

Knowledge and attitudes about emergency management of avulsed teeth among primary and secondary school teachers in Malatya, Turkey

Gülsüm Duruk^{1*}, Tamara Pelin Gündoğdu Özdağ²

¹Department of Pediatric Dentistry, Faculty of Dentistry, Inonu University, Malatya, Turkey

²Private Hospital, Ankara, Turkey

Abstract

Background and Aim: Dental trauma is highly frequent in children during school time and school teachers are often the first witnesses of the incident. This cross-sectional study aimed to assess the knowledge of school teachers about dental avulsion and its management.

Methods: This cross-sectional questionnaire study was conducted on 782 primary and secondary school teachers in Malatya, Turkey. The questionnaire included three sections assessing (i) demographic characteristics, (ii) knowledge and attitudes about emergency management of avulsed permanent teeth, and (iii) teachers' perspective on dental trauma education and self-evaluation of dental trauma knowledge. The correct answer scores were calculated according to section 2 (6 questions-17 items). Data were analyzed using Mann-Whitney U test, Kruskal-Wallis test, and multiple linear regression analysis.

Results: The correct answer score was calculated out of 17; the highest score was 13 and the mean score was 8.5. The level of knowledge on emergency management of avulsed teeth was higher among the teachers who had previously been trained on the subject.

Conclusion: The knowledge of Turkish school teachers about emergency management of avulsed teeth is limited. The findings obtained in this study indicated that an educational strategy for teachers is strongly required.

Keywords: Tooth Injury; Tooth Avulsion; Emergency; Knowledge; School Teachers

Citation: Duruk G, Gundogdu Ozdal TP. Knowledge and attitudes about emergency management of avulsed teeth among primary and secondary school teachers in Malatya, Turkey. *J Oral Health Oral Epidemiol.* 2022;11(3):156-163. doi:10.34172/johoe.2022.06

Received: January 4, 2021, **Accepted:** January 30, 2022, **ePublished:** October 4, 2022

Introduction

Traumatic injuries of teeth are common among children in the mixed and permanent dentition (1,2) and may result in developmental, psychological, and financial problems for children and their parents (3).

Dental avulsion is a type of dental trauma in which the tooth is completely dislodged from its socket, and it accounts for 0.5%–3% of all permanent tooth injuries (4). A good prognosis of avulsed teeth depends on the viability of periodontal ligament (PDL) cells, and the first intervention at the accident site is very important. It is recommended that the avulsed tooth be held from its crown without touching the root surface, rinsed briefly under running water, and replanted into the alveolar socket. Then, the patient should go to the dentist immediately. If the avulsed tooth cannot be replanted into its socket, it should be delivered to the dentist immediately in an appropriate storage medium (4).

Several epidemiological studies have indicated that

dental trauma is highly prevalent in schools (5,6). This could be due to the recreational and sporting activities, and the amount of time children spend in school on a daily basis (7).

Emergency management of tooth avulsion is performed mostly by school teachers who are close to the child at the moment of the trauma, however, previous studies have reported that their knowledge regarding emergency procedures is not enough to ensure a good prognosis (8-13).

A few studies have been conducted on teachers' level of knowledge about dental trauma in Turkey (8,14,15). Therefore, this study aimed to investigate the knowledge of primary and secondary school teachers in Malatya, Turkey regarding emergency management of avulsed teeth and their source of information.

The null hypothesis of this study was that there is no difference among school teachers in their level of knowledge about emergency management of avulsed



teeth according to the teachers' specialization.

Methods

This cross-sectional study utilized a self-administered questionnaire distributed to one thousand school teachers of 18 public schools randomly selected from the city center of Malatya and completed by 782 teachers from February to April 2018.

The post-hoc power analysis revealed nearly 83.2% power, considering type I error (alpha) of 0.05, sample sizes of 307, 390, and 85, as well as effect size of 0.27 for the maximum difference of the mean knowledge score among teachers from different specializations and two-sided alternative hypothesis (H1).

The study was approved by the Malatya Clinical Research Ethics Committee (2015/65). It was emphasized in the first page of the questionnaire that the study was intended for scientific purposes only and the personal data provided would be kept confidential.

The questionnaire was developed from a combination of questionnaires used in previous studies (11,13,16,17). It was divided into three sections. The first section was about sociodemographic status of the participants, the second section about emergency management of avulsed permanent teeth, and the third section was about teachers' perspective on dental trauma education and self-evaluation of dental trauma knowledge. Moreover, a picture of dental avulsion with a description were placed on the first page of the questionnaire before the questions section.

