

Comparison of effectiveness of different training tools on the level of knowledge about emergency management of avulsed teeth in non-dentists

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Abstract

Objective: Tooth avulsion is a type of trauma requiring an emergency response, and the level of knowledge of non-dentists on the emergency management of avulsed teeth is important for the prognosis of affected teeth. This study aimed to compare the effectiveness of training given using different tools on the level of knowledge about the emergency management of avulsed teeth in non-dentists.

Methods: A total of 125 individuals (female, 32.8%; male, 67.2%; mean age, 38.5 ± 7.32 years) participated in the study. The participants were randomly assigned to three groups, and the training was offered to these groups using different training tools (group 1, storybook; group 2, poster; group 3, ToothSOS App). A survey was conducted on all participants to measure their knowledge levels before training (T_0), immediately after (T_1), and 1 month later (T_2). The Mann-Whitney U, Kruskal-Wallis, Wilcoxon, and Friedman tests were used for statistical analysis.

Results: The participants' mean correct answer scores on a scale from 0 to 21 were 7.76 ± 4.00 , 5.47 ± 4.71 , and 7.38 ± 2.96 at T_0 in groups 1, 2, and 3, respectively, and their mean scores increased to 14.68 ± 4.10 , 13.74 ± 3.28 , and 13.86 ± 3.01 at T_1 and 13.41 ± 3.34 , 12.34 ± 3.77 , and 13.66 ± 3.56 at T_2 . The correct answer scores increased significantly at both T_1 and T_2 in all groups ($p < 0.001$).

Conclusion: None of the training tools used in the study was superior in increasing the level of knowledge. More comprehensive and long-term studies on this subject are needed.

Keywords

Tooth avulsion, emergency, education, mobile app, poster

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Introduction

In a recent meta-analysis study, it was determined that 15.2% of 1 billion people living in the world had a traumatic dental injury (TDI).¹ TDIs are a health problem that can cause aesthetic, functional, and psychological concerns in individuals.² The most severe type of TDI is avulsion, which is the complete removal of the tooth from its socket,¹ and avulsion of permanent teeth is seen in 0.5–16% of all TDIs.³

The appropriate emergency response is crucial for the successful treatment of avulsed teeth, and immediate

replantation of the teeth into their socket has been considered the most appropriate treatment for avulsed permanent teeth.³ Previous studies on the emergency management of avulsed teeth have shown that non-dentists do not have a sufficient level of knowledge.^{4–7} Therefore, increasing the

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knowledge level of non-dentists with training is critical in the prognosis of avulsed teeth.

Studies have reported that the traditional training methods are effective in increasing the knowledge level of the emergency management of TDIs in the short term but do not provide long-term benefits.^{8–10} The reason why the information is forgotten shortly after the training on the emergency management of TDI is that it is usually taught in the form of a didactic lecture in traditional education programs. Robertson¹¹ stated that a 1-hour didactic lecture would potentially fill working memory. Powell et al.¹² observed that it required extensive and repetitive efforts to train the parents, and they should be called back after 14–28 days. Thicket and Newton¹³ evaluated the effectiveness of learning retention of three different training methods immediately after training and 6 weeks later, stating that repetition increased long-term memory consolidation. Biesbrock et al.¹⁴ emphasized the importance of the different training methods in acquiring long-term memory consolidation.

In previous studies, many training methods such as posters, seminars, brochures, and mobile apps were used to increase the knowledge level of non-dentists about the emergency management of avulsed teeth, and the effectiveness of these training methods was examined. However, these training tools were not found to be superior to each other in the transfer of knowledge.^{15–19} Therefore, more studies are needed to increase the level of knowledge and learning retention about the emergency management of avulsed teeth and to define ideal and reliable training tools.

This study aimed to compare the effectiveness of the training with different training tools on the level of knowledge about the emergency management of avulsed teeth in non-dentists.

The null hypothesis (H_0) of this study was that there were no statistically significant differences among the training tools used in the training about the emergency management of avulsed teeth in terms of their effectiveness in increasing the level of knowledge.

Methods

This study is a prospective cross-sectional study, and ethical approval was obtained from the İnönü University Health Sciences Non-Interventional Clinical Research Ethics Committee (ethics number: 2020/1158).

