

KNOWLEDGE OF EGYPTIAN GENERAL DENTISTS, ENDODONTISTS, AND PEDIATRIC DENTISTS REGARDING MANAGEMENT OF TRAUMATIC DENTAL INJURIES IN CHILDREN: A CROSS SECTIONAL STUDY

Yasmine Elhamouly^{1*} BDS, MSc, PhD

ABSTRACT

INTRODUCTION: Traumatic dental injuries (TDIs) are common in childhood. Treatment options for TDIs are based on the extent and nature of the injury. General dentists play an important role in the treatment of TDIs.

OBJECTIVE: this study aimed to assess the knowledge of general dental practitioners (GDPs) compared to pediatric dentists (PDs), and endodontists (EDs) regarding emergency management of TDIs and application of International Association of Dental Traumatology (IADT) guidelines in a sample of dentists in Alexandria, Egypt.

MATERIAL AND METHODS: Participants completed a two-part questionnaire (ten questions covering demographic, professional, and personal data and 14 questions about given trauma cases scenarios) in electronic format to assess their knowledge regarding TDIs. One score was dedicated to each correct answer: score of 0-4= poor knowledge, scores 5-8, 9-11 and 12-14= moderate, good and excellent, respectively. Data was collected and transferred to a secured spread sheet. Frequencies and percentage were calculated for qualitative variables. Comparisons between the three categories were done using Chi-square test. Ordinal logistic regression was conducted to assess the association between dental specialties with knowledge score. Odds ratio (OR) and 95% confidence intervals (CI) were calculated. Significance was set at p value < 0.05.

RESULTS: PDs and EDs had a higher knowledge score than GDPs (P= 0.01, B=11.19, 95%CI: 1.74, 71.77) and (P= 0.000, B= 36.18, 95%CI: 5.29, 247.28), respectively. Dentists who assessed their knowledge as comprehensive or sufficient had a higher knowledge score than those who assessed their knowledge as fragmentary (P= 0.000, B=24.58, 95%CI: 8.71, 69.30) and (P= 0.000, B= 7.93, 95%CI: 3.60, 17.48) respectively.

CONCLUSIONS: The knowledge level of GDPs on TDIs was significantly lower than that of PDs and EDs, while no significant difference was encountered between PDs and EDs.

KEYWORDS: Traumatic Dental Injuries; General Dental Practitioner; Pediatric Dentists, Endodontists, Knowledge Assessment

1-Lecturer of Pediatric Dentistry, Faculty of Dentistry, Pharos University in Alexandria, Egypt

***Corresponding author:**

yasmine.elhamouly@pua.edu.eg

INTRODUCTION

Traumatic dental injuries (TDIs) are common in childhood, with reported incidences ranging from 7% to 58% in children and 35% in adults (1,2). Approximately 50% of schoolchildren experience dental trauma before completing their school years. Traumatic dental injuries have both physical and psychological-effects on patients. Both children and their parents are more concerned about the aesthetic aspects rather than the symptomatic aspects of the problem (3). Traumatic dental injuries in childhood can have negative consequences as they can impact permanent dentition-and their diagnosis and treatment can be complex (3). Anterior teeth are the most commonly affected in both children and adults, and these injuries have a detrimental effect on quality of life (3). Luxation injuries are more common in

primary dentition, while crown fractures are more frequently reported in permanent teeth (4,5,6).

Treatment options for TDIs depend on the extent and nature of the injury and may include interventions for soft tissue, restoration of the tooth, replacement of the coronal fragment, or reimplantation of an avulsed tooth. Due to the wide range of cases, multiple treatment sequences involving general dental practitioners (GDPs) and other dental specialties, such as pediatric dentists and endodontists may be necessary (7). Most dental trauma patients seek treatment at emergency clinics in state hospitals, private polyclinics, or private practice clinics (5). Therefore, general dentists play a-crucial role in the management of TDIs (7). They should be familiar with appropriate emergency approaches and evidence-based guidelines, such as those provided by

the International Association of Dental Traumatology (IADT) (8). It is important to note that inadequate or no treatment following a dental trauma can lead to tooth discoloration, mobility, sensitivity, pulpal necrosis, root or bone resorption, and ultimately tooth loss (9).