The validity of the questionnaire was established by expert opinion. The questionnaire was sent to four experts (two pediatric dentists, one endodontist, and one maxillofacial surgeon). Item-content validity index (I-CVI) was calculated for each question (for each item of Q5 and Q6 in section 2) based on the opinions of the four experts, and the resultant average I-CVI was 1 (100%). All calculations were performed via Microsoft Excel 2016 for Windows. In line with the comments from the experts, no change was made in the content of the survey, but some terminological changes were applied to make the questionnaire more understandable.

The reliability of the questionnaire was assessed with internal consistency using Cronbach's alpha coefficient and test-retest reliability using Cohen's Kappa. For test-retest reliability, 15 teachers (seven primary school teachers, six secondary school teachers, and two physical education teachers) completed the final version of the questionnaire twice in a 1-week interval and then they were excluded from the study. For the questionnaire, Cronbach's alpha was 0.871 ($0.80 \leq \alpha < 0.90$ indicating good internal consistency) and Cohen's kappa was calculated as 0.89 ($\kappa > 0.75$ showing good agreement).

The teachers' level of knowledge about dental avulsion was assessed in section 2 of the questionnaire (6

questions-17 items). The correct answers of the questions in section 2 were determined with reference to the 2012 avulsion guidelines of the International Association of Dental Traumatology (IADT) (4). The total knowledge score was calculated by summing the correct answers to the 17 items. Each correct answer was scored 1 and each incorrect answer was scored 0. The theoretical range was from 0 "no knowledge" to 17 "excellent knowledge."

The data were analyzed using IBM SPSS V22 (SPSS Inc). Internal consistency and test-retest reliability were used to measure the reliability of the questionnaire with the Cronbach's alpha and Cohen's Kappa, respectively. The data were first analyzed for the normal distribution with Kolmogorov-Smirnov and Shapiro-Wilk tests, and then, the data were analyzed using non parametric tests for differences. Mann-Whitney U and Kruskal-Wallis tests were used to compare the number of correct answers among teachers. Multiple linear regression analysis was performed to estimate the relative parameters of the knowledge score of emergency management. The significance level was set at $P < 0.05$.

Results

From among 1000 school teachers, 782 participated in this study (response rate: 78.2%). The mean age of the respondents was 40.73 ± 8.16 years (23-63), and 54.4% of the respondents were female and 45.5% were male.

Table 1 shows the percentage distribution of the teachers regarding their demographic characteristics

Table 1. Characteristics of school teachers (1st section)

Variable	
Age, mean \pm SD (min-max)	40.73 \pm 8.16 (23-63)
Gender, No (%)	
Female	426 (54.5)
Male	356 (45.5)
Do you have a child/children?, No (%)	
Yes	682 (87.2)
No	100 (12.8)
Teachers' specialization, No (%)	
Class teacher in primary school	307 (39.3)
Branch teacher in secondary school	390 (49.9)
Physical education teacher	85 (10.9)
Years of experience (y), No (%)	
1-5	100 (12.8)
6-10	69 (8.8)
11-15	171 (21.9)
15-20	201 (25.7)
>20	241 (30.8)
Have you ever encountered tooth avulsion before?, No (%)	
Yes	50 (6.4)
No	732 (93.6)
The number of dental avulsion cases encountered in a year at the school where you work, No. (%)	
0	477 (61.0)
1-5	288 (36.8)
>5	17 (2.2)

such as age, gender, having a child/children, teaching specialization, years of experience, whether to encounter tooth avulsion before, and the number of tooth avulsion cases encountered in a year at the school where the teacher works.

The percentages of the teachers' answers to 6 questions about the emergency management steps for an avulsed permanent tooth according to IADT are presented in Table 2.

The mean correct knowledge score (based on section 2) was 8.50 ± 1.78 and the median score (min-max) was 8 (3-13).

The statistical significance levels of the mean knowledge

score according to the eight variables are presented in Table 3. The mean knowledge score was statistically significant in terms of "years of experience", "whether to encounter tooth avulsion before", "the number of dental avulsion cases encountered in a year at the school where the teacher works", "whether to receive information about dental trauma", and "self-assessment of knowledge". The teachers who had encountered tooth avulsion before, who had received information about dental trauma, and who self-evaluated their knowledge of dental trauma as "3" and "4" had higher mean knowledge scores than others ($P < 0.01$). The teachers with 16 to 20 years of experience had the highest mean knowledge score (8.75 ± 1.80).