While preparing the self-administered questionnaire, the questions were modified, and new questions whose validity and reliability were tested in previous studies were added.^{19–21}

For the content validity of the developed questionnaire, the questionnaire was sent to experts (three pediatric dentists; one endodontist; one oral, dental, and maxillofacial surgeon; one general dentist; and one biostatistician). In line with the suggestions from the experts, no changes were made to the content of the questionnaire, only some terminology changes were made to make it more

understandable, and then it was sent to three different pediatric dentists for a second evaluation. In the secondary assessment, the questionnaire was approved by the experts. Finally, language editing was performed by a linguist to make the survey language more understandable.

In the pilot study for the reliability assessment of the questionnaire, a test–retest was performed using Cohen's Kappa measure. The questionnaire was administered to 20 randomly selected volunteers, twice, with an interval of 2 weeks, and these participants were not included in the study. In line with the data obtained, no changes were made to the survey questions.

The questions in the 33-item questionnaire consisting of 21 questions were divided into three sections. In the first section, there were eight questions containing personal information. In the second section, there were seven questions about the participants' experience with TDI. Both Q3 and Q5 in the third section, which consisted of six questions measuring the knowledge level of individuals about the emergency management of avulsed teeth, comprised seven items. This section had a total of 18 items, with a score range of 0–21.

A picture about dental avulsion was added to the beginning of Section 3 so that the participants could better understand the definition of dental avulsion.

It was planned to train the participants with three different training tools on the emergency management of avulsed teeth and to divide the participants into three different groups in this respect.

Group 1. Trained with a storybook: The book entitled “*Kuka'nın Dişi Yerinden Çıktı—Kuka's Tooth Knocked Out*” has 27 pages, consisting of 1364 words, with pictures on each page, 22 × 28 cm size, “Comic Sans MS” font, 18 font size, 1.15 line spacing, prepared for primary school children. The reading time of the book is between 8 and 13 min, depending on the reading speed.

Group 2. Trained with a poster: The “*Save Your Tooth*” poster, prepared by the International Association of Dental Traumatology (IADT).

Group 3. Trained with the *ToothSOS App*: The app was launched by IADT for free in 2018.

According to the power analysis, the minimum sample size required to detect a significant difference in the knowledge score was calculated to be at least 35 in each group (105 in total for three groups), considering type I error (alpha) of 0.05, power (1-beta) of 0.8, an effect size of 0.31, and two-sided alternative hypothesis (H1).

All participants were informed at the beginning of the study that participation in the survey was entirely voluntarily and that details of their identity would be kept strictly confidential and the data obtained would be used only for research purposes.

Those who agreed to participate in the study and who completed the post-training questionnaire were included

in the study. Those who were illiterate, who worked in any dental-related field (e.g., dental technicians, dental assistants), who were dentist/dental students, and who did not have a smartphone (for those who would receive training through the mobile phone application) were excluded from the study.

One hundred eighty volunteers (80 males, 100 females) were selected based on the inclusion criteria of the study. Each was introduced to the İnönü University, Faculty of Dentistry, Department of Oral Diagnosis and Radiology, between April 2021 and September 2021 and was invited to the study. Sixty people were allocated for each group from these 180 people with different sociodemographic characteristics. Ten out of 60 people who would receive training with a storybook, seven out of 60 people who would receive training with a poster, and five out of 60 people who would receive training with the ToothSOS App refused to participate in the study by stating that they did not want to receive training. The questionnaire was administered to 158 people, 50 from group 1, 53 from group 2, and 55 from group 3, before (T_0) the training and immediately after (T_1) (participation rates: 83%, 88%, and 92%, respectively). One month later (T_2), 13 people in group 1, 15 people in group 2, and five people in group 3 were excluded from the study because they did not complete the questionnaire. The study was completed with a total of 125 participants, 37 from group 1, 38 from group 2, and 50 from group 3 (participation rates: 62%, 63%, and 83%, respectively).

The participants who agreed to participate in the study were invited to the seminar room of İnönü University, Faculty of Dentistry, Department of Pedodontics. No one other than the researcher (ZŞG) and the participant was admitted to the seminar room, and the training was given in this room.

The study was designed that the questionnaire would be applied to each participant three times, before (T_0) the training, immediately after (T_1), and 1 month later (T_2). The question about “whether they were satisfied with the training” was added in all groups at T_1 , and the question about “whether they examined the ToothSOS App within 1 month” was added in group 3 at T_2 . In addition, the participants in group 3 were also asked whether they were aware of the ToothSOS App at T_0 .

The questionnaire was administered to the participants at T_2 by inviting them to the faculty or making home visits (ZŞG) to those who could not come to the faculty.

