

A simple technical innovation to prevent needle stick injuries among dental professionals

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Abstract. – OBJECTIVE: Dental healthcare personnel face the potential danger of being exposed to infectious patients while administering local anesthesia injections during dental operations. This could lead to unintentional transfer of infectious diseases from patients to physicians. Although safety measures such as the One-hand-scoop technique and the use of safety syringes, plastic needle cap holders, and needles with safety caps are in place, there have been instances of needle stick injuries reported in clinics. This might be due to the lack of adherence to conventional safety measures or the impracticality of safety techniques and safety syringes. This article aims to demonstrate the utilization of dental tweezers, specifically London College tweezers or dental forceps, for the secure recapping of needles, eliminating the requirement for extra equipment or devices.

SUBJECTS AND METHODS: After obtaining ethical approval (Approval No.: 024-01-2024) from the College of Dentistry, Dar Al Uloom University, 67 dental professionals, with consent for participation in the study, were included. They were requested to use dental tweezers/London College tweezers and dental extraction forceps such as maxillary anterior, mandibular anterior, and maxillary bayonet root forceps individually to recap

the local anesthetic needles. The efficacy of these techniques was evaluated against the one-hand scoop technique for its ease, convenience, and reliability in preventing needle stick injuries.

RESULTS: The evaluation of dental professionals regarding the ease of using dental tweezers to recap needles, compared to the one-hand scoop technique ($p=0.592$), maxillary bayonet root forceps ($p=0.746$), mandibular anterior forceps ($p=0.380$), and maxillary anterior forceps ($p=0.808$), did not yield statistically significant results. The assessment of the procedural simplicity of the one-hand scoop technique showed a satisfaction rate of over 40%, whereas the application of dental tweezers resulted in a satisfaction rate of 30%. However, the use of dental tweezers for needle recapping resulted in a satisfaction rate of over 50%, compared to a satisfaction rate of 30% for the one-handed scoop technique.

CONCLUSIONS: There is no statistically significant difference in the assessment of the efficacy of dental tweezers and the one-hand scoop technique, bayonet root forceps, mandibular anterior forceps, maxillary anterior forceps, and dental tweezers for the needle capping technique. Therefore, dental forceps can be used instead of the one-handed scoop approach. The needle recapping procedure outlined in our study, aimed

at preventing needle stick injuries, is simple to implement, and all dental specialties have convenient access to the required instruments.

Key Words:

Needle stick injuries, Sharps injuries, Dental forceps, Dental extraction, Safety needles, Syringes, Infectious diseases.

Introduction

Many dental specialties use needles for local anesthesia. Several issues can arise from needle stick injuries, one of which is the potential for the spread of blood-borne infections, including HIV, hepatitis B, or hepatitis C^{1,2}. It is uncommon for a needle stick injury to cause nerve damage. Dental professionals injured by needle sticks might experience psychological repercussions like concern, anxiety, and a fear of becoming hurt again. It is important to handle and dispose of needles correctly. Dental needles should be properly labeled and stored in a container that can withstand punctures after use. To avoid unintentional needle stick injuries, dentists should dress appropriately in protective gear such as gloves, gowns, and face shields. Dental professionals should be educated and trained in safe injection procedures, as well as how to handle and dispose of needles properly to prevent needle stick injuries. Any injuries caused by needle sticks should be reported right away to the relevant authorities. Ensuring that the impacted practitioner obtains the proper medical attention and follow-up might be facilitated by prompt reporting. It is recommended that dentists receive vaccinations against blood-borne illnesses such as hepatitis B³. Among the suggestions for preventing needle stick injuries include the use of safety devices such as retractable needles, safety syringes, and needleless systems. With a one-handed scoop approach, the needle is closed with the cap after the local anesthetic injection. The needle cap is stored on the operation tray. It is advised to recap used needles until the course of treatment is finished using plastic needle-cap holders⁴.

There have been several reports of needle stick injuries in the clinics despite the safety procedures in place. This may be explained by the inability to apply normal safety procedures or by the viability of using safety syringes and techniques. 79.5% of healthcare professionals who participated in a cross-sectional survey said they had experienced one or more needle stick injuries during their careers. Most of these wounds

(34%) happened during recapping. Needle stick injuries happened in 75 cases (29.3%) while the needle was being handled, in 54 (21.1%) due to collision with another person, and in 39 (15.2%) due to manipulation by the patient⁵. Most accidents happen during handling that takes place in the time between using the needle and discarding it, not during the use itself⁶. An interesting yet basic method was proposed to solve these issues. The purpose of this article is to demonstrate how to safely recap needles using dental forceps or dental tweezers, often known as London College tweezers, which are easily available chairside.

