Original Article

Evaluation of General Dentists' Knowledge of Tooth Avulsion Management Based on the 2020 IADT Guidelines before and after an Educational Pamphlet Intervention

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KEY WORDS
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ABSTRACT

Background: Tooth avulsion, a traumatic dental injury, prevalent in children, causes tooth loss if mismanaged. Immediate proper treatment is crucial for tooth survival and preventing lifelong functional / esthetic complications.

Purpose: This study was conducted to evaluate the knowledge of general dentists and postgraduate students in Shiraz regarding tooth avulsion management based on the 2020 international association of dental traumatology (IADT) guidelines, and to assess the effectiveness of an educational pamphlet intervention.

Materials and Method: A descriptive-analytical interventional study was conducted on 243 participants (general dentists and postgraduate students) using a validated 12-item questionnaire. Knowledge was assessed at three time points: before intervention (T0), one-week post-intervention (T1), and three months post-intervention (T2). The educational intervention consisted of a pamphlet developed according to IADT 2020 guidelines. Data were analyzed using t-tests, ANOVA, chi-square tests, and subgroup analyses comparing general dentists and postgraduate students with SPSS v27, with significance set at $p<0.05$.

Results: Baseline knowledge (T0) averaged 6.42±1.96 (poor), improving significantly to 10.09±1.92 (good) at T1 (p Value< 0.001), then declining to 8.90±1.80 at T2 (p< 0.001vs T1). Postgraduate students scored higher than general dentists at T0 (p= 0.021), with pediatric postgraduate students outperforming other specialties. No significant associations were found with gender, work experience, or trauma exposure history. Critical gaps were identified: only 1.2% knew all recommended storage media at T0. Management of open-apex teeth showed particularly low awareness (9.9% correct at T0).

Conclusion: Educational pamphlets significantly improve short-term knowledge of avulsion management, but knowledge retention declines over time. This study underscores the importance of accessible, evidence-based educational materials in dental trauma management to maintain guideline adherence.

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Introduction

Traumatic dental injuries refer to damage to the tooth and the surrounding soft and hard tissues. These injuries may occur due to several factors, including sports activities, falls, facial impacts, and accidents [1-3].

Studies in different populations have reported various reasons for dental trauma. In Shiraz, the most common causes of dental trauma among patients who have

visited the trauma center of the Faculty of Dentistry are falls and traffic accidents [4].

Traumatic dental injuries include crown fractures, root fractures, crown-root fractures, tooth luxation and avulsion [5]. Tooth crown fractures followed by avulsion are the most common injuries in Shiraz [4].

Dental avulsion is defined as the complete displacement of the tooth from its alveolar socket, which, if not properly managed, can lead to cosmetic, economic and functional problems for patients and therefore affects their quality of life [5].

Avulsion accounts for approximately 0.5% to 16% of dental traumas and occurs more commonly in the anterior teeth of the maxilla [5]. The age group of 7 to 12 years shows the highest frequency of this injury, which frequently affects boys three times more than girls [4].

According to the 2020 international association of dental traumatology (IADT) guidelines, immediate replantation or placement in an evidence-based storage medium is essential for periodontal ligament (PDL) cell survival [6-7].

As a result, the prognosis of treatment in avulsion injury depends highly on proper management by the first people who encounter with the injured person [5]. These individuals include school and sports coaches, parents, and others who interact with children that can be the decision makers for treatment and consequently influence the overall prognosis [8-9].However, due to lack of knowledge or even self-confidence of managing these injuries, many people do not perform immediate replantation and instead refer the patient to the first available dental office [10].

Recently, a systematic and meta-analysis study concluded that the global awareness among general dentists and specialists about proper management of dental traumas is inadequate [8].

One of the reasons for this low awareness among general dentists is the lack of evidence-based information about the updated guidelines of the IADT [11]. Consequently, several studies have investigated various methods of educational interventions to increase the level of awareness regarding the management of dental traumas [11-12]. However, limited studies are available evaluating general dentists' knowledge in Shiraz and the impact of different educational methods on their awareness and information retention through time.

Considering the relatively high prevalence of avulsion in Shiraz and the absence of studies assessing the level of awareness of general dentists in this city so far, the primary goal of this study was to evaluate the level of knowledge of general dentists and dental postgraduate students of Shiraz regarding the management of avulsion. Additionally, this study investigated the progress of their level of awareness after providing them with an educational pamphlet and compared the retention of the acquired information in short-term and long-term.