The correct answers to the questions in the third section, which determined the level of knowledge about the emergency management of avulsed teeth, were determined according to the 2012 and 2020 avulsion guidelines of the IADT. Each correct answer was worth 1 point, and incorrect answers were worth 0 points. Q1, Q4, and Q5 of this section were scored as follows: ideal answer, 2 points; correct answer, 1 point; and incorrect answer, 0 points.

Thus, in the scoring of the knowledge-level section, 18 items with six questions, the theoretical range was accepted as between 0 “no knowledge” and 21 “excellent knowledge.” The knowledge level of the participants about the emergency management of avulsed teeth was evaluated using the correct answer score determined on a scale ranging from 0 to 21.

IBM SPSS Statistics for Windows, V22 software package (SPSS Inc., Chicago, IL, USA), was used for the statistical analyses. Test–retest reliability using Cohen’s Kappa was performed to measure the reliability of the questionnaire. The data were firstly analyzed for the normal distribution using the Shapiro–Wilk and Kolmogorov–Smirnov tests. The Mann–Whitney U and Kruskal–Wallis tests were used for intergroup comparisons of correct answer scores, and Wilcoxon signed-rank and Friedman tests were used for within-group comparisons of correct answer scores at baseline and post-training. The independent variables affecting the dependent variable “change in knowledge scores” were calculated using multiple linear regression analysis. For this reason, three different regression models (“model 1, T_1-T_0 ”; “model 2, T_2-T_0 ”; “model 3, T_2-T_1 ”) were created. P -values of <0.05 were considered significant.

Results

Of the 125 participants, 84 (67.2%) were female and 41 (32.8%) were male, and the mean age was 38.5 ± 7.32 (range, 20–57) years. One-quarter (24.8%) were non-dental healthcare workers (e.g., physicians, pharmacists, nurses, health technicians), and 75.2% were from other professions (e.g., teachers, engineers, housewives). Table 1 shows the sociodemographic distribution of the participants and their experience with TDI. The answers given by the participants to the questions about the emergency management of avulsed teeth at all three time periods are also presented in Table 2.

For this questionnaire, the kappa coefficient was 0.864 ($\kappa > 0.75$) indicating good agreement.

Table 3 shows the mean (SD) and median (min–max) values of the participants’ correct answer scores in all groups at the three time points. There were statistically significant differences among the three time points for all groups ($p < 0.001$). The participants’ correct answer scores showed a statistically significant difference at T_0 between groups 1 and 3 ($p = 0.006$) (Figure 1).

In all three groups, the participants’ correct answer scores statistically significantly increased at both T_1 and T_2 ($p < 0.001$).

The median (min–max) correct answer scores of the participants in groups 1, 2, and 3 on a scale of 0 to 21 increased from 8 (0–17), 4.5 (0–16), and 7 (2–15) to 16 (6–20), 14 (6–19), and 14 (6–20) at T_1 and to 14 (6–19), 15 (2–19), and 14 (3–20) at T_2 , respectively (Table 3).

Table 1. Sociodemographic status and dental trauma experience.

Section 1 (eight-question)	Group 1	Group 2	Group 3	Total
Age (mean ± SD)	35.38 ± 8.41	38.87 ± 6.06	32.1 ± 6.65	38.5 ± 7.32
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Gender				
Male	10 (27.0)	14 (36.8)	17 (34.0)	41 (32.8)
Female	27 (73.0)	24 (63.2)	33 (66.0)	84 (67.2)
Education				
Primary school	4 (10.8)	4 (10.5)	3 (6.0)	11 (8.8)
Secondary school	0 (0.0)	6 (15.8)	2 (4.0)	8 (6.4)
High school	5 (13.5)	8 (21.1)	2 (4.0)	15 (12.0)
University	24 (64.9)	18 (47.7)	27 (54.0)	69 (55.2)
Postgraduate	4 (10.8)	2 (5.3)	16 (32.0)	22 (17.6)
Profession				
Healthcare worker	10 (27.0)	5 (13.2)	16 (32.0)	31 (24.8)
Non-healthcare worker	27 (73.0)	33 (86.8)	34 (68.0)	94 (75.2)
Income				
Low (<5000 TRY)	19 (51.4)	24 (63.2)	18 (36.0)	61 (48.8)
Medium (5000–10000 TRY)	13 (37.8)	12 (31.6)	28 (56.0)	53 (42.4)
High (>10,000 TRY)	5 (10.8)	2 (5.3)	4 (8.0)	11 (8.8)
Having a dentist in the family				
Yes	5 (13.5)	2 (5.3)	10 (20.0)	17 (13.6)
No	32 (86.5)	36 (94.7)	40 (80.0)	108 (86.4)
Having a child/children				
Yes	25 (67.6)	35 (92.1)	30 (60.0)	90 (72.0)
No	12 (32.4)	3 (7.9)	20 (40.0)	35 (28.0)
Number of children, if any				
0	12 (32.4)	3 (7.9)	20 (40.0)	35 (28.0)
1	7 (18.9)	4 (10.5)	17 (34.0)	28 (22.4)
2	11 (29.7)	13 (34.2)	10 (20.0)	34 (27.2)

(continued)

Table 1. Continued.