Table 2. The percentage distribution of teachers' opinions on emergency management of tooth avulsion (2nd section)

	No. (%)		
Q1. Can the avulsed permanent tooth be reimplanted?			
Yes	494 (63.2)		
No	267 (34.1)		
Do not know	21 (2.7)		
Q2. What should one do in case of dental avulsion?			
Go to the dentist	251 (32.1)		
Go to the dentist with avulsed tooth in proper storage medium	431 (55.1)		
Go to the dentist immediately after reimplanting avulsed tooth	56 (7.2)*		
Doing nothing	31 (4.0)		
Do not know	13 (1.7)		
Q3. What is the critical time period for avulsed tooth replantation?			
Immediately	590 (75.4)*		
In the first hour	79 (10.1)		
In a few hours	55 (7.0)		
In 24 hours	26 (3.3)		
Within any time frame	26 (3.3)		
Do not know	6 (0.8)		
Q4. Where would you hold an avulsed tooth from?			
Crown	487 (62.3)		
Root	189(24.2)		
Anywhere	88(11.3)		
Do not know	18(2.3)		
Q5. If the avulsed tooth were dirty, it would be cleaned with...?			
	Preferable	Unpreferable	No idea
Tap water	187 (23.9)	552 (70.6)	43 (5.5)
Alcohol	77 (9.8)	632 (80.8)	73 (9.3)
Normal saline	88 (11.3)	645 (82.5)	49 (6.3)
Wet gauze	24 (3.1)	722 (92.3)	36 (4.6)
Scrubbing with clean gauze or brushing and washing with tap water	39 (5.0)	711 (90.9)	32 (4.1)
Doing nothing	328 (41.9)	430 (55.0)	24 (3.1)
Q6. If avulsed tooth were unable to be reimplanted, it could be kept in [...] till delivered to the dentist.			
	Preferable	Unpreferable	No idea
Sponge, cotton, or napkin	527 (67.4)	247 (31.6)	8 (1.0)
Ice	83 (10.6)	664 (84.9)	35 (4.5)
Normal saline	33 (4.2)	742 (94.9)	7 (0.9)
Patient's saliva	5 (0.6)	772 (98.7)	5 (0.6)
Tap water	17 (2.2)	759 (97.1)	6 (0.8)
Cold milk	45 (5.8)*	733 (93.7)	4 (0.5)
Any aseptic solution	32 (4.1)	725 (92.7)	25 (3.2)

Correct answers are bold. *Ideal correct answer.

Table 3. The correct scores on dental avulsion management according to school teachers' characteristics

	Mean (SD)	Median (min-max)	Test statistic*	P value
Gender				
Female	8.58 (1.72)	8 (3-13)	$U=72.806$	0.328
Male	8.39 (1.83)	8 (3-13)		
Do you have a child/children?				
Yes	8.51 (1.68)	8 (3-13)	$U=32.242$	0.370
No	8.41 (2.32)	8 (3-13)		
Teachers' specialization				
Class teacher in primary school	8.52 (1.83)	8 (3-13)	$\chi^2=4.508$	0.105
Branch teacher in secondary school	8.39 (1.70)	8 (3-13)		
Physical education teacher	8.88 (1.89)	8 (5-13)		
Years of experience				
1-5 y ^{ab}	8.51 (2.36)	8 (3-13)	$\chi^2=17.368$	0.002
6-10 y ^a	7.94 (1.36)	8 (4-11)		
11-15 y ^a	8.25 (1.71)	8 (4-13)		
16-20 y ^b	8.75 (1.80)	9 (3-13)		
20 < y ^{ab}	8.61 (1.57)	8 (6-13)		
Have you ever encountered tooth avulsion before?				
Yes	10.66 (1.99)	10.5 (6-13)	$U=7.069$	<0.001
No	8.35 (1.66)	8 (3-13)		
The number of dental avulsion cases encountered in a year at school				
0 ^a	8.63 (1.77)	8 (3-13)	$\chi^2=9.640$	0.008
1-5 ^b	8.24 (1.72)	8 (3-13)		
> 5 ^{ab}	9.18 (2.27)	9 (5-13)		
Receiving information about dental trauma				
Yes	9.36 (1.90)	9 (5-13)	$U=99.139$	<0.001
No	8 (1.49)	8 (3-13)		
Self-assessment of knowledge				
1: I have no idea ^a	8.23 (1.64)	8 (4-13)	$\chi^2=16.382$	0.001
2: Insufficient ^{ab}	8.53 (1.79)	8 (3-13)		
3: Sufficient but incomplete ^b	8.72 (1.85)	9 (3-13)		
4: Comprehensive ^b	10.43 (1.81)	11 (8-13)		

* χ^2 : Kruskal-Wallis test statistic. ^{a,b,c} Mean values followed by different superscript letters are significantly different ($P<0.05$).

The percentages of the teachers' attitude towards dental trauma education and self-evaluation of their dental trauma knowledge are presented in Table 4.

According to the median score, the level of knowledge about the emergency management of dental avulsion was low in 27% of the teachers (median scores < 8), moderate in 25% (median scores = 8), and high in 48% (median scores > 8) (Figure 1). The prevalence of excellent answers (the knowledge score = 17) was 0% for emergency management of dental avulsion. The maximum score was 13 (of 17).