Studies have shown that Lithuanian and Turkish general dental practitioners lack sufficient training to handle TDIs, resulting in inadequate management (10-11). Additionally, a group of Italian dentists demonstrated heterogeneous knowledge levels, particularly in the management of specific clinical cases and topics related to traumatic dental injuries (12).

To our knowledge there are few studies on the assessment knowledge levels of TDIs among general dental practitioners and specialists in Egypt (13) and no published studies among general dental practitioners and specialists in Alexandria. Hence, the aim of this study was to assess and compare the knowledge of general dental practitioners (GDPs), pediatric dentists (PDs), and endodontists (EDs) regarding the emergency management of TDIs and application of IADT guidelines in a sample of dentists in Alexandria, Egypt. The null hypothesis was that there is no difference between the knowledge of (GDPs), (PDs), and (EDs) regarding the emergency management of TDIs and application of IADT guidelines.

MATERIAL AND METHODS

Study design and eligibility criteria

A descriptive cross-sectional study was conducted on a purposive sample of GDPs, PDs, and EDs working in Alexandria, Egypt in the period from May to August 2023. The eligibility criteria were practicing GDPs, with at least 2 years of experience after graduation and EDs, PDs working inside Alexandria. Participants were excluded from the study if they were working outside Alexandria, having another dental specialty inside Alexandria, or still undergraduate dental students.

Sample size calculation

Sample size was determined by an online calculator for estimating population proportion based on the following assumptions: confidence level= 95%, margin of error= 5%. Assuming that 50% of the Egyptian dentists had a high knowledge of TDI, the minimum required sample size was 385 participants (14).

Ethics Approval

Prior commencement of the study, ethics approval was obtained by the Unit of Research Ethics Approval Committee (UREAC), Faculty of Pharmacy, Pharos University in Alexandria, Egypt, PUA0220233263062 (Supplementary file).

Data was collected by means of a validated, reliable version of the multiple-choice questionnaire developed by Akhlaghi et al. (15). The participants filled in the questionnaire after reading the study purpose and consented that they have voluntarily participated without any pressure. The questionnaire was divided into two parts: Part I consisted of seven questions about personal and professional information; including gender, age, university, frequency of patients with TDI they encountered in their daily practice (frequent, occasional and very rare), attendance at educational courses of TDI (yes or no), location of their present professional practice (personal office, university clinics, health centers, other), willingness to receive training in the management of TDI (yes, no), and dentists' self-assessment regarding their knowledge on the management of TDI (comprehensive, sufficient and fragmentary) (15). Part II contained 7 imaginary dental trauma cases to collect information about dentists' knowledge in the management of TDIs. These questions were about the management of a complicated crown fracture in a permanent tooth with open apex after 2 days, an uncomplicated crown fracture of a mature permanent tooth immediately after trauma, apical third root fracture of a permanent tooth with mature apex immediately after trauma, an intruded permanent tooth with open apex immediately after trauma, an extruded permanent tooth with closed apex, an avulsed permanent tooth with closed apex with extraoral dry time longer than 60 min in a 12-year-old patient and an avulsed permanent tooth with closed apex in a child whose parents called the dental office to seek for advice at the exact moment. One score was dedicated to each correct answer. Score 0-4 was considered as poor knowledge, 5-8 was considered as moderate knowledge, 9-11 was considered as good knowledge, and 12-14 was considered as excellent knowledge (15).