Materials and Method

This descriptive-analytical interventional study was conducted over six months in 2024 among general dentists and dental postgraduate students in Shiraz. All stages of the study adhered to the 1964 *Helsinki declaration* and its later amendments or comparable ethical standards. This study was approved by the Ethical Committee of the Shiraz University of Medical Sciences (number= IR.SUMS.DENTAL.REC.1402.009). Ethical considerations were observed throughout the research process. Informed consent was obtained from all individual participants included in the study and their identity was kept confidential throughout the research process.

The target population consisted of general dentists practicing in private offices, public clinics, and institutional centers across Shiraz, as well as postgraduate dental students (year1-3) in endodontics, pediatric dentistry, oral and maxillofacial radiology, oral and maxillofacial surgery, and oral pathology. The sample size was determined 274 participants using Cochran's formula at the error level of alpha = 0.05 and a margin of error of d = 5%. A total of 274 individuals (201 general dentists and 73 postgraduate students) were invited using simple random sampling from the Medical Council registry list and participated in the initial phase of the study (T0). All participants completed the baseline knowledge assessment. However, 31 participants (22 general dentists, 9 postgraduate students) were subsequently excluded from final analysis due to either (1) failure to complete the follow-up questionnaires at T1 (one-week post-inter-vention) and/or T2 (three months post-intervention), or (2) providing incomplete responses in

any of the three assessment phases.

Therefore, the final analysis included complete data from 243 participants. This attrition rate (11.3%) was within acceptable limits for longitudinal educational interventions.

Data were collected using a questionnaire designed to assess the level of awareness based on the 2020 guidelines of IADT for the management of avulsion. Content validity was evaluated by a panel of 15 experts including faculty members in pediatric dentistry (n=5), endodontics (n=5) and oral and maxillofacial surgery (n=5). The Content Validity Ratio and Content Validity Index were calculated using two indices. The minimum value of Content Validity Ratio for acceptable content validity was achieved by this questionnaire with the score of 0.71. Using the Content Validity Index formula, a Content Validity Index of 0.92 was calculated.

Test-retest reliability was assessed in a subsample of 30 general dentists after a three weeks interval (r = 0.79), indicating acceptable stability.

One point was given for each correct answer and zero for each wrong answer. Considering that three options of the first question are correct, three points were assigned to this question. Therefore, the knowledge score ranged between zero and maximum 14, which was divided into three sections including poor (0-7), moderate (7<10) and good (10<14).

The educational intervention was a purpose-designed pamphlet (submitted as supplementary file) outlining the emergency management of tooth avulsion according to the IADT 2020 guideline. Questionnaires (submitted as supplementary file) were distributed among the study subjects, and in T0, educational intervention was done by an A5 bi-fold pamphlet. Then, in T1 and T2 the questionnaires were completed by the subjects.

Data were entered into the statistical software SPSS version27.0 (IBM Corp., Armonk, NY, USA) and analyzing using statistical tests. For data analysis, we employed statistical tests including descriptive statistical indices, Independent T-test, Paired T-test, ANOVA, Post-Hoc Friedman test, and Chi-square test. A $p < 0.05$ was considered statistically significant.

Results

Of the 274 general dentists and postgraduate students, 31 participants were excluded from the study due to incomplete responses to the questionnaires or failure to complete all three stages. A total of 243 participants completed the questionnaires, and the data obtained from the questionnaires were analyzed and the results are as follows.

The general knowledge score of general dentists in Shiraz was calculated as 6.42± (1.96) in T0, which is considered poor. This score increased significantly after the educational intervention in T1 and reached 10.09± (1.92) ($p< 0.001$). This score reached 8.90± (1.80) in T2, which is significantly higher compared to T0 ($p< 0.001$) and significantly lower compared to T1 ($p< 0.001$) (Figure 1).

At baseline (T0), the mean knowledge score of postgraduate students was significantly higher than the knowledge of general dentists ($p= 0.021$) (Figure 2).