According to the eight variables in the regression model, 21% of the variances could be predicted in the correct answer scores on emergency management of dental avulsion among the teachers ($P<0.001$). The variable "whether to receive information about dental trauma" had the most predictive power in the regression model and was positively related to the higher knowledge scores ($\beta=0.311$, $P<0.001$) (Table 5).

Discussion

School teachers are among the first ones to see a child immediately after a dental injury, which can occur during school hours. Therefore, the knowledge level of teachers

about the emergency management of traumatic dental injuries is critical for the prognosis of the injured tooth. Determining the level of knowledge of school teachers about dental trauma will shed light on the development of the strategies to increase their level of knowledge. This study revealed that the school teachers lack knowledge about the emergency management of avulsed teeth.

Tewari et al (18) performed a meta-analysis of 23 previous studies on school teachers' knowledge about dental trauma. All the previous studies had been published within the last decade. Eleven studies were done in primary schools and two in combinations of schools, while 10 studies did not categorize the schools as primary or secondary. Except for two studies (one of them was a multicenter study; $n=2270$ (9), and the other was conducted with 1520 teachers (19)), the sample size ranged from 40 to 600 in all the studies. In this study, both primary and secondary school teachers were included, and the sample size was 782.

To assess the emergency management of avulsed teeth, the respondents were first asked whether the avulsed permanent tooth could be replanted or not. About 63.2% of the teachers answered that avulsed permanent teeth can be replanted into its socket. This percentage was

Table 4. The teachers’ attitude toward dental trauma education and self-evaluation of their dental trauma knowledge (3rd section)

Teachers’ attitude	No. (%)
Did you receive any information about dental trauma? If yes, from where?	
Yes	
Faculty, where I graduated	0 (0.0)
TV/radio/ public spotlight	0 (0.0)
Internet/ social media	140 (17.9)
Dentist	144 (18.4)
First aid training	0 (0.0)
Others	0 (0.0)
No	498 (63.7)
Do you think it is important to attend an educational program about “management of dental trauma”?	
Yes	
Yes	719 (91.9)
No	63 (8.1)
Would you like to attend any educational program on “management of dental trauma”?	
Yes	
Yes	556 (71.1)
No	226 (28.9)
How would you score self-assessment of your dental trauma knowledge from 1 to 4?	
1: I have no idea	206 (26.3)
2: Insufficient	463 (59.2)
3: Sufficient but incomplete	106 (13.6)
4: Comprehensive	7 (0.9)

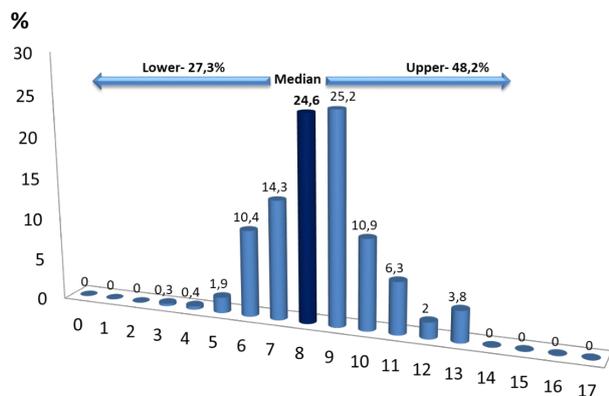


Figure 1. The percentages of the correct answer scores.

reported to be 75.4% by Marcano-Caldera et al (9), 52.2% by Tzimpoulas et al (10), 24.9% by Niviethitha et al (12), 37.1% by Arikan and Sönmez (15), 47.66% by Taranath et al (20), and 24.8% by Shamarao et al (21).

In this study, only 7.2% of the teachers would replant the avulsed tooth, while 55.1% would go to the dentist with avulsed tooth in a proper storage medium. This is similar to the results reported by Marcano-Caldera et al (9) stating that 5.8% would reposition the tooth in the alveolus, and 66.7% would save it and send it to the dentist or doctor. Most of the teachers were not willing to replant the avulsed tooth. This shows that teachers do not have the courage to replant the tooth due to the

lack of knowledge about dental avulsion management. Similar results have reported that the fear of hurting the child or the fear of bleeding stopped them from taking responsibility to act at the right time (22,23).

Time, which should be as short as possible, is one of the most important factors for avulsed teeth to preserve the vitality of PDL cells after reimplantation. In this study, when asked about the ideal time to replace an avulsed tooth, 75.4% of the teachers said ‘immediately’ and 10.1% said ‘within 1 hour’. The percentage of the acceptable answers (85.5%) was very high in the present study in comparison with other studies: 30 minutes - 17% (10), 15 minutes - 26.9% and 30 minutes - 24.3% (12), immediately-26.2% and 1 hour - 14.7% (15), 1 hour - 49.8% (9), < 30 minutes - 30.3% (21), within 30 minutes to 1 hour - 33.60% (20), and 30 minutes - 71.8% (14).