Section 1 (eight-question)	Group 1	Group 2	Group 3	Total
3	4 (10.8)	14 (36.8)	3 (6.0)	21 (16.8)
4	1 (2.7)	3 (7.9)	0 (0.0)	4 (3.2)
5	0 (0.0)	1 (2.6)	0 (0.0)	1 (0.8)
6	2 (5.4)	0 (0.0)	0 (0.0)	2 (1.6)
Section 2 (seven-question)				
Have you ever encountered TDI?				
Yes	4 (10.8)	6 (15.8)	8 (16.0)	18 (14.4)
No	33 (89.2)	32 (84.2)	42 (84.0)	107 (85.6)
Receiving first aid training				
Yes	20 (54.1)	11 (28.9)	36 (72.0)	67 (53.6)
No	17 (45.9)	27 (71.1)	14 (28.0)	58 (46.4)
Was dental trauma part of the first aid training?				
Yes	2 (5.4)	1 (2.6)	36 (72.0)	39 (31.2)
No	35 (94.6)	37 (97.4)	14 (28.0)	86 (68.8)
Receiving training about dental trauma				
Yes	5 (13.5)	0 (0.0)	9 (18.0)	14 (11.2)
No	32 (86.5)	38 (100)	41 (82.0)	111 (88.8)
If yes, where did you receive it? (multiple choice)				
Dentist	0 (0.0)	0 (0.0)	2 (4.0)	2 (1.6)
First aid training course	0 (0.0)	0 (0.0)	1 (2.0)	1 (0.8)
Internet	2 (5.4)	0 (0.0)	0 (0.0)	2 (1.6)
Health journals	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Faculty	1 (2.7)	0 (0.0)	5 (10.0)	6 (4.8)
Brochure, public spotlight	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Other	3 (8.1)	0 (0.0)	1 (2.0)	4 (3.2)
Can you distinguish between primary and permanent teeth?				
Yes	19 (51.4)	23 (60.5)	26 (52.0)	68 (54.4)
No	17 (45.9)	15 (39.5)	24 (48.0)	56 (44.8)

(continued)

Table 1. Continued.

Section 1 (eight-question)	Group 1	Group 2	Group 3	Total
Undecided	1 (2.7)	0 (0.0)	0 (0.0)	1 (0.8)
Were you satisfied with the training?*				
Yes	37 (100)	38 (100)	50 (100)	125 (100)
No	0 (0.0)	0 (0.0)	0 (0.0)	0.0 (0)
Undecided	0 (0.0)	0 (0.0)	0 (0.0)	0.0 (0)
Have you reviewed the ToothSOS App in a month?***				
Yes	-	-	24 (48.0)	24 (48.0)
No	-	-	26 (52.0)	26 (52.0)

*Asked in T₁. **Asked in T₂.

The mean correct answer scores of the participants in group 1 at T₀ and the participants in group 3 at T₀, T₁, and T₂ were statistically significant between healthcare workers and non-healthcare workers (Table 4).

Three models were created using multivariate linear regression analysis. The dependent variable was considered to be a change in the knowledge score between T₁ and T₀ in model 1, T₂ and T₀ in model 2, and T₂ and T₁ in model 3. The number of the predictor variables was 12 (age, sex, education, profession, income, “having a dentist in the family,” “having a child/children,” “number of children, if any,” “whether TDI had been ever encountered,” “whether the first aid training was received,” “whether dental trauma was part of the first aid training,” and “whether training about dental trauma was received”). However, one more variable “whether the app had been reviewed in a month” was added in group 3 for regression models 2 and 3. The three regression models created to determine the estimation power of the independent variables on the change in the correct answer score were not statistically significant in all groups ($p > 0.05$).

The multivariate linear regression model demonstrated that being a non-healthcare worker was positively associated with the change in the knowledge score in group 1 (model 2; T₂-T₀: $\beta = 0.528$; $p = 0.040$). It was also found that the “number of children the participants had” variable had the highest change in the knowledge score in group 1 (model 1; T₁-T₀: $\beta = 0.791$; $p = 0.012$ and model 3; T₂-T₁: $\beta = -0.797$; $p = 0.017$).