Questionnaire distribution

The questionnaire was converted into an online google form and the link (<https://forms.gle/2sQh4iWyKf4XWJ4S6>) was broadcasted via social media platforms and applications (Facebook, whats app, email). To ensure including Public Hospital's practitioners, a single investigator was responsible to collect the data by reaching out to those dentists and ensure they fill in the questionnaire via Quick Response (QR) code. The online form was available for 30 days. The approximate time to answer the questionnaire was informed to be about 7-10 minutes. The answers and data obtained were stored by the researchers and used only for this study. To ensure the anonymity of each respondent, no identifying information was collected.

Responses were automatically recorded, and the data was collected and transferred to a secured spreadsheet (Excel, Microsoft Corp., Redmond, Wash., USA). The primary outcome of this study was to assess the knowledge of GDPs regarding emergency management of TDI and the secondary outcome was to compare the knowledge of GDPs to that of EDs and PDs.

Statistical analysis:

Frequencies and percentage were calculated for qualitative variables. Comparisons between the three dental specialties were done using Chi-square test. Ordinal logistic regression was conducted to assess the association between dental specialties with knowledge score. Odds ratio (OR) and 95% confidence intervals (CI) were calculated. Significance was set at p value < 0.05 . Data was analyzed using IBM SPSS version 23.0.

RESULTS

The total sample required for this study was 385 participants. The response rate was 91%, in which 351 participants responded and were included for statistical analysis. Description of the sample (part I) is displayed in Table 1. Participants' correct answers about clinical management of traumatic events in cases 1-7 (part II) are summarized in Table 2.

Association between dental specialty and knowledge score showed that 1.5% of the GDPs had excellent knowledge compared to 8.0% and 7.5% for EDs and PDs, respectively. About 10.5% of the GDPs showed good knowledge compared to 81.3% and 72.6% for EDs and PDs, respectively. Moderate knowledge was shown by 39.8% of the GDPs compared to 10.7% and 18.9% for EDs and PDs, respectively. The highest percentage of GDPs (48.1%) showed poor knowledge compared to 0.0% and 0.9% for EDs and PDs respectively, with statistical significance difference between the 3 categories, $p=0.000$, (Table 3). Multiple pairwise comparison between the three dental specialties and knowledge score showed a high statistical significance in the level of knowledge between the GDPs and both EDs and PDs where $P=0.000$, respectively. However no statistical significance was found between EDs and PDs, $P=0.869$, (Table 4).

In the multivariable ordinal logistic regression, knowledge score was significantly associated with the dental specialty where pediatric dentists and endodontists had a higher knowledge score than general practitioners ($P= 0.01$, $B=11.19$, 95%CI: 1.74, 71.77) and ($P= 0.000$, $B= 36.18$, 95%CI: 5.29, 247.28) respectively. Knowledge score was significantly associated with dentists' self-assessment regarding their knowledge about TDI

where dentists who assessed their knowledge as comprehensive or sufficient had a higher knowledge score than those who assessed their knowledge as fragmentary ($P= 0.000$, $B=24.58$, 95%CI: 8.71, 69.30) and ($P= 0.000$, $B= 7.93$, 95%CI: 3.60, 17.48) respectively. However, knowledge score was not significantly associated with the location of the present professional practice, gender, age, qualification, frequency of patients, attendance, and willingness to receive training in relation to the management of TDI, (Table 5).

Table 1: Sample description (n=351)