To prevent the vitality of the PDL cells, the root portion of avulsed tooth should not be touched while holding it. However, 38.7% of the teachers stated that they would hold the avulsed tooth from the root or any other area, and 50.50% stated that they would hold it from the crown. In other studies, the percentage of the teachers who stated that they would hold the tooth by its crown was 62.3% (12), 14.6% (15), and 53.8% (20).

If the avulsed tooth is dirty, it should be cleaned with tap water or saline without rubbing before replantation. In the present study, 23.9% of the teachers preferred tap water, while 11.3% preferred saline to clean avulsed teeth. The percentages of the teachers’ preference for tap water in other studies were higher than the present study: 27.5% (10), 51.8% (9), 48.5% (12), 48.7% (14), 54.20% (20), and 62.5% (21).

If an avulsed tooth cannot be reimplanted, it must be delivered to the dentist in an appropriate storage medium, such as HBSS, cold milk, patient’s saliva or mouth, saline, tap water, etc., which is extremely important for the viability of the PDL cells. In this study, 67.4% of the school teachers stated that they would store the tooth in a dry environment (napkin), while only 5.8% of them stated that they would choose milk, which is the ideal correct answer, as a storage medium. This is similar to the result obtained by Marcano-Caldera et al (9) who stated that 58.9% of the teachers would choose dry environment and 6.5% would choose milk to store the tooth until delivered. In other studies, the percentages of the teachers who chose milk as a storage medium were 3.3% (12), 9% (21), 10% (15), 19.7% (19), and 19.9% (10).

Mostly, the previous studies reported the percentages of responses and the studies giving an average correct answer score were very few. In Alsdhan and colleagues’ study (19), the total score for the questions assessing the knowledge of traumatic dental injuries was calculated out of 9, and the maximum score was 7 with an average score of 2.85, which corresponds to approximately 1/3 of the highest score. In Fux-Noy and colleagues’ study

Table 5. The predictive power on the correct answer scores of the independent variables in the multiple regression model

	Beta	95% CI	P value*
(Constant)		6.840 – 8.076	<0.001
Gender (1: Female; 2: Male)	-0.078	-0.509 – -0.048	0.018
Having a child/children (0: No; 1: Yes)	0.058	-0.043 – 0.661	0.085
Teacher's specialization (1: Class; 2: Branch; 3: Physical education)	0.032	-0.094 – 0.267	0.348
Years of experience	0.073	0.009 – 0.185	0.031
Having encountered tooth avulsion before (0: No; 1: Yes)	0.253	1.368 – 2.301	<0.001
The number of dental avulsion cases encountered in a year at school	-0.108	-0.579 – -0.136	0.002
Receiving information (0: No; 1: Yes)	0.311	0.908 – 1.388	<0.001
Self-assessment of knowledge	0.057	-0.023 – 0.335	0.087
R ² (Adjusted)	0.213		<0.001

Dependent variable: Correct answer score.

*Multiple linear regression analysis.

(13), the average knowledge score about traumatic dental injuries was 4.59 (in a scale of 0–10), which corresponds to approximately half of the highest score of the scale. In Arikan and Sönmez's study (15), the average score for all respondents was 5.8 (0–13), which corresponds to less than half of the highest score. In this study, the average knowledge score about dental avulsion was 8.50 and the maximum score was 13 in a scale of 0–17. This average knowledge score, which is half of the highest score of the scale (of 17), is similar to the score reported in Alsadhan and colleagues' study (19).

In this study, 6.4% of the teachers had previously witnessed at least one dental avulsion. The level of knowledge of the teachers who had previously witnessed avulsion was higher than that of others. This shows that their knowledge increased because of what they encountered during the treatment process. In fact, dental avulsion is one of the most severe dental accidents ever experienced and it is not easily forgotten. Similarly, Arikan and Sönmez (15) stated that the teachers who had previously encountered traumatic dental injuries had significantly higher scores than those who had not.

When teachers were asked how many avulsion cases occur in their schools in average in a year, 61% of them said no case, 36.8% said between 1 and 5 cases, and 2.2% said more than 5 cases. These numbers did not only reflect the number of cases they had witnessed but also reflected the number of cases they had heard of. Therefore, the accuracy of the responses of the teachers who answered "none" cannot be guaranteed. In some cases, the teachers participating in the study had not witnessed or heard about the dental avulsion that occurred at school.