Subjects and Methods

The research was carried out in the Dentistry College of Dar Al Uloom University in Riyadh, Saudi Arabia, for a duration of 25 days. Each author in the study primarily participated in evaluating the instruments (as seen in Figure 1) for their ability to grasp local anesthetic needles. Following this, they collectively approved four instruments for use in needle capping procedures. Subsequently, 67 dental professionals (which includes dental interns and teaching faculty) who agreed to participate in the study were asked to use dental tweezers, specifically London college tweezers, as well as dental extraction forceps, including maxillary anterior, mandibular anterior, and maxillary bayonet root forceps, for the purpose of needle recapping procedures. The efficacy of these methods was assessed in comparison to a single-handed scoop technique in terms of ease, convenience, and reliability in preventing needle stick injuries.

Technique

1. With the right hand, grasp the needle cap with the dental tweezers or the tooth extraction forceps (Figures 2 a-c and 3).
2. With the left hand, hold the local anesthetic syringe and the needle.
3. Carefully slide the needle cap onto the needle and lock it securely.

Holding the forceps on the greatest diameter of the needle cap provides a firmer grip, as shown in Figure 2c. However, holding the forceps on any portion of the needle cap provides a grasp (Figure 2a-c). Following the local anesthetic injection technique, the needle can be removed from the syringe using the same forceps or dental tweezers as follows:

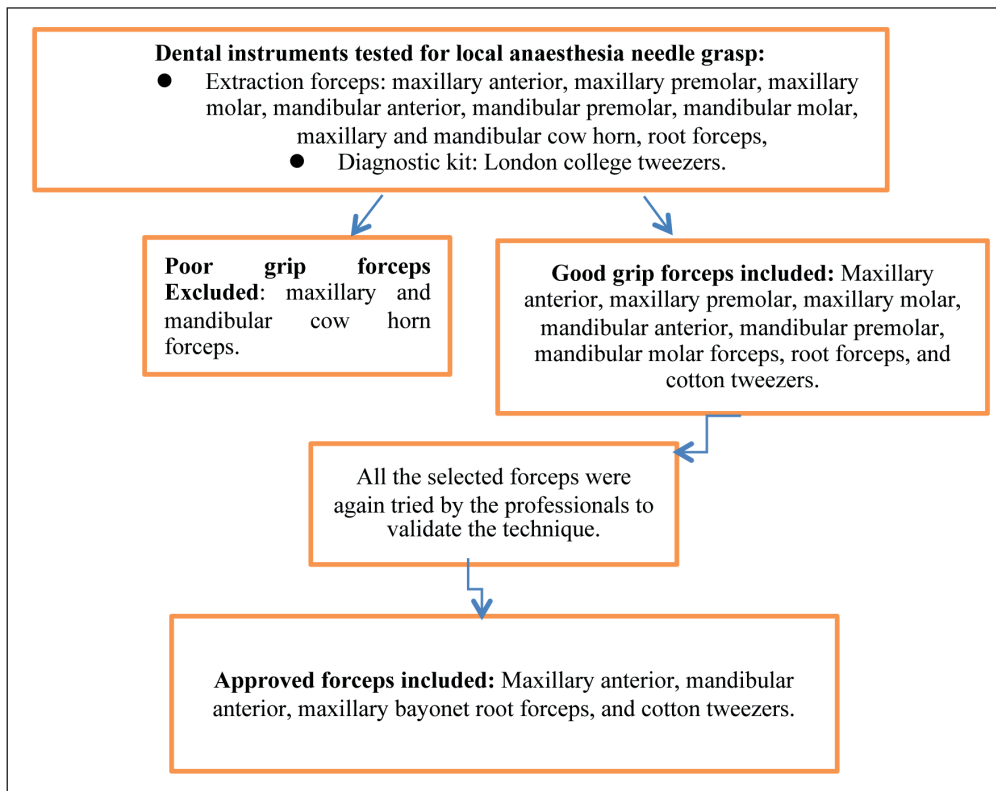


Figure 1. Flowchart to show the methodology design.