		N (%)
Gender	Male	180 (51.3%)
	Female	169 (48.1%)
Age	25 – 35	215 (61.3%)
	36 – 45	119 (33.9%)
	46 – 55	13 (3.7%)
	56 - 65	3 (0.9%)
Specialty	General dental practitioner	133 (37.9%)
	Endodontist	112 (31.9%)
	Pediatric dentist	106 (30.2%)
Qualification	Bachelor's degree	132 (37.6%)
	Master's degree	209 (59.5%)
	Doctorate degree	10 (2.8%)
Year of graduation	2010 – 2020	189 (53.8%)
	2000 - 2009	75 (21.4%)
	1990 – 1999	54 (15.4%)
	1980 – 1989	28 (8.0%)
	1970 – 1979	5 (1.4%)
Frequency of patients with TDI in practice	Frequent	48 (13.7%)
	Occasional	73 (20.8%)
	Very rare	193 (55.0%)
	Never	37 (10.5%)
Attendance at educational courses about TDI	Yes	87 (24.8%)
	No	263 (74.9%)
Location of the present professional practice	Public hospitals	128 (36.5%)
	University clinics	32 (9.1%)
	Private hospitals	18 (5.1%)
	Private office	173 (49.3%)
Willingness to receive training in relation to the management of TDI	Yes	249 (70.9%)
	No	102 (29.1%)
Dentists' self-assessment regarding their knowledge about TDI	Comprehensive	45 (12.8%)
	Sufficient	71 (20.2%)
	Fragmentary	235 (67.0%)

Table 3: Association between dental specialty and knowledge score

		Speciality N (%)			Total N (%)	P value 0.000* X2 = 201.840
		General dental practitioner	Endodontist	Pediatric dentist		
Knowledge score	Excellent	2 (1.5%)	9 (8.0%)	8 (7.5%)	19 (5.4%)	
	Good	14 (10.5%)	91 (81.3%)	77 (72.6%)	182 (51.9%)	
	Moderate	53 (39.8%)	12 (10.7%)	20 (18.9%)	85 (24.2%)	
	Poor	64 (48.1%)	0 (0.0%)	1 (0.9%)	65 (18.5%)	

*Statistically significant at P value < 0.05

Table 4: Multiple pairwise comparison between the three dental specialties and knowledge score

	Group	Compared to	P value
Knowledge score	General dental practitioners	Pediatric dentists	0.000*
	General dental practitioners	Endodontists	0.000*
	Pediatric dentists	Endodontists	0.869

*Statistically significant at P value < 0.05

Table 5: Multivariable ordinal logistic regression of the relation between knowledge score about management of TDIs and the dentists' personal and professional variables

		Unadjusted model		Adjusted model	
		OR (95% CI)	P value	OR (95% CI)	P value
Specialty	Pediatric dentists	38.08 (19.23, 75.43)	0.000*	11.19 (1.74, 71.77)	0.01*
	Endodontists	60.61 (29.67, 123.79)	0.000*	36.18 (5.29, 247.28)	0.000*
	General dental practitioners	Reference category			
Gender	Male	0.55 (0.36, 0.82)	0.000*	0.81 (0.46, 1.43)	0.47

	Female	Reference category			
Age	25 - 35	0.36 (0.04, 2.95)	0.34	2.46 (0.15, 40.77)	0.53
	36 - 45	1.96 (0.23, 16.61)	0.54	2.07 (0.13, 33.25)	0.61
	46 - 55	3.06 (0.27, 34.89)	0.37	1.44 (0.07, 28.95)	0.81
	56 - 65	Reference category			
Qualification	Bachelor's degree	0.05 (0.01, 0.21)	0.000*	0.41 (0.04, 4.45)	0.46
	Master's degree	1.99 (0.48, 8.24)	0.34	3.50 (0.69, 17.88)	0.13
	Doctorate degree	Reference category			
Frequency of patients with TDI in practice	Frequent	1.85 (0.84, 4.06)	0.13	2.10 (0.71, 6.22)	0.18
	Occasional	3.28 (1.57, 6.84)	0.000*	1.83 (0.65, 5.11)	0.25
	Very rare	4.57 (2.33, 8.93)	0.000*	1.75 (0.73, 4.20)	0.21
	Never	Reference category			
Attendance at educational courses about TDI	Yes	0.71 (0.46, 1.10)	0.13	0.78 (0.37, 1.66)	0.52
	No	Reference category			
Location of the present professional practice	Public hospitals	1.0 (0.06, 0.17)	0.000*	0.51 (0.23, 1.10)	0.09
	University clinics	0.34 (0.15, 0.74)	0.01*	1.04 (0.39, 2.78)	0.94
	Private hospitals	0.12 (0.05, 0.32)	0.000*	0.89 (0.27, 2.97)	0.85
	Private office	Reference category			
Willingness to receive training in relation to the management of TDI	Yes	0.37 (0.23, 0.59)	0.000*	1.00 (0.50, 2.01)	1.00
	No	Reference category			
Dentists' self-assessment regarding their knowledge about TDI	Comprehensive	1.06 (0.60, 1.86)	0.85	24.58 (8.71, 69.30)	0.000*
	Sufficient	1.68 (1.02, 2.78)	.04	7.93 (3.60, 17.48)	0.000*
	Fragmentary	Reference category			