Dental injuries usually occur during physical activities and are mostly encountered by physical education teachers. Therefore, physical education teachers are expected to be more knowledgeable about dental injuries than other teachers. However, contrary to the expectations, their level of knowledge was not higher than other teachers. Therefore, the null hypothesis of

this study is accepted. Among the physical education teachers in Hong Kong, only 17.5% were able to indicate the appropriate management for an avulsed tooth (24).

In this study, the main sources of information regarding dental trauma were consulting with a dentist (18.4%) and the internet/social media (17.9%). First aid training was not mentioned by any teacher as a source of information. Unfortunately, most of the teachers (63.7%) had not received information about dental trauma. This result is concrete evidence that teachers should be informed about the management of dental trauma. Fux-Noy et al (13) stated that the main source of the information about dental trauma among teachers was consulting with a dentist (54.9%), while 3% had received first aid training and 1.2% of them had no information. The results of the study by Tzimpoulas et al (10) demonstrated that 77.2% of the participants received neither previous dental trauma training nor any information on dental trauma injuries. Alsadhan et al (19) stated that 32% of the respondents had received first aid training, 38.2% had read or heard about the management of dental injuries, and only 20.1% had previously learned about the management of dental injuries. In Antunes and colleagues' study (11), first aid training in school was taken by 24.4% of the teachers and 4.1% received some kind of information on traumatic dental injury. Similar to the present study, Arikan and Sönmez (15) indicated that the level of knowledge was higher among those who had access to the information.

In this study, 79% of the teachers stated that they would contact a dentist in case of dental trauma, 18.5% would go to the nearest emergency service/physician, and 2.4% said that a child only with a dental problem can go to the dentist at any time period. These percentages are similar to those of other studies. In case of dental trauma, 83.35% of the teachers in Greece would contact a dentist, 16.65% would contact a physician (10), and 89% of the teachers in Israel would contact a dentist (13).

Well-fitted and well-designed mouthguards protect children from dentoalveolar injuries in most cases of

physical sports. In Fux-Noy and colleagues' study (13), physical education teachers claimed that mouthguards can prevent dental trauma, and they had higher awareness about it than the other teachers.

According to the present study, only 46.3% of the teachers stated that they had information about mouth protectors, but none of them had their students use mouthguards. Although the use of mouthguards is recommended in various contact sports (25), unfortunately, prevention of dental trauma at schools is very hard as it happens during children's normal activity.

Concerning self-assessment, more than half of the teachers (59.2%) had insufficient knowledge, and 26.3% had no knowledge. Only 0.9% of the teachers stated that they had comprehensive knowledge. Fux-Noy et al (13) stated that less than half of the teachers were highly (8%) or moderately (27.4%) satisfied with their knowledge, while 18.9% of the teachers had no knowledge. Alsdhan et al (19) reported that only 14.1% of the teachers were satisfied with their current knowledge. In Antunes and colleagues' study (11), almost all (92.1%) participants reported having no knowledge of dental trauma. In this study, the teachers whose self-assessment score was "comprehensive" had a higher level of knowledge than others. This result is similar to the results of Fux-Noy and colleagues' study (13), as they stated that there was a correlation between self-assessed knowledge and knowledge score. This shows that teachers are aware of their current knowledge regarding the management of dental trauma.

In this study, the majority (71.1%) of the teachers wanted to receive training on how to manage dental trauma. This percentage was 76.3% in Alsdhan and colleagues' study (19).

According to the regression analysis results, receiving information about dental trauma was significant ($P < 0.001$) and positively related ($\beta = 0.311$) to higher knowledge scores. This was similar to the results of the study by Young et al (26) as they also reported that prior first aid training with information on dental injury and acquisition of dental injury information from other sources were significant and positively related to higher scores.

The findings of this study indicated that informative tools including posters, leaflets, conferences, workshops, mobile applications, and webinars are required to raise the level of awareness among teachers regarding the emergency management of dental trauma.

The ToothSOS mobile application developed by the IADT and translated into Turkish and other languages can be a very useful training tool for providing instant guidelines to school teachers during dental trauma injuries (27). The emergency management of dental trauma should be included in the curriculum as a compulsory subject. It should be obligatory for teachers

to receive first aid training that includes emergency response to dental trauma.

The limitation of this study was that the results cannot be generalized to the overall Turkish school teachers since the data were obtained only from one province. However, the strengths of this study were its sample size and the average scores of teachers' correct answers along with the percentages of their answers.

Conclusion

Turkish teachers lack knowledge about emergency management of avulsed teeth and they are aware of this. A clear positive connection was found in this study between the level of knowledge of emergency management of avulsed teeth and having received education on the subject. It is important to understand the need for an educational strategy on dental trauma to develop a health policy.