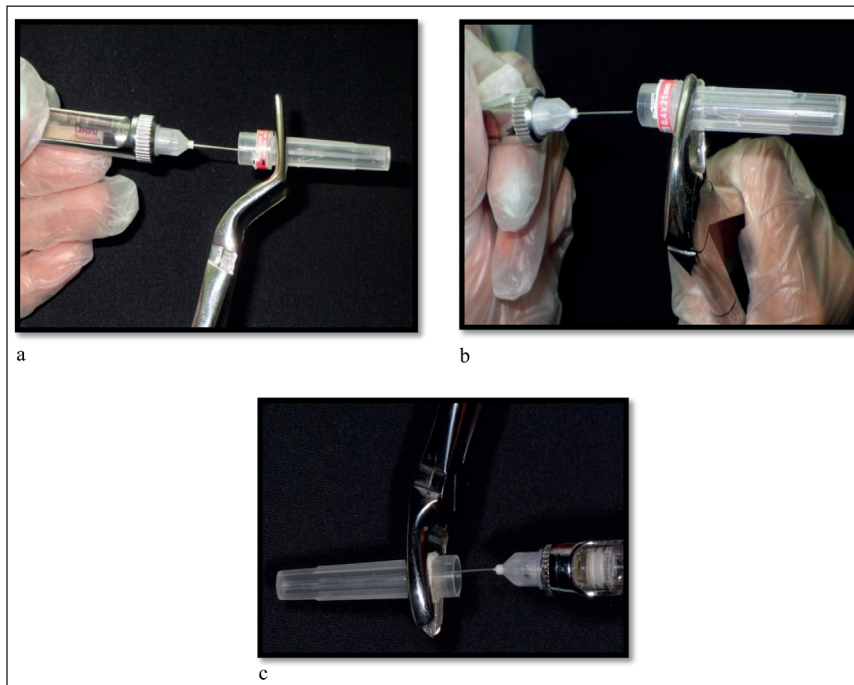


Figure 2. Demonstrates the use of various dental extraction forceps. **a.** Maxillary bayonet root forceps holding the needle cap, being advanced towards the needle for needle recapping procedure. The beak of the forceps is not on the greatest diameter of the needle cap. **b.** Mandibular anterior forceps holding the needle cap, being advanced towards the needle for needle recapping procedure. The beak of the forceps is not on the greatest diameter of the needle cap. **c.** Maxillary anterior forceps held on the greatest diameter of the needle cap while advancing towards the needle for closure.

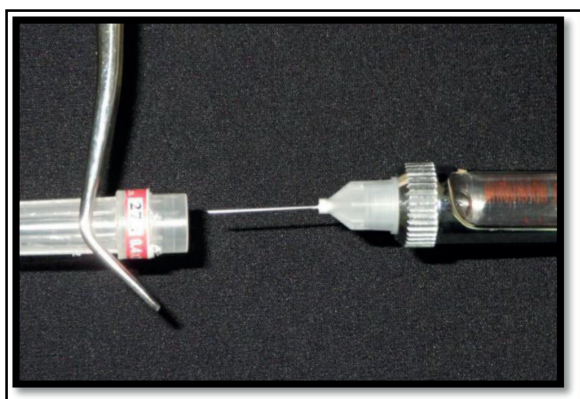


Figure 3. Demonstrating the use of dental tweezers to recap the needle. The beak of the forceps is not on the greatest diameter of the needle cap.

1. Holding the tooth extraction forceps in the right hand and the local anesthetic syringe with the capped needle in the left, rotate, remove, and discard the needle cap using the forceps/tweezers.

Statistical Analysis

Mean \pm SD and frequency (%) were used to express categorical variables, respectively. An independent *t*-test was employed to compare quantitative parameters between categories. To determine if categorical variables were related, the Fisher's exact test and the Chi-square test were employed. The groups' ordinal parameters were compared using the Mann-Whitney U test. The threshold for statistical significance was set at $p < 0.05$ for all statistical interpretations. The statistical software program SPSS version 20.0 (IBM Corp., Armonk, NY, USA) was used to carry out the analysis.