OR: Odds Ratio, CI: Confidence Interval,
*statistically significant at p value <0.05

DISCUSSION

This study aimed to assess the knowledge of general dental practitioners (GDPs) compared to pediatric

dentists (PDs) and endodontists (EDs) regarding the emergency management of traumatic dental injuries (TDIs) and the application of International Association of Dental Trauma (IADT) guidelines in a sample of dentists in Alexandria, Egypt. The results showed a statistically significant difference in knowledge between GDPs and both EDs and PDs, thus the null hypothesis was rejected.

In this study the participants were approached via email and GDPs and specialists' groups on social media platforms. Owing to the nature of our sample that requires participants who are likely to possess certain characteristics, we had to include a representative sample from public hospitals. Therefore, when very few responses were received from dentists working in public hospitals, an investigator approached them in person at the public hospitals to ensure they fill in the questionnaire via link or QR code. In the current study, more than half of the participants (55%) stated that they rarely encountered traumatic events in their daily practice. This is consistent with previous studies (15-17) that have shown that TDIs occur infrequently and often catch practitioners unprepared for proper management. This lack of preparedness could be attributed to the lack of parental knowledge and proper attitude towards dealing with TDIs in children so they less frequently access dental care in these cases and therefore the GDPs are less exposed to such situations. Consequently, when they occasionally face them, they are probably unprepared to provide proper management due to lack of clinical experience.

The study reported that the knowledge score was significantly associated with the dental specialty, with a higher percentage of GDPs showing poor knowledge compared to EDs and PDs. This is probably because dental curricula rarely allow students to evaluate and manage acute TDIs. Due to this lack of exposure, graduating dentists are mostly undertrained and ill-prepared to handle oral trauma and their experience level is mostly based on education, prior knowledge, and months of internship. Moreover, complicated cases are most often referred to specialists in workplaces (18). Knowledge was also associated with the dentists' self-assessment of their knowledge about TDIs, with those who assessed their knowledge as comprehensive or sufficient having a higher knowledge score than those who assessed their knowledge as fragmentary. This is probably because specialists already have the knowledge and will be able to assess its level; however, GDPs lack the knowledge at the first place to assess its level. On the other hand, knowledge score was not significantly associated with the location of professional practice, gender, age, qualification, frequency of patients, attendance, or

willingness to receive training in TDI management. This is consistent with previous studies conducted in the United Kingdom and the United Arab Emirates (11, 19), which also found that specialization was a significant factor in knowledge about emergency management of dental trauma cases and no statistically significant difference was found between traumatology knowledge, gender, age group, attending educational courses in dental trauma, and frequency of trauma cases. Nonetheless, the results do not align with a study conducted in Iran (15), which reported that the rare frequency of patients in dental practice and the participants' attendance of educational dental traumatology courses did indeed have a statistically significant effect on their knowledge.