Determining the level of knowledge of school teachers about dental trauma will shed light on the development of the strategies to increase their level of knowledge. Thus, more comprehensive studies on the subject are needed.

Authors' contributions

GD conceived the idea for the research, prepared the questionnaire, collected data, performed the statistical analyses, wrote the initial framework, and drafted the manuscript as the principal author. TPGÖ collected data and contributed to writing the manuscript. All authors read and approved the final manuscript.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgements

This study was not financially supported by any foundation. The authors wish to thank all participants for their invaluable contribution to this study.

References

1. Petti S, Glendor U, Andersson L. World traumatic dental injury prevalence and incidence, a meta-analysis-One billion living people have had traumatic dental injuries. *Dent Traumatol.* 2018;34(2):71-86. doi: [10.1111/edt.12389](https://doi.org/10.1111/edt.12389).
2. Glendor U. Epidemiology of traumatic dental injuries--a 12 year review of the literature. *Dent Traumatol.* 2008;24(6):603-11. doi: [10.1111/j.1600-9657.2008.00696.x](https://doi.org/10.1111/j.1600-9657.2008.00696.x).
3. Antunes LS, Debossan PF, Bohrer LS, Abreu FV, Quintanilha LE, Antunes LA. Impact of traumatic dental injury on the quality-of-life of children and adolescents: a case-control study. *Acta Odontol Scand.* 2013;71(5):1123-8. doi: [10.3109/00016357.2012.750011](https://doi.org/10.3109/00016357.2012.750011).
4. Andersson L, Andreasen JO, Day P, Heithersay G, Trope M, Diangelis AJ, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. *Dent Traumatol.* 2012;28(2):88-96. doi: [10.1111/j.1600-9657.2012.01125.x](https://doi.org/10.1111/j.1600-9657.2012.01125.x).
5. Marcenes W, Alessi ON, Traebert J. Causes and prevalence of traumatic injuries to the permanent incisors of school children aged 12 years in Jaraguá do Sul, Brazil. *Int Dent J.* 2000;50(2):87-92. doi: [10.1002/j.1875-595x.2000](https://doi.org/10.1002/j.1875-595x.2000).