Results

The responses from the dental professionals regarding the maxillary bayonet root forceps ($p=0.746$), mandibular anterior forceps ($p=0.380$), maxillary anterior forceps ($p=0.808$), and the "easiness of procedure using dental tweezers in comparison with one-hand scoop technique" ($p=0.592$) failed to demonstrate statistical significance (Table I). An evaluation of the "ease of procedure for one-hand scoop technique" for needle recapping procedures revealed that, compared to the use of dental tweezers, 30% of respondents expressed extreme pleasure with the approach (Figure 4). On the other hand, more than 50% of respondents were satisfied with the "ease of procedure" for dental tweezers and maxillary anterior forceps, 30% with one-handed scoop techniques, and 40% with maxillary bayonet root forceps (Figure 4).

Dental professionals were evaluated regarding "prevention of needle stick injuries". The results showed that there was no statistically significant difference between the dental tweezers and one-hand scoop technique ($p=0.877$), maxillary bayonet root forceps ($p=0.483$), mandibular anterior forceps ($p=0.835$), and maxillary anterior forceps ($p=0.127$) (Table II). In Table III, the mean score for the statement "easy procedure" was 4.1 for both the one-hand scoop technique and the dental tweezers. The evaluation of dental professionals regarding prevention of needle stick injuries using dental tweezers in comparison with one-hand scoop technique ($p=0.889$), maxillary bayonet root forceps ($p=0.312$), mandibular anterior forceps ($p=0.485$), and maxillary anterior forceps ($p=0.657$) was not statistically significant. The mean score for the dental tweezers was 4.0, and the mean score for the one-hand scoop technique for the needle capping process was 4.1, making it "convenient to practice in all dental specialties". The dental tweezers received a mean score of 3.6 and the one-hand scoop technique, which "prevents needle stick injuries", received a mean score of 4.1 for the needle capping operation (Figure 5).

Discussion

Healthcare personnel still sustain hypodermic needle injuries despite safety precautions; 34% of these incidents are documented⁵⁻¹¹ to happen during needle recapping and during and after surgical procedures. A lot of training programs for preventing needle stick injuries stress that you can dispose of the needles and caps separately in the sharps' container after use and that recapping is not required. Dental professionals can lower the likelihood of needle stick injuries and shield themselves and their patients from any possible health

Table 1. Evaluation of dental professionals about easiness of procedure using the following 5 dental instruments for safe needle capping procedure.

Easy procedure	One hand scoop technique	Maxillary bayonet root forceps	Mandibular anterior forceps	Maxillary anterior forceps	Dental tweezer
Extremely dissatisfied	1 (1.5)	5 (7.5)	16 (23.9)	1 (1.5)	0 (0)
Dissatisfied	7 (10.4)	19 (28.4)	26 (38.8)	15 (22.4)	6 (9)
Neutral	7 (10.4)	7 (10.4)	14 (20.9)	4 (6)	4 (6)
Satisfied	23 (34.3)	27 (40.3)	10 (14.9)	35 (52.2)	36 (53.7)
Extremely satisfied	29 (43.3)	9 (13.4)	1 (1.5)	12 (17.9)	21 (31.3)
Mean ± SD	4.1 ± 1	3.2 ± 1.2	2.3 ± 1	3.6 ± 1.1	4.1 ± 0.9
Median	4.0	4.0	2.0	4.0	4.0

Dental tweezer vs. one-hand scoop technique; $Z\#=2.8, p=0.592$. Dental tweezer vs. maxillary bayonet root forceps; $Z\#=1.94, p=0.746$. Dental tweezer vs. mandibular anterior forceps; $Z\#=4.2, p=0.380$. Dental tweezer vs. maxillary anterior forceps; $Z\#=1.61, p=0.808$. #Mann-Whitney U test.

risks by taking precautionary steps. In hospitals, following safety procedures is vitally important. Illnesses as AIDS, hepatitis, and other infectious diseases could spread if these precautions are not taken. Healthcare institutions should not confuse a low reporting rate with a low injury rate, since needle stick injuries are usually underreported¹². The true rate of occupational injuries may be up to

ten times higher than what is reported by standard reporting systems¹³. An alarming lack of adherence to basic infection-control protocols involving the use of syringes, needles, multiple-dose vials, single-use vials, and flush solutions was discovered in a 2010 study¹⁴ on 5,446 healthcare professionals. Hospital employees who were registered nurses made up 89.5% of the survey participants.