Regarding specific aspects of TDI management, GDPs knowledge about the use of calcium hydroxide or mineral trioxide aggregate (MTA) as a medicament for uncomplicated crown fractures of immature teeth followed by glass ionomer cement was considered satisfactory (almost 70%), compared to PDs (<80%) and EDs (<90%). This is likely because this type of fracture is more commonly encountered and easily managed by dental practitioners. These findings align with the recommendations from Krastl et al. (20) and the IADT guidelines (8) regarding immediate dentin protection with calcium hydroxide after injury. On the other hand, less than 50% of GDPs answered correctly regarding the management of complicated crown fractures, extrusion, avulsed primary teeth, critical time for replantation of avulsed permanent teeth, treatment of uncomplicated crown fractures, root fractures, intrusion, avulsion of permanent teeth, and splinting duration. This is inconsistent with the current guidelines of the IADT (8), which recommend partial pulpotomy as the treatment of choice for complicated crown fractures in immature teeth with large pulp exposures (>2 mm) or when the pulp has been exposed to the oral environment for more than 24 hours.

General dental practitioners showed the least knowledge regarding root fractures, while the highest knowledge was observed in EDs followed by PDs. . The recommended treatment for root fractures was immediate repositioning and splinting for a period of 3 to 4 weeks and at least followed up for 1-year, with root canal treatment performed if the coronal segment shows necrosis. This contradicts the findings of Cvek et al. (21), who suggested that prognosis can be enhanced through prompt treatment and careful management of the root segments. Moreover, they showed that obturation of both the coronal and the apical fragments leads to failure, while using interappointment calcium hydroxide dressing

followed by root canal filling limited to the coronal segment seems to be the most effective treatment approach.

Less than half of GDPs and EDs, compared to nearly 60% of PDs, would wait for spontaneous re-eruption of intruded teeth with incomplete root formation. This contradicts the findings of Andreasen et al. (22), who reported that the long-term outcome of surgical exposure and endodontic treatment followed by orthodontic repositioning in cases of severe intrusive luxation was satisfactory. Similarly, very poor knowledge was reported for GDPs and EDs, compared to PDs, in the case of extrusion of mature permanent teeth, with nearly 65% of PDs choosing immediate repositioning and splinting as the method of choice for management.

The stage of root development at the time of injury, the duration of extra-alveolar time, and the storage medium are the most crucial factors for the long-term success of a replanted avulsed tooth (23, 24). In this study, most of the EDs have sufficient knowledge about managing avulsed teeth with complete root formation with extra -oral time exceeding 1 hour, while more than half of the PDs and most of the GDPs lack knowledge in this area. A determining element that can affect the prognosis of traumatized teeth is the time factor (25). Most EDs and PDs prefer to replant the avulsed tooth immediately at the accident site rather than in the dental office as this would reduce the risk of replacement root resorption and external inflammatory root resorption (5, 26). However, if the tooth is replanted incorrectly by untrained individuals, it may increase the risk of failure. Therefore, patients should seek immediate expert assistance at or near the scene of the injury. The rate of GDPs agreeing with this method was 44.36%, which is lower than the 67% agreement reported by Akhlaghi et al. (15). It is noteworthy that less than 30% of GDPs possess knowledge about the appropriate splinting time and duration after reimplantation. This finding aligns with previous studies, which reported that 10-30% of clinicians would splint the tooth for 7-10 days (11, 27), and lower than that reported by Akhlaghi et al. (15).

According to the published guidelines (24-26), endodontic treatment within 7 to 14 days after replantation of an avulsed mature tooth replanted within less than 1 hour is the best treatment approach. However, only 25% of the GDPs in this study correctly stated this. This contradicts the findings of Akhlaghi et al (15), who reported that over 50% of the clinicians would perform endodontic treatment within this timeframe. Both EDs and PDs in this study demonstrated sufficient knowledge on the previous topics, with PDs having higher knowledge

in splinting time and duration, and antibiotic prescription. On the other hand, only EDs showed higher knowledge regarding the timing of endodontic treatment. Almost half of the GDPs reported that the management approach for an avulsed primary tooth is different from that of a permanent tooth. Most EDs and PDs stated that they would not replant an avulsed primary tooth. This corresponds to the findings of Akhlaghi et al (15) and is in line with the current guidelines and recommendations of the IADT (24).