The “previous TDI experience” was negatively associated with the change in the knowledge score in group 3 (model 3; T₂-T₁: $\beta = -0.358$; $p = 0.030$). The level of knowledge of participants without TDI experience decreased 0.36 times more than the others at T₂. The “to have reviewed the ToothSOS App within one month”

was positively associated with the change in the correct answer score (model 2; T₂-T₀: $\beta = 0.375$; $p = 0.017$).

Discussion

Numerous studies have been conducted on dental avulsion, which is one of the most serious injuries among dental traumas and requires emergency intervention.^{15,19-21} It is crucial to provide training to increase the public awareness about the emergency management of avulsed teeth, and various training tools are used for this purpose.^{15-17,19,20,22}

Two different meta-analysis studies stated that dental injuries negatively affect oral health-related quality of life.^{23,24} Therefore, emergency management of avulsed teeth is very important, and training the community on this issue is critical. It is widely advocated to train individuals who may be at the scene of an accident to raise the necessary awareness.²⁵

Most studies on the emergency management of avulsed teeth conducted on non-dentists show that the level of knowledge on this issue is low. In four different meta-analysis studies on the knowledge levels of school teachers,⁵ sportspersons and coaches,⁶ non-dental healthcare professionals,⁷ and dentists²⁶ about the emergency management of TDI, the low level of knowledge was demonstrated. Similarly, the lack of knowledge of parents on the subject has also been emphasized in many studies.^{20,27,28} In a previous study²¹ conducted on dentists about the emergency and clinical management of avulsed teeth, it was stated that the knowledge level of other specialists and general dentists was lower than that of pediatric dentists.

The sample of this study consists of non-dentists such as parents, teachers, physicians, other healthcare professionals, and different professional groups. In this study, in parallel with the literature, the knowledge level of the

Table 2. Responses of the participants to the questions about the emergency intervention of avulsed teeth at all three time points.

Section 3 (six-question–18 items)		T ₀		T ₁		T ₂	
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Q1. What should be done for a knocked-out tooth after a TDI?							
There is no need to visit the dentist if no pain or tooth abscess.		1 (0.8)	1 (0.8)	1 (0.8)	0 (0.0)	0 (0.0)	0 (0.0)
The knocked-out tooth is unimportant. It cannot be placed back to its original place. The dentist should be visited as soon as possible.		15 (12.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
The knocked-out tooth should be found and kept moist, and the dentist should be visited as soon as possible.*		60 (48.0)	43 (34.4)	55 (44.0)			
The knocked-out tooth should be found, rinsed briefly in water, and immediately placed back to its original place; the mouth should be closed with a piece of gauze, clean handkerchief, or napkin between the upper and lower front teeth; and the dentist should be visited as soon as possible.**		19 (15.2)	81 (64.8)	70 (56.0)			
Do not know		30 (24)	0 (0.0)	0 (0.0)			0 (0.0)
Q2. Where to hold a knocked-out tooth from?							
Crown*		64 (51.2)	119 (95.2)	112 (89.6)			
Root		6 (4.8)	3 (2.4)	4 (3.2)			
Anywhere		5 (4.0)	1 (0.8)	5 (4.0)			
Do not know		50 (40.0)	2 (1.6)	4 (3.2)			
Q3. If a knocked-out tooth is dirty, what should we clean it with? (seven items)							
		+	-	0	+	-	0
Tap water*		55 (44.0)	23 (18.4)	47 (37.6)	109 (87.2)	8 (6.4)	99 (79.2)
Saline*		58 (46.4)	6 (4.8)	61 (48.8)	71 (56.8)	22 (17.6)	72 (57.6)
Milk*		29 (23.2)	41 (32.8)	55 (44.0)	91 (72.8)	11 (8.8)	93 (74.4)
						23 (18.4)	9 (7.2)
							23 (18.4)

(continued)

Table 2. Continued.