Among the postgraduate students, the level of knowledge of the pediatric was higher than others, being significantly higher than endodontics ($p= 0.007$), radiology ($p= 0.005$), maxillofacial surgery ($p= 0.019$) and p-

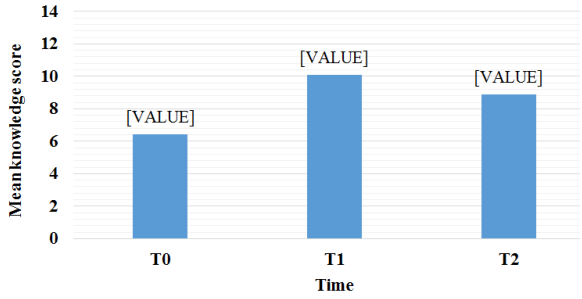

Figure 1: Knowledge level of participants in different time periods (baseline (T0), one-week post-intervention (T1) and three- month post-intervention (T2))

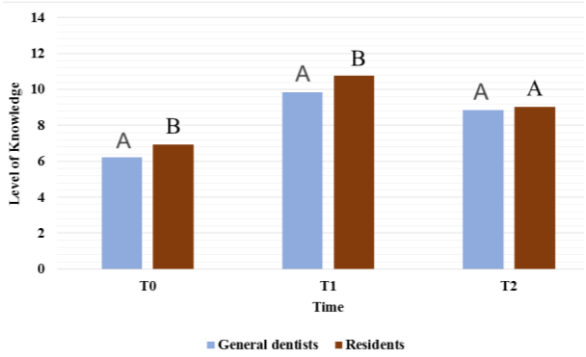

Figure 2: Comparison of knowledge level of dentists and postgraduate students in different time periods (baseline (T0), one-week post-intervention (T1) and three- month post-intervention (T2). Different capital letters above columns indicate significant differences between groups. Presenting common letters is a sign of o significant difference between groups)

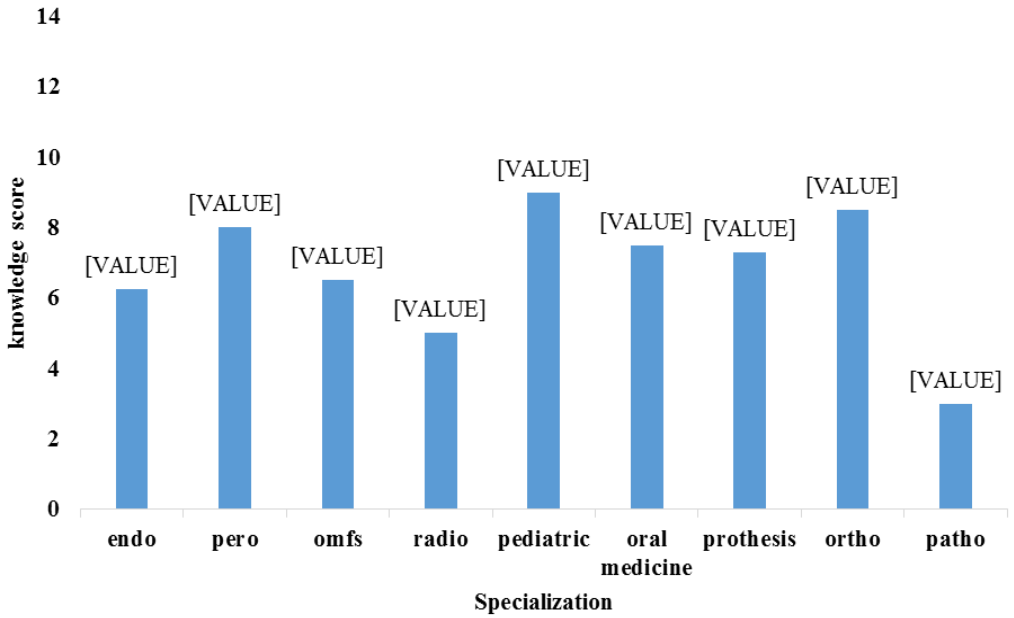

Figure 3: Comparison of knowledge level of different groups of postgraduate students in T0 (Different capital letters above columns indicate significant differences between groups. Presenting common letters is a sign of o significant difference between groups)

athology postgraduate students ($p< 0.001$) (Figure 3).

Furthermore, the level of knowledge was significantly higher in people who had read IADT guidelines ($p< 0.001$). Moreover, there was no significant relationship between the level of knowledge and sex, work experience and history of dental trauma exposure ($p< 0.05$).