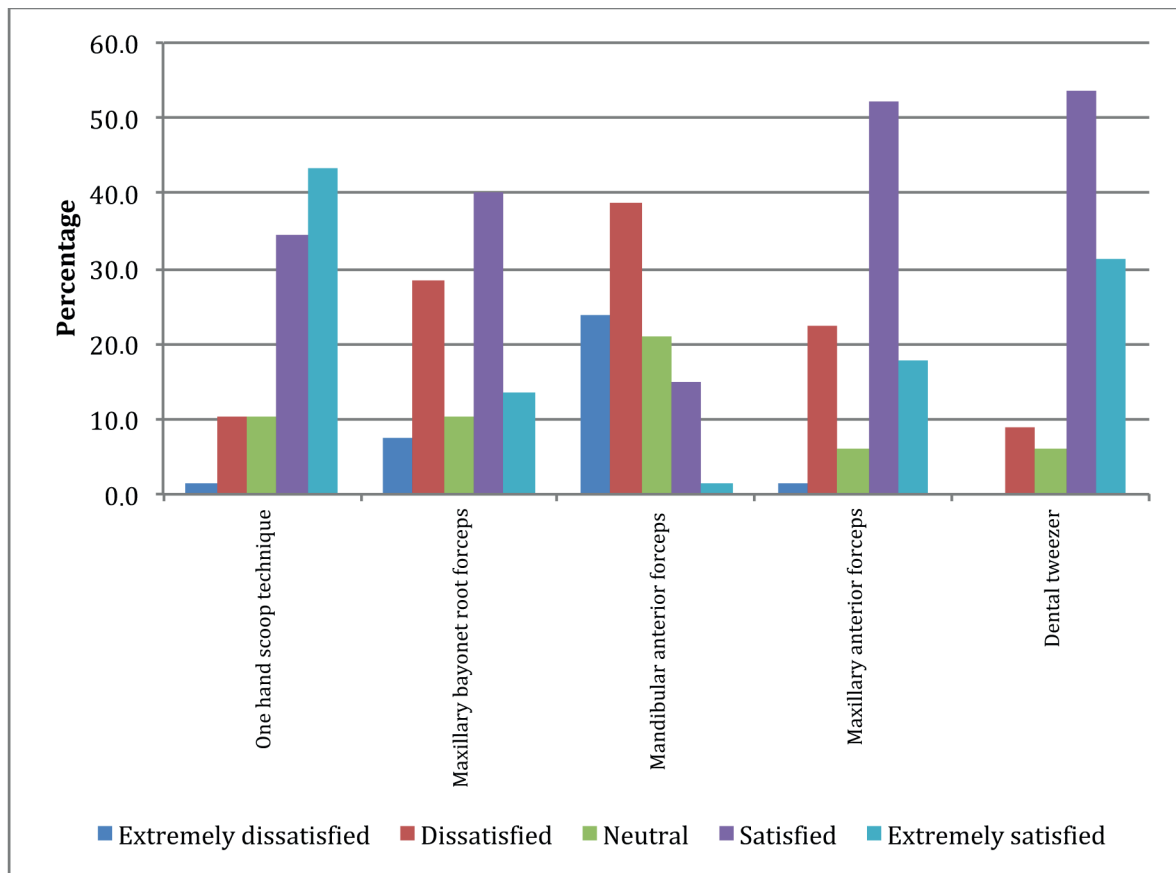


Figure 4. Evaluation of dental professionals about the easiness of the procedure.

Table II. Evaluation of dental professionals about prevention of needle stick injuries.

Easy procedure	One hand scoop technique	Maxillary bayonet root forceps	Mandibular anterior forceps	Maxillary anterior forceps	Dental tweezer
Extremely dissatisfied	1 (1.5)	5 (7.5)	6 (9)	5 (7.5)	5 (7.5)
Dissatisfied	7 (10.4)	9 (13.4)	9 (13.4)	5 (7.5)	5 (7.5)
Neutral	7 (10.4)	2 (3)	4 (6)	2 (3)	2 (3)
Satisfied	23 (34.3)	44 (65.7)	47 (70.1)	53 (79.1)	53 (79.1)
Extremely satisfied	29 (43.3)	7 (10.4)	1 (1.5)	2 (3)	2 (3)
Mean ± SD	4.1 ± 1	3.6 ± 1.1	3.4 ± 1	3.6 ± 1	3.6 ± 1
Median	4.0	4.0	4.0	4.0	4.0

Dental tweezer vs. one-hand scoop technique; Z#=1.21; p=0.877. Dental tweezer vs. maxillary bayonet root forceps; Z#=3.47, p=0.483. Dental tweezer vs. mandibular anterior forceps; Z#=1.45; p=0.835. Dental tweezer vs. maxillary anterior forceps; Z#=7.17, p=0.127. #Mann-Whitney U Test.