Section 3 (six-question—18 items)		T ₁			T ₂				
	T ₀								
The patient's own saliva*	27 (21.6)	35 (28.0)	63 (50.4)	43 (34.4)	41 (32.8)	41 (32.8)	54 (43.2)	30 (24.0)	41 (32.8)
Alcohol	17 (13.6)	36 (28.8)	72 (57.6)	10 (8.0)	74 (59.2)	41 (32.8)	13 (10.4)	59 (47.2)	53 (42.4)
Clean gauze/napkin/cotton	65 (52.0)	16 (12.8)	44 (35.2)	37 (29.6)	55 (44.0)	33 (26.4)	45 (36.0)	43 (34.4)	37 (29.6)
It should not be cleaned in any way	10 (8.0)	35 (28.0)	80 (64.0)	6 (4.8)	91 (72.8)	28 (22.4)	1 (0.8)	87 (69.6)	37 (29.6)
Q4. "Critical time" which determines the treatment procedure in the knocked-out tooth is..... after the accident?									
First 20 min**	23 (18.4)			51 (40.8)			44 (35.2)		
First 60 min*	34 (27.2)			38 (30.4)			44 (35.2)		
First 90 min	4 (3.2)		15 (12.0)				18 (14.4)		
<90 min	5 (4.0)		15 (12.0)				14 (11.2)		
Any time period	4 (3.2)		3 (2.4)				4 (3.2)		
Do not know	55 (44.0)		3 (2.4)				1 (0.8)		
Q5. If the knocked-out tooth was unable to be replanted, it could be kept in till reaching the dentist (seven items)									
	+	-	0	+	-	0	+	-	0
Clean gauze/napkin/cotton	74 (59.2)	11 (8.8)	40 (32.0)	34 (27.2)	78 (62.4)	13 (10.4)	51 (40.8)	63 (50.4)	11 (8.8)
Cold milk**	36 (28.8)	27 (21.6)	62 (49.6)	116 (92.8)	4 (3.2)	5 (4.0)	105 (84.0)	10 (8.0)	10 (8.0)
Tap water*	24 (19.2)	36 (28.8)	65 (52.0)	58 (46.4)	36 (28.8)	31 (24.8)	54 (43.2)	42 (33.6)	29 (23.2)
The patient's cheek cavity*	25 (20.0)	39 (31.2)	61 (48.8)	72 (57.6)	38 (30.4)	15 (12.0)	65 (52.0)	35 (28.0)	25 (20.0)
The patient's own saliva*	32 (25.6)	26 (20.8)	67 (53.6)	55 (44.0)	44 (35.2)	26 (20.8)	65 (52)	27 (21.6)	33 (26.4)
Saline*	55 (44.0)	4 (3.2)	66 (52.8)	72 (57.6)	28 (22.4)	25 (20.0)	69 (55.2)	27 (21.6)	29 (23.2)

(continued)

Table 2. Continued.

Section 3 (six-question–18 items)	T ₀	T ₁	T ₂
The medium delivered is not important.	4 (3.2)	18 (14.4)	4 (3.2)
Q6. The knocked-out primary tooth ...	103 (82.4)	121 (96.8)	118 (94.4)
Can be placed back to its original place	28 (22.4)	58 (46.4)	5 (4.0)
Cannot be placed back to its original place*	44 (35.2)	61 (48.8)	49 (39.2)
Do not know	53 (42.4)	6 (4.8)	10 (8.0)

Correct answers highlighted in bold. (+) preferred; (-) not preferred; (0) no idea. **ideal answer; * correct answer.

Table 3. The mean (SD) and median (min-max) values of the correct answer scores at three time points.

	Time	Mean (SD)	Median (min-max)	Change between	Change in score (SD)	Effect size	Magnitude of change	**P-values
Group 1	T₀	7.76 (4.00)	8 (0-17) ^a	T₀ and T₁	6.92 (5.05)	+1.73	Large	<0.001
	T₁	14.68 (4.10)	16 (6-20) ^b	T₀ and T₂	5.65 (4.25)	+1.41	Large	<0.001
	T₂	13.41 (3.34)	14 (6-19) ^c	T₁ and T₂	-1.27 (3.04)	-0.31	Medium	0.015
	*P-value	<0.001						
Group 2	T₀	5.47 (4.71)	4.5 (0-16) ^a	T₀ and T₁	8.26 (4.85)	+1.75	Large	<0.001
	T₁	13.74 (3.28)	14 (6-19) ^b	T₀ and T₂	6.87 (6.24)	+1.46	Large	<0.001
	T₂	12.34 (3.77)	12.5 (2-19) ^c	T₁ and T₂	-1.39 (4.66)	-0.43	Medium	0.033
	*P-value	<0.001						
Group 3	T₀	7.38 (2.96)	7 (2-15) ^a	T₀ and T₁	6.48 (3.93)	+2.19	Large	<0.001
	T₁	13.86 (3.01)	14 (6-20) ^b	T₀ and T₂	6.28 (3.87)	+2.12	Large	<0.001
	T₂	13.66 (3.56)	14 (3-20) ^b	T₁ and T₂	-0.2 (3.41)	-0.014	Small	0.721
	*P-value	<0.001						

SD, standard deviation.