Discussion

Avulsion is recognized as one of the most serious dental injuries, and its correct management as soon as possible has a significant impact on the treatment prognosis [5]. The primary aim of this study was to evaluate the knowledge of general dentists and postgraduate students in Shiraz regarding the 2020 IADT guidelines for avulsion management. The secondary aim was to assess the progress of their awareness level after providing them with an educational pamphlet in the short and long term. According to the results obtained from this study, the average knowledge score of general dentists in Shiraz city, before training, was generally weak and none of them had ideal knowledge. Notably before the intervention, 91.3% of the people stated that they needed training on avulsion trauma management. Additionally, only 44.4% believed that they were capable of managing avulsion injuries if encountered.

Consistent with our results, Abbasi *et al.* [13] reported that 67% of general dentists had an unacceptable knowledge score regarding avulsion management. Similarly, Araghizadeh *et al.* [14] found that the awareness level of 59.3% of the general dentists in Bandar Abbas city about the treatment of tooth avulsion was average. Also, in similar studies such as the study of Mazur *et al.* [15], Duruk *et al.* [16], and Abdullah *et al.* [17], general dentists' knowledge about avulsion trauma management was insufficient and there was a need to improve awareness. Variations in dentists' awareness scores in different studies may be due to difference in questionnaire content or baseline awareness levels (Questionnaire 1).

According to the results of this study, the average knowledge score in T1, increased significantly, which is in the range of good knowledge. The dentists' awareness score in T2 was still in the range of good awareness. However, the level of awareness in T2 compared to T1 has been significantly reduced. These results show the improvement of general dentists' knowledge regarding the management of avulsion trauma in T1 and T2 (Figure 4). It is generally accepted that after training, acquired information is forgotten over time. The results of surveys in the field of medical education indicate that approximately two-thirds to three-fourths of knowledge will be retained after one year [18].

Our results are consistent with the results of Al-Asfour *et al.* [19] and Ghaderi *et al.* [20]. In both of these studies, the parents' awareness regarding avulsion mana-

Questionnaire on Knowledge of Avulsed Tooth Management Based on the 2020 Guidelines of the Endodontic Association

Section 1 (Demographics):

1. Gender: Male ☐ Female ☐

2. Specialty (if you are a resident):

Endodontics ☐ Oral & Maxillofacial Surgery ☐ Pathology ☐ Pediatric Dentistry ☐
Restorative Dentistry ☐ Diagnosis ☐ Prosthodontics ☐ Orthodontics ☐

3. Clinical experience: 2 to 10 years ☐ over 10 years ☐

4. Received training on dental trauma in the past year: Yes ☐ No ☐

Training method: Online lecture ☐ In-person lecture ☐ Article/Pamphlet ☐ other ☐

5. Did you encounter patients with dental trauma in the past year: Yes ☐ No ☐

6. Did you review the Endodontic Association guidelines about dental trauma? Yes ☐ No ☐

If yes, what was the most recent guideline year?

Section 2 (knowledge of dentist):

1. **What is the suitable storage medium for an avulsed tooth if not replanted immediately?**

a) No special handling b) water c) brine d) Ice e) Coca cola
f) Milk g) Normal saline h) Patient's mouth/cheek i) Dry tissue/container
j) Plastic k) No special medium needed l) No idea

2. How do you clean a contaminated avulsed tooth?

a) Rinse under water (<10 seconds) b) No rinsing needed before replantation c) Soak in saline/milk
d) Scrub with brush/water e) Soak in Sodium Fluoride solution for 3 minutes f) No idea

3. What is the suitable splint duration for tooth if dry time was less than 60 minutes?

a) 10 -14 days b) 28 – 30 days c) 60 days d) No splinting needed e) No idea

4. What is the Follow-up duration for an avulsed tooth?

a) 2 week, 6 month, 1 year, annually b) 2 week, 1 months, 3 months, 6 months, 1 year, up to 5 years
c) Every 6 months to 36 months d) No follow-up needed e) No idea

5. What is the ideal time for tooth replantation after avulsion?

a) Immediately b) 30 Minutes after trauma c) One Hour after trauma d) Not a critical factor e) No idea