Table III. Evaluation of dental professionals for “convenient to practice in all dental specialities”.

Easy procedure	One hand scoop technique	Maxillary bayonet root forceps	Mandibular anterior forceps	Maxillary anterior forceps	Dental tweezer
Extremely dissatisfied	1 (1.5)	18 (26.9)	18 (26.9)	15 (22.4)	0 (0)
Dissatisfied	7 (10.4)	30 (44.8)	30 (44.8)	24 (35.8)	4 (6)
Neutral	7 (10.4)	10 (14.9)	10 (14.9)	8 (11.9)	10 (14.9)
Satisfied	23 (34.3)	9 (13.4)	9 (13.4)	20 (29.9)	33 (49.3)
Extremely satisfied	29 (43.3)	0 (0)	0 (0)	0 (0)	20 (29.9)
Mean ± SD	4.1 ± 1	2.1 ± 1	2.1 ± 1	2.5 ± 1.1	4 ± 0.8
Median	4.0	2.0	2.0	2.0	4.0

Dental tweezer vs. one-hand scoop technique; Z#=1.13, p=0.889. Dental tweezer vs. Maxillary bayonet root forceps; Z#=3.57, p=0.312. Dental tweezer vs. Mandibular anterior forceps; Z#=2.45, p=0.485. Dental tweezer vs. Maxillary anterior forceps; Z#=1.61, p=0.657. #Mann-Whitney U test.

In the US, there are between 600,000 and 800,000 needle stick injuries every year. Most of these, if not all of them, go unreported. In response to the exposure risk, institutions have placed a high priority on primary prevention to lower the frequency of needle sticks and, consequently, the number of blood-borne pathogen transmissions. There is a strict regimen that one should follow while suffering a needle stick injury. First and foremost, it is crucial to avoid being in a panic. Protocols have been devised with the goal of reducing the possibility of infection following exposure. Moreover, exposure is a crucial component that cannot be ignored. Furthermore, the subsequent actions can be put into practice.

- It is advised to immediately wash the area with soap and water.
- After the occurrence is documented, a form for an exposure report must be completed.
- The evaluation of exposure should consider multiple parameters, such as the characteristics of the fluid, the type of needle employed, and the amount of blood present on the needle, among other variables.
- It is essential to assess the exposure source:

- a. Status of HIV, HBV, and HCV in the patient.
- b. If the patient’s condition is uncertain, get their permission and test them for these illnesses.
- c. Evaluating the likelihood of infection by considering the chance of contracting a disease within the population that the hospital serves in cases where the patient is not able to undergo testing. It is essential to manage any positive exposure effectively¹⁵.

During the period of 2015-2018, a study¹⁶ was undertaken in India to examine incidences of needle stick injuries. Out of the 116 injuries observed, 55% of them employed hypodermic needles, which are specifically designed for subcutaneous or submucosal injections. Needle stick injuries were caused by Lancet and Suture needles, accounting for 10% and 8% of the injuries, respectively. Additional devices accounting for a lower percentage (27%) comprised an intravenous cannula, a surgical blade, an insulin pen, an eclipse needle, and an epidural needle, among others. The study¹⁶ found that 114 (54%) were caused by violations of hospital policies. The remaining portion comprised procedural incidents, accounting for 90

