoral local anesthesia. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2007;103:e11–e13.
- Malamed SF. *Handbook of Local Anesthesia*. St Louis, Mo: Elsevier Health Sciences; 2014.
- Gaum LI, Moon AC. The “ART” mandibular nerve block: a new approach to accomplishing regional anesthesia. *J Can Dent Assoc*. 1997;63:454–459.
- Monheim L, Bennett C. *Monheim's Local Anesthesia and Pain Control in Dental Practice*. St Louis, Mo: CV Mosby; 1984.
- Cook-Waite Laboratories. *Manual of Local Anesthesia in General Dentistry*. New York, NY: Cook-Waite Laboratories; 1947.
- Meechan JG, Wilson NHF. *Practical Dental Local Anaesthesia*. London, England: Quintessence; 2002.
- Centers for Disease Control and Prevention. Update: human immunodeficiency virus infections in health-care workers exposed to blood of infected patients. *MMWR Morb Mortal Wkly Rep*. 1987;36:285–289.
- Pugliese G, Germanson T, Bartley J, et al. Evaluating sharps safety devices meeting OSHA's intent. *Infect Control*. 2001;22:456–458.
- Callan R, Caughman F, Budd M. Injury reports in a dental school: a two-year overview. *J Dent Educ*. 2006;70:1089–1097.

24. Gaballah K, Warbuton D, Sihmbly K, Renton T. Needle stick injuries among dental students: risk factors and recommendations for prevention. *Libyan J Med*. 2012;7:1.
25. Cleveland J, Barker L, Cuny E, Panlilio A. Preventing percutaneous injuries among dental health care personnel. *J Am Dent Assoc*. 2007;138:169–178.
26. Kapoor V, Gambhir R, Singh S, et al. Knowledge, awareness and practice regarding needle stick injuries in dental profession in India: a systematic review. *Niger Med J*. 2013;54:365.
27. Wicker S, Rabenau H. Occupational exposures to bloodborne viruses among German dental professionals and students in a clinical setting. *Int Arch Occup Environ Health*. 2010;83:77–83.
28. Collins A, Cleveland J, Harte J, Eklund K, Malvitz D. Guidelines for infection control in dental health-care settings—2003. *MMWR Morb Mort Weekly Rep*. 2003;52:1–61.
29. Cuny E, Fredekind R, Budenz AR. Safety needles. New requirements of the Occupational Safety and Health Administration bloodborne pathogens rule. *J Calif Dent Assoc*. 1999;27:525–530.
30. McGowan P, Nasser N. A novel and safe technique for injections into the oral cavity. *J Oral Maxillofac Surg*. 2006;64:1463–1464.
31. Castella A, Vallino A, Argentero P, Zotti C. Preventability of percutaneous injuries in healthcare workers: a year-long survey in Italy. *J Hosp Infect*. 2003;55:290–294.
32. Saxena P, Gupta S, Newaskar V, Chandra A. Advances in dental local anesthesia techniques and devices: an update. *Natl J Maxillofac Surg*. 2013;4:19.
33. Nasehi A, Bhardwaj S, Kamath A, Gadicherla S, Pentapati K. Clinical pain evaluation with intraoral vibration device during local anesthetic injections. *J Clin Exp Dent*. 2015;7:e23.
34. San Chong B, Miller J, Sidhu S. Alternative local anaesthetic delivery systems, devices and aids designed to minimise painful injections—a review. *Endod Pract Today*. 2014;8:7–22.
35. Bali R, Ahluwalia R. Risk of blood borne viruses: clear and present danger. *Dent Pract*. 2011;10.
36. Meechan JG, Wilson NHF. Techniques in maxillary anesthesia. In: Meechan JG, Wilson NHF, eds. *Practical Dental Local Anaesthesia*. London, England: Quintessence; 2002:40–41.