6. What is your first action if a patient presents with a self-replanted avulsed tooth?

a) Leave the tooth untouched, splint it, and initiate root canal therapy b) Reposition if misplaced (allowed within 48 hours post-trauma)
c) Reposition if misplaced only within the first 2 hours. d) No idea

7. What is the splinting conditions for an avulsed tooth with alveolar fracture?

a) Flexible splint- 2 weeks b) Rigid splint-2 weeks c) Flexible splint-4 weeks d) Rigid splint- 4 weeks
c) No splinting needed. e) No idea

8. What is the suitable antibiotic therapy post-avulsion?

a) Not required b) Doxycycline (topical on root) c) Oral tetracycline (first choice) d) Oral penicillin (first choice). e) No idea

9. What's the best time for root canal therapy for an immediately replanted tooth with closed apex?

a) Immediately after replantation b) 7-10 days later c) 2 week later (during splint removal) d) Only if symptoms appear.
e) A decision for root canal therapy is made if the tooth is not vital f) No idea

10. What is the suitable local anesthesia during avulsed tooth replantation?

a) local anesthesia with epinephrine b) local anesthesia without epinephrine c) Avoid anesthesia totally. d) No idea

11. What is your approach for replantation of child's avulsed tooth that refers to you?

a) Always replant the tooth b) Only for permanent teeth c) Time-dependent d) Refer to a specialist. e) No idea

12. What is your Management of an avulsed permanent tooth with open apex and dry time more than 60 minutes for replantation?

a) Soak in 2% sodium fluoride (20 minutes) b) Initiate extra oral RCT before replantation c) Splint for 4 weeks
d) Replant and monitor root apex development. e) No idea

Section 3 (Self-Assessment):

1. **Is your knowledge of avulsion management adequate?** Yes ☐ No ☐
2. **Can you confidently manage avulsion cases?** Yes ☐ No ☐
3. **Do you need further training?** Yes ☐ No ☐

Questionnaire 1: Questionnaire on Knowledge of Avulsed Tooth Management Based on the 2020 Guidelines of the Endodontic Association

gement significantly improved one week after reading an educational leaflet. In the study of Arikan *et al*. [21], similar results were obtained and the level of awareness of primary school teachers in Ankara about dental trauma increased significantly one month after intervention.

Additionally, in the study of McIntyre *et al*. [22] the awareness of elementary school teachers improved immediately and in long term. Similarly, Razeghi *et al*. [23] reported increased awareness among elementary school teachers in Arak at one and six months of follow-ups after the leaflet intervention.

The findings of this research show that there was a significant difference between general dentists and postgraduate students before training and at T0, and postgraduate students had higher knowledge than general dentists. Also, there was a significant difference in T0 between different groups of postgraduate students. Based on the obtained results, the highest knowledge was related to the pediatric group and the lowest knowledge was related to the pathology group.

The reason for the higher awareness of pediatric postgraduate students can be attributed to the more common dental traumas in children and more cases of dealing with trauma. Also, more comprehensive teaching of trauma management in the educational curriculum of pediatric dentistry is also effective. Probably the