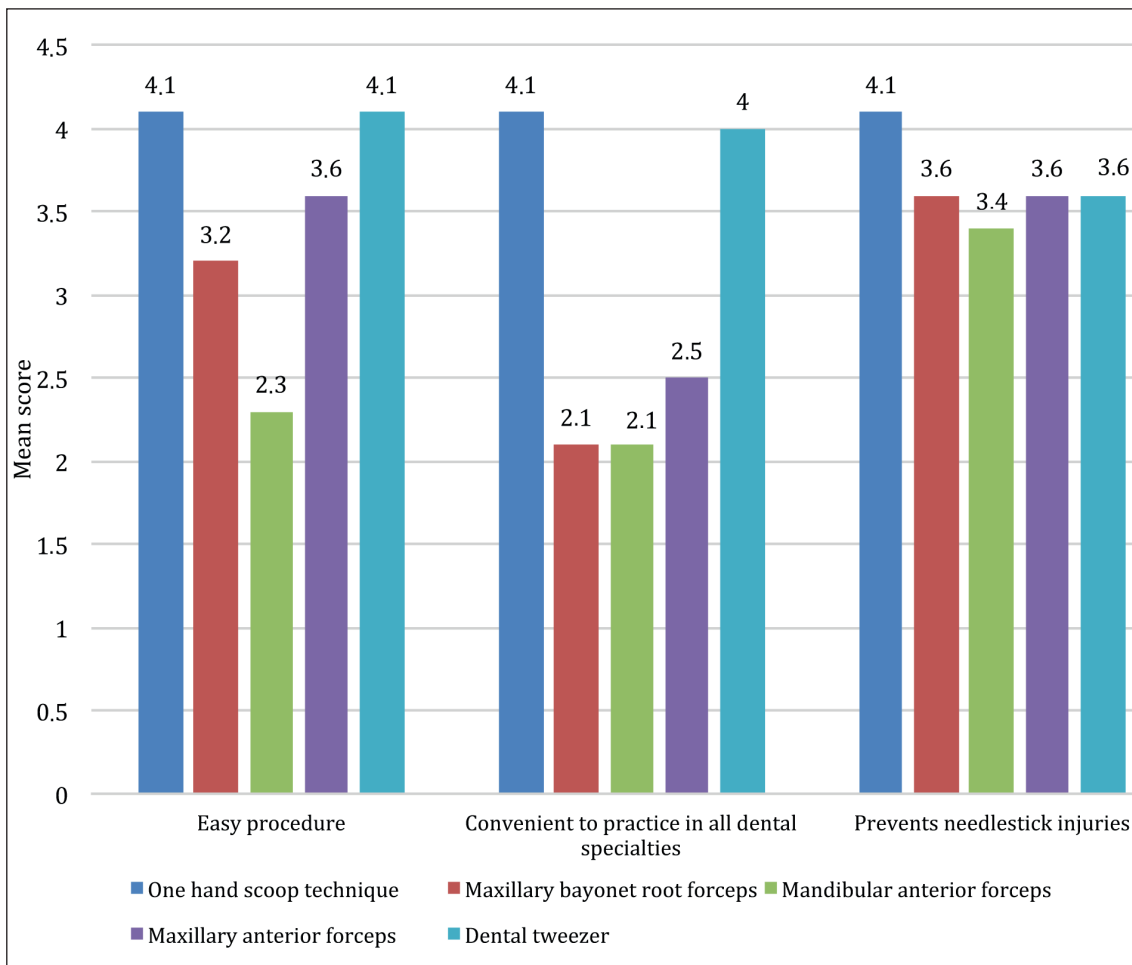


Figure 5. Evaluation of dental professionals on the use of different techniques for needle capping.

incidents or 43% of the total, and insufficient training, which accounted for 7.3%.

Our study found no significant variation in the effectiveness of different techniques, including the one-hand scoop approach, the use of bayonet root forceps, mandibular anterior forceps, maxillary anterior forceps, and dental tweezers, for needle capping (Table I). This can be due to the regular use of the one-hand scoop technique by dental experts. Nevertheless, the findings of this study indicate that dental tweezers are also favored by dental professionals from different dental specializations due to the straightforwardness of the procedure and its widespread accessibility (Figure 4).

Conclusions

Injuries from needle sticks are common in the healthcare sector. Thus, healthcare workers must have

a thorough awareness of the possible hazards related to exposure and receive the necessary instruction on how to react appropriately in such circumstances. The instruments needed for the needle recapping procedure are easily accessible to all dental specialties, and it is a simple procedure to use, as we have shown in our study, to prevent needle stick injuries.

Ethics Approval

Ethical approval (Approval No.: 024-01-2024) was obtained from the College of Dentistry, Dar Al Uloom University, Riyadh, Saudi Arabia.

Informed Consent

All professionals gave consent for participating in the study.

Authors' Contributions

The conception and design of the study: NT, MD, SA. Acquisition of data: NT, MD, AD.AQ, AM.

Analysis and interpretation of data: AK, NT, VCJ, SK, GF.
Drafting the article or revising it critically for important intellectual content: NT, MD, AK, FM.
Final approval of the version: NT, MD, VCJ, AK, AD, MN, MZ.

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Conflicts of Interest

The authors declare no conflict of interest.

Data Availability

Data are shown in the study. There are no additional data to share.

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