*Friedman test. **Wilcoxon signed-rank test.

^{a-c}: Different letters indicate statistically *significant* differences at $p < 0.05$ in the same column.

An effect of <0.2 indicated a small but clinically meaningful magnitude of change, 0.2-0.7 a moderate change, and >0.7 a large change.

participants about the emergency management of avulsed teeth was found to be low before the training. The mean correct pre-training answer scores of the participants who received training with the storybook, poster, and the ToothSOS App were determined as 7.76 ± 4.00 , 5.47 ± 4.71 , and 7.38 ± 2.96 , respectively, on a scale from 0 to 21.

All the training tools used in this study were prepared before the publication of the IADT's 2020 guide. Therefore, the IADT's 2012 guideline and the recommendations of each training tool were taken into account in the preparation of the survey questions, the evaluation of the answers given to the questions, and the determination of the correct answer scores.

In the third section of the questionnaire used in the study, which measured the level of knowledge, the question with the lowest correct answer rate after the training was the question (Q6) about whether primary teeth could be replanted. This is because it is only emphasized in the ToothSOS App that primary teeth cannot be replanted. In a previous study, it was stated that only 5% of parents had sufficient knowledge about avulsion of primary teeth.²⁸ The question about holding the avulsed tooth from its crown (Q2) had the highest correct answer rate

after the training. Probably, the answer to this question might have aroused more curiosity in the participants and the expression of holding the tooth by the crown during the training might have been more memorable.

Studies are conducted to increase the social awareness about the emergency management of TDI, and various training tools such as seminars, posters, short animated films, brochures, and mobile apps are used for this purpose.^{15-17,19,20,22,29} There are a limited number of studies comparing the success of the different training tools, and the ideal method in terms of both giving information and its cost/benefit has not yet been determined.^{18,19,29} Many studies argue that using more than one training tool together will be more effective than using a single training tool and emphasize that studies evaluating the long-term effects of training tools are insufficient.^{14,18,19,29,30}

Al-Asfour et al.¹⁹ reported that the level of knowledge of the parents who received training on the emergency management of avulsed teeth with a brochure was higher than the parents who did not receive any training. Enikawati et al.¹⁵ used a poster with instructions on the emergency management of an avulsed tooth by designing it according to the IADT guideline as a training tool in their study and reported that the median scores of teachers' knowledge

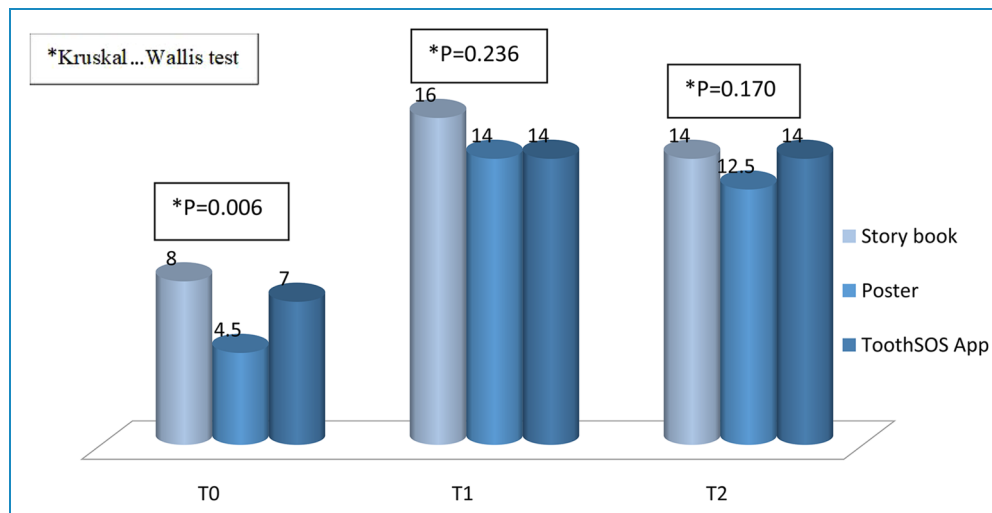


Figure 1. The chart of the median values of correct answer scores and the p -values.

Table 4. The mean (SD) values of the correct answer scores at three time points according to whether the participants were healthcare workers.