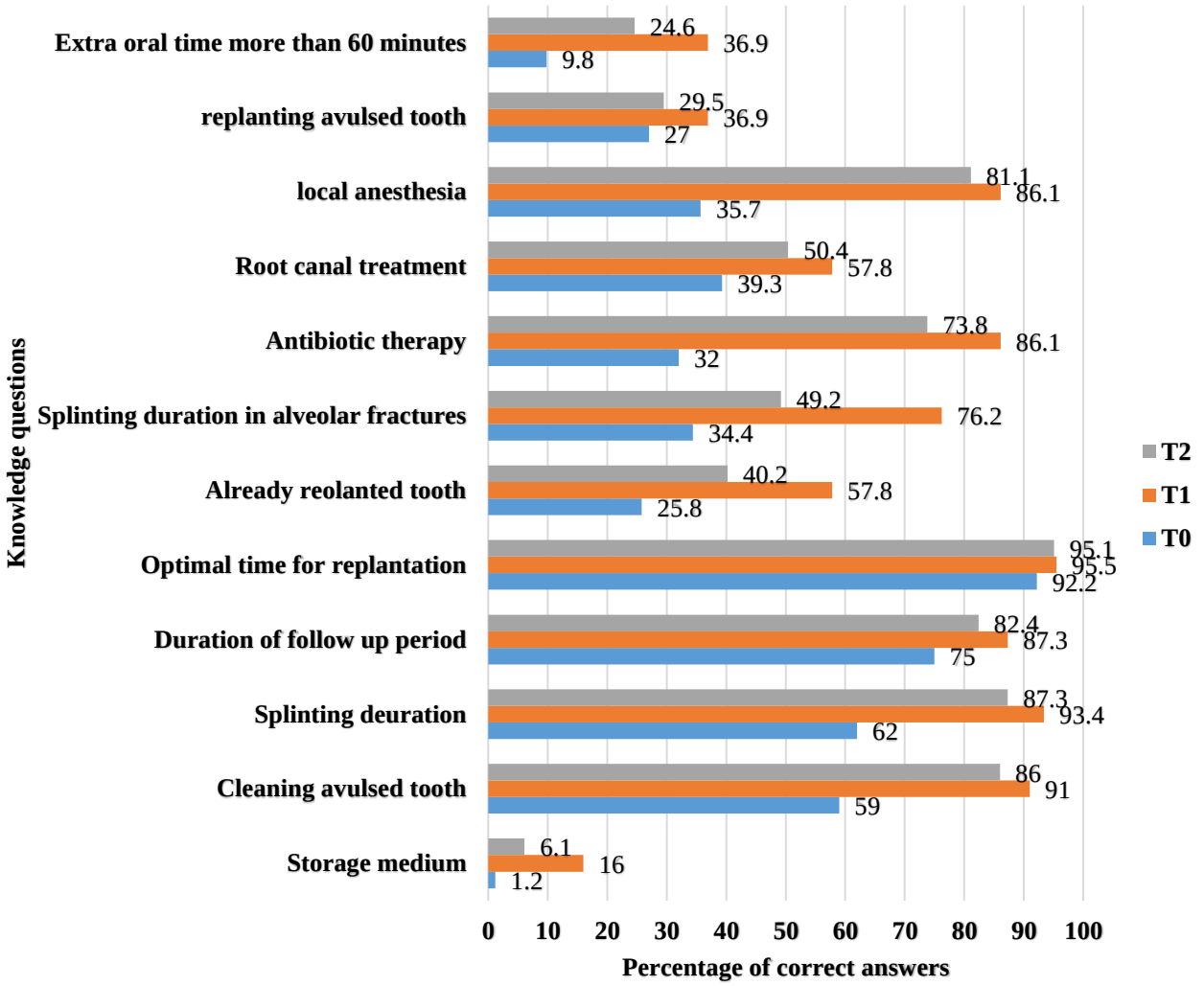

Figure 4: Comparison of knowledge level of 12 awareness question in different time periods, before intervention (T0), one-week post-intervention (T1), and three months post-intervention (T2)

reason for the lower level of knowledge of pathology postgraduate students is their lack of contact with dental trauma patients. According to the results obtained from the present study, there was no significant difference between men and women in terms of awareness. This finding is in agreement with several previous studies, including those by Mazur *et al.* [24], Duruk *et al.* [25], Abbasi *et al.* [26], and Araghizadeh *et al.* [27].

In our study, there was no significant difference between the knowledge of people with ten years of work experience and people with less than ten years of work experience at T0, but the knowledge of people with less than ten years of work experience was reported higher. These results were in agreement with the results of Araghizadeh *et al.'s* study [27]; however, it was in contrast the results of Mazur *et al.* [24], Duruk *et al.* [25] and Abbasi *et al.* [26].

Having a training experience in the last year in T0 did not have a significant effect on the level of knowledge of the participants. However, the level of awareness of the trained people was higher. Araghizadeh *et al.* [27] and Baginska *et al.* [28] also reported that having a training history after graduation did not affect the knowledge score of general dentists about avulsion management.

In all questions, the level of awareness had increased from T0 to T1 and also from T0 to T2. Regarding the question about the suitable environment for tooth placement, if it is not possible to immediately place a tooth with avulsion, the tooth should be placed in a suitable environment for preservation as soon as possible. Before the educational intervention, only 1.2% of participants selected all correct storage media which were Hank's balanced salt solution (HBSS) , milk and normal

saline, according to 2020 IADT guidelines. Additionally, 62.7% of respondents at T0 considered the patient's mouth or cheek to be appropriate for restoring the avulsed tooth. According to the 2020 guideline and as mentioned in the pamphlet, the patient's cheek is not recommended due to the risk of swallowing or choking [5]. At baseline (T0), 9.7% of participants incorrectly selected water as a suitable storage medium which is contraindicated according to the 2020 guidelines. In Mazur *et al*.'s study [24], 4.6% of people chose water as a suitable environment (Figure 5).