- tb00804.x.
6. Skaare AB, Jacobsen I. Etiological factors related to dental injuries in Norwegians aged 7-18 years. *Dent Traumatol.* 2003;19(6):304-8. doi: [10.1046/j.1600-9657.2003.00211.x](https://doi.org/10.1046/j.1600-9657.2003.00211.x).
 7. Al-Jundi SH. Dental emergencies presenting to a dental teaching hospital due to complications from traumatic dental injuries. *Dent Traumatol.* 2002;18(4):181-5. doi: [10.1034/j.1600-9657.2002.02081.x](https://doi.org/10.1034/j.1600-9657.2002.02081.x).
 8. Bayrak S, Tunc ES, Sari E. Evaluation of elementary school teachers' knowledge and attitudes about immediate emergency management of traumatic dental injuries. *Oral Health Prev Dent.* 2012;10(3):253-8.
 9. Marcano-Caldera M, Mejía-Cardona JL, Parra Sanchez JH, Méndez de la Espriella C, Covo Morales E, Sierra Varón G, et al. Knowledge about emergency dental trauma management among school teachers in Colombia: a baseline study to develop an education strategy. *Dent Traumatol.* 2018;34(3):164-74. doi: [10.1111/edt.12393](https://doi.org/10.1111/edt.12393).
 10. Tzimpoulas N, Markou M, Zioutis V, Tzanetakis GN. A questionnaire-based survey for the evaluation of the knowledge level of primary school teachers on first-aid management of traumatic dental injuries in Athens, Greece. *Dent Traumatol.* 2020;36(1):41-50. doi: [10.1111/edt.12503](https://doi.org/10.1111/edt.12503).
 11. Antunes LA, Rodrigues AS, do Couto Martins AM, Cardoso ES, Homsí N, Antunes LS. Traumatic dental injury in permanent teeth: knowledge and management in a group of Brazilian school teachers. *Dent Traumatol.* 2016;32(4):269-73. doi: [10.1111/edt.12249](https://doi.org/10.1111/edt.12249).
 12. Niviethitha S, Bhawarlal C, Ramkumar H, Dhakshanamoorthy S, Shanmugam H. Effectiveness of an audio-visual aid on the knowledge of school teachers regarding the emergency management of dental injuries. *Dent Traumatol.* 2018. doi: [10.1111/edt.12405](https://doi.org/10.1111/edt.12405).
 13. Fux-Noy A, Sarnat H, Amir E. Knowledge of elementary school teachers in Tel-Aviv, Israel, regarding emergency care of dental injuries. *Dent Traumatol.* 2011;27(4):252-6. doi: [10.1111/j.1600-9657.2010.00970.x](https://doi.org/10.1111/j.1600-9657.2010.00970.x).
 14. Caglar E, Ferreira LP, Kargul B. Dental trauma management knowledge among a group of teachers in two south European cities. *Dent Traumatol.* 2005;21(5):258-62. doi: [10.1111/j.1600-9657.2005.00321.x](https://doi.org/10.1111/j.1600-9657.2005.00321.x).
 15. Arikan V, Sönmez H. Knowledge level of primary school teachers regarding traumatic dental injuries and their emergency management before and after receiving an informative leaflet. *Dent Traumatol.* 2012;28(2):101-7. doi: [10.1111/j.1600-9657.2011.01042.x](https://doi.org/10.1111/j.1600-9657.2011.01042.x).
 16. Prasanna S, Giriraju A, Narayan NL. Knowledge and attitude of primary school teachers toward tooth avulsion and dental first aid in Davangere city: a cross-sectional survey. *Int J Clin Pediatr Dent.* 2011;4(3):203-6. doi: [10.5005/jp-journals-10005-1110](https://doi.org/10.5005/jp-journals-10005-1110).
 17. Duruk G, Erel ZB. Assessment of Turkish dentists' knowledge about managing avulsed teeth. *Dent Traumatol.* 2020;36(4):371-81. doi: [10.1111/edt.12543](https://doi.org/10.1111/edt.12543).
 18. Tewari N, Goel S, Rahul M, Mathur VP, Ritwik P, Haldar P, et al. Global status of knowledge for prevention and emergency management of traumatic dental injuries among school teachers: a systematic review and meta-analysis. *Dent Traumatol.* 2020;36(6):568-83. doi: [10.1111/edt.12579](https://doi.org/10.1111/edt.12579).
 19. Alsdhan SA, Alsayari NF, Abuabat MF. Teachers' knowledge concerning dental trauma and its management in primary schools in Riyadh, Saudi Arabia. *Int Dent J.* 2018;68(5):306-13. doi: [10.1111/idj.12385](https://doi.org/10.1111/idj.12385).
 20. Taranath M, Senaikarasi RM, Manchanda K. Assessment of knowledge and attitude before and after a health education program in East Madurai primary school teachers with regard to emergency management of avulsed teeth. *J Indian Soc Pedod Prev Dent.* 2017;35(1):63-7. doi: [10.4103/0970-4388.199218](https://doi.org/10.4103/0970-4388.199218).
 21. Shamarao S, Jain J, Ajagannanavar SL, Haridas R, Tikare S, Kalappa AA. Knowledge and attitude regarding management of tooth avulsion injuries among school teachers in rural India. *J Int Soc Prev Community Dent.* 2014;4(Suppl 1):S44-8. doi: [10.4103/2231-0762.144599](https://doi.org/10.4103/2231-0762.144599).
 22. Glendor U, Jonsson D, Halling A, Lindqvist K. Direct and indirect costs of dental trauma in Sweden: a 2-year prospective study of children and adolescents. *Community Dent Oral Epidemiol.* 2001;29(2):150-60. doi: [10.1034/j.1600-0528.2001.290210.x](https://doi.org/10.1034/j.1600-0528.2001.290210.x).
 23. Loo TJ, Gurunathan D, Somasundaram S. Knowledge and attitude of parents with regard to avulsed permanent tooth of their children and their emergency management--Chennai. *J Indian Soc Pedod Prev Dent.* 2014;32(2):97-107. doi: [10.4103/0970-4388.130781](https://doi.org/10.4103/0970-4388.130781).
 24. Chan AW, Wong TK, Cheung GS. Lay knowledge of physical education teachers about the emergency management of dental trauma in Hong Kong. *Dent Traumatol.* 2001;17(2):77-85. doi: [10.1034/j.1600-9657.2001.017002077.x](https://doi.org/10.1034/j.1600-9657.2001.017002077.x).
 25. Caglar E, Kargul B, Tanboga I. Dental trauma and mouthguard usage among ice hockey players in Turkey premier league. *Dent Traumatol.* 2005;21(1):29-31. doi: [10.1111/j.1600-9657.2004.00271.x](https://doi.org/10.1111/j.1600-9657.2004.00271.x).
 26. Young C, Wong KY, Cheung LK. Emergency management of dental trauma: knowledge of Hong Kong primary and secondary school teachers. *Hong Kong Med J.* 2012;18(5):362-70.
 27. Duruk G, Gümüşboğa Z. Effectiveness of the ToothSOS App as a training tool for the emergency management of traumatic dental injuries among non-dentists. *Dent Traumatol.* 2022;38(3):229-37. doi: [10.1111/edt.12742](https://doi.org/10.1111/edt.12742).