		Group 1			Group 2			Group 3		
		n (%)	Mean (SD)	P -values	n (%)	Mean (SD)	P -values	n (%)	Mean (SD)	P -values
T₀	Healthcare worker	10 (27)	9.90 (4.82)	0.046**	5 (13.2)	7.20 (5.26)	0.271*	16 (32)	8.88 (3.16)	0.013**
	Non-healthcare worker	27 (73)	6.96 (3.44)		33 (86.8)	5.21 (4.66)		34 (68)	6.68 (2.63)	
T₁	Healthcare worker	10 (27)	14.80 (4.96)	0.749*	5 (13.2)	12.20 (4.21)	0.266**	16 (32)	15.31 (2.63)	0.018**
	Non-healthcare worker	27 (73)	14.63 (3.85)		33 (86.8)	13.97 (3.13)		34 (68)	13.18 (2.97)	
T₂	Healthcare worker	10 (27)	12.40 (3.03)	0.271**	5 (13.2)	14.40 (2.88)	0.194**	16 (32)	15.25 (3.00)	0.018*
	Non-healthcare worker	27 (73)	13.78 (3.42)		33 (86.8)	12.03 (3.83)		34 (68)	12.91 (3.60)	

*Mann-Whitney U test; **independent sample t -test.

P -values with statistical significance are highlighted in bold.

increased from 5 (range 1–10) to 10 (range 4–14) immediately after the training ($p < 0.001$).

Previous studies have shown that the use of the “Save Your Tooth” brochure or poster containing IADT’s instructions on the emergency management of avulsed teeth as a training tool increases knowledge levels.^{17,19,27,31} Studies in the literature investigating the effectiveness of training tools used in the emergency management of TDIs are mostly demonstrated in posters and brochures,^{15,18,20,29,31} but there is no study investigating the effectiveness of a storybook yet. In addition, only one study was found on the effectiveness of the ToothSOS App.²² With the growth of the mobile technology, traditional training methods are gradually losing their popularity. In dentistry,

an increasing number of paid and free apps are being offered these days. Loureiro et al.³² compared the features of many mobile apps related to TDIs and critically analyzed the features of the apps.

Iskander et al.¹⁷ used the Dental Trauma smartphone app (Dental Trauma Ulf Glendor Ltd, Linköping, SWE) and the “Save Your Tooth” poster as training tools and reported that both training tools were effective in educating parents, and the tools were not superior to each other, but the majority of the parents preferred the smartphone app. In the present study, similar to Iskander et al.’s study, it can be said that the poster and the mobile app did not have superiority over each other in transferring information, and the participants preferred the mobile app more than the other training tools

because the highest number of participants was in the group trained with the ToothSOS App at T₀ and T₁ (92%).

In this study, the level of knowledge increased immediately after the training was given with all the three training tools. Similarly, 1 month after the training, the level of knowledge was also higher than it was before the training. None of the three training tools were found to be superior to one another in increasing the level of knowledge. In addition, because the 1-month period was very short, it cannot be said whether the training was successful in terms of the permanence of the knowledge. Although the mean knowledge level of the participants was the highest immediately after the training (T₁), a slight decrease was observed 1 month later (T₂). This decrease (mean difference T₂–T₁) is an expected possible outcome supported by the literature.^{8,10}

Although the storybook and poster are seen to be effective on the level of knowledge when used as a training tool for the emergency management of avulsed teeth, they cannot be considered as a training tool to be used in the event of an accident. On the other hand, the ToothSOS App can be used both as a training tool for the emergency management of avulsed teeth and can be easily accessed in the event of an accident. In addition, the ToothSOS App contains instructions to be followed in the emergency intervention of dental avulsion and those to be followed in the emergency management of seven different dentofacial traumatic injuries. The ToothSOS App is arguably more advantageous than the other two training tools due to these features. The fact that it is free and easily accessible also shows that the ToothSOS App can be an indispensable training tool.

As a result, the limitations of this study included the following: (i) random selection of participants, (ii) selection criteria were not specific to a particular group, (iii) the participants were not allowed to choose the training tool they would be involved in, (iv) equal scoring of all questions despite differences in difficulty, and (v) not knowing how successful the acquired knowledge was in putting it into practice. However, the strength of this study is that it is the first study to evaluate and compare the effectiveness of the knowledge level of three different training tools.

Conclusion


None of the training tools used in the study had superiority over one another in increasing knowledge levels. More studies with long-term follow-up are needed on the subject. All the three training tools used in the study should be updated according to the 2020 guidelines of the IADT.

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