During placement, if the tooth is contaminated, according to the 2020 guideline, it can be rinsed in milk, normal saline, or saliva [5]. In response to the question

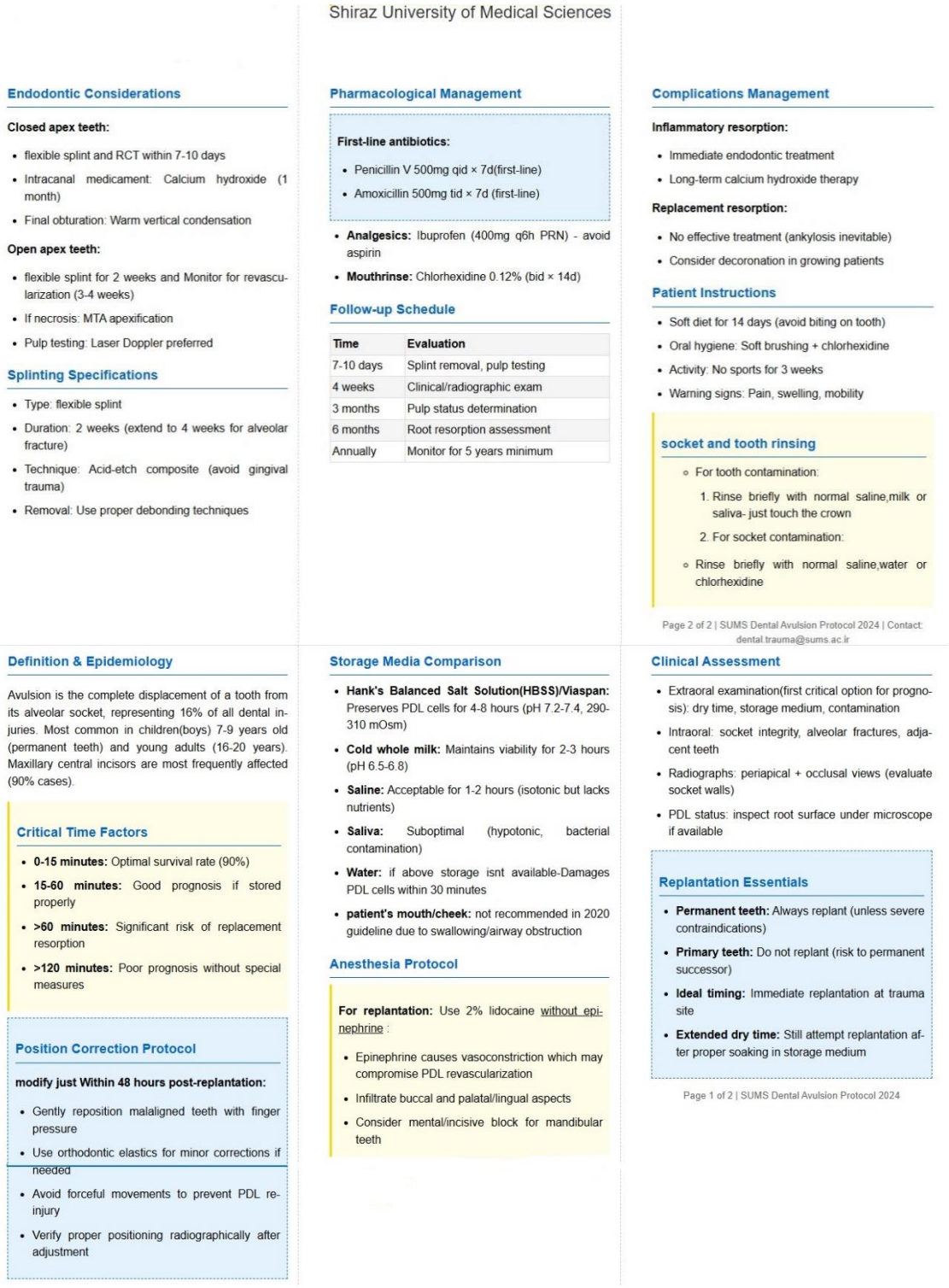

Figure 5: Pamphlet

"If the tooth has an infected avulsion, how do you clean it?" The majority, 59% of the respondents in T0 answered this question correctly. In the study of Mazur *et al*. [24], 78.9% chose the correct option of washing with saline.

In the question regarding the correction of the incorrect position of the implanted tooth, the teeth should be implanted within 48 hours after the accident according to the new guideline [5]. According to the data, only 25.8% of people chose the correct option. The majority, i.e. 46.7%, believed that it is possible to correct the position of the tooth only two hours after placement. Also, 16% stated that the tooth would stay in place without manipulation.

The first-choice antibiotic treatment for avulsion trauma is oral penicillin [5], which 32% of participants correctly identified before the educational intervention. According to the 2012 guideline, tetracycline is the first choice [29], and only 11.1% of people considered tetracycline information as the first choice. 19.7% of people stated that they use doxycycline topically on the root, which is in agreement with the 2012 guideline, but is not recommended in the 2020 guideline [29]. Therefore, a total of 30.8% of the participants had knowledge based on the 2012 guideline.

Regarding the use of appropriate anesthesia when placing a tooth with an avulsion, 35.7% of people knew that according to the 2020 guideline, they should use local anesthesia without epinephrine. Conversely, 25.9% chose the use of local anesthesia with epinephrine, indicating a likely reliance on outdated information rather than current evidence-based guidelines.

According to 2020 guidelines, the placement of teeth with avulsion applies only to permanent teeth. 27% stated that they would perform avulsed tooth placement only in cases of permanent teeth. 4.9% stated that they will perform placement in both permanent and baby teeth cases. The majority (45.5%) believed that time is important.

In the study of Abbasi *et al*. [26] a significant percentage of dentists (73%) answered correctly that milk teeth cannot be replaced. In the study of Akhlaghi *et al*. [30], 83.3% of dentists expressed the lack of replacement of primary teeth. Contrary to these results, in the study of Upadhyay *et al*. [31] a high percentage of participants (68.6 %) reported that primary teeth could be replanted.

Only 9.9% of people at T0 knew how to properly manage an avulsed permanent tooth with an open apex that had been in a dry environment for more than 60 minutes and declared that they would wait for root development after placement. According to the updated 2020 IADT guidelines, the current recommendation for this scenario involves attempting replantation after proper soaking in a storage medium, applying a flexible splint for 2 weeks, and closely monitoring for revascularization [5]. However, 55.4% of people believed that we should immerse the tooth in sodium fluoride. According to IADT guidelines in 2012, the protocol for placement of teeth with avulsion if left dry for more than 60 minutes included immersing the tooth in a sodium fluoride solution [29].Probably, the reason that participants believed in immersion in sodium fluoride solution was the lack of up-to-date information according to the new guidelines of IADT.

Several misconceptions were revealed, particularly regarding outdated 2012 recommendations such as topical doxycycline, epinephrine anesthetic use and fluoride soak, which are no longer included in the 2020 IADT guidelines.

This study had several limitations. First, the sample was limited to one city, which may reduce generalizability. Second, responses were self-reported and may be affected by recall or social desirability bias. Third, the absence of a control group limits causal inference regarding the effect of the educational intervention. Additionally, long-term retention was measured only up to three months. Future studies with multi-city sampling, objective assessment of clinical performance, and longer follow-up (6-12 months) are recommended. Considering the limitations of this interventional study, we recommend conducting similar research among general dentists in other cities, as well as studies focusing on the management of other types of dental trauma, to allow for broader clinical comparisons.

Future studies with multi-city sampling, objective assessment of clinical performance, and longer follow-up (6-12 months) are recommended. Additionally, facilitating access to up-to-date, evidence-based resources-potentially through digital platforms endorsed by health authorities- may further enhance preparedness for emergency dental trauma situations [32].

Conclusion

This study demonstrated that a simple pamphlet-based intervention significantly improved short-term knowledge of avulsion management; however, retention declined over time. This highlights the need for ongoing educational programs, particularly for endodontic postgraduate students, to ensure optimal management of dental trauma cases.

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Conflict of Interest

Authors declare no Conflict of interest statement.

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