The results of the present study showed that the majority of participants (67%) described their knowledge as fragmentary, which is consistent with other published studies (15,28,). It is worthy to mention that thorough initiatives should be taken to enhance the understanding of GDPs regarding emergency management of TDIs in children. This can be achieved through postgraduate educational courses and the distribution of approved IADT guidelines in the form of booklets and posters in dental clinics of public hospitals, aiming to improve the knowledge of clinicians and the general public. Additionally, specialized TDI centers with qualified staff could be established to provide 24-hour treatment, particularly for emergency situations. General Dental Practitioners should also be made aware of the availability of online assistance through the IADT website (15, 20, 29).

The lack of estimates for the number of specialists in Alexandria made it difficult to stratify our sample, which was considered a constraint to this study. However, despite that this study was an exploratory study, and could be a foundation for future studies with larger sample size and wider distribution, it had enough power to detect the significant difference between participants with this calculated sample. Further studies are recommended with larger stratified sample and further research is advised on the effectiveness of trauma-management courses in improving clinician expertise to ensure that such training is extended to all GDPs in Alexandria, Egypt.

CONCLUSIONS

General dental practitioners in Alexandria showed a significant poor level of knowledge regarding management of traumatic dental injuries compared to EDs and PDs who showed a higher knowledge level with no significant difference between both specialties. The knowledge score was found to be significantly associated with the dental specialty, location of the current professional practice, gender, and dentists' self-assessment. The knowledge level of those working in public hospitals was low compared to those working in university hospitals or private offices. Additionally, males had a significantly lower

knowledge score than females, and dentists who assessed their knowledge as comprehensive or sufficient had a higher knowledge score than those who assessed their knowledge as fragmentary.

ACKNOWLEDGMENTS

The author is profoundly grateful to Ahmed Aldrainy, Muhammed Yasser, and Hisham Elgezawy, senior students in the Faculty of Dentistry, Pharos University in Alexandria Egypt, for their great help in the data collection. The author also extends the thanks to Dr. Amira Elhousseiny, Assistant lecturer of Dental Public Health, Faculty of Dentistry, Alexandria University, Egypt, for performing the sample size calculation and the statistical analysis of this study.

FUNDING

There is no funding to declare.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no competing interests.

REFERENCES

1. Glendor U. Epidemiology of traumatic dental injuries – a 12-year review of the literature. *Dent Traumatol.* 2008; 24:603–11.
2. Soriano EP, Caldas AdF, Carvalho MVDD, Amorim Filho HDA. Prevalence and risk factors related to traumatic dental injuries in Brazilian school children. *Dent Traumatol.* 2007;23:232-40.
3. Andreasen JO, Andreasen FM. Dental traumatology: quo vadis. *Endod Dent Traumatol* 1990; 6:78-80.
4. Andreasen JO, Andreasen FM, Andersson L. Textbook and color atlas of traumatic injuries to the teeth, 4th ed. Copenhagen: Munksgaard; 2007.
5. Oliveira MC, Hernandez PAG, Kramer PF. A retrospective study of oral and maxillofacial injuries in an emergency hospital in Southern Brazil. *Braz Res Pediatr Dent Integr Clin.* 2016; 16:339-50.
6. Flores MT. Traumatic injuries in the primary dentition. *Dent Traumatol* 2002; 18: 287– 98.
7. De Amorim LD, Da Costa LR, Estrela C. Retrospective study of traumatic dental injuries in primary teeth in a Brazilian specialized pediatric practice. *Dent Traumatol.* 2011; 27:368–373.
8. Di Angelis AJ, Andreasen JO, Ebeleseder KA et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations of permanent teeth. *Dent Traumatol.* 2012; 28:2–12.
9. Arhakis A, Athanasiadou E, Vlachou C. Social and psychological aspects of dental trauma, behavior management of young patients who have suffered dental trauma. *Open Dent J.* 2017; 11:41-7.
10. Ravikumar D, Jeevanandan G, Subramanian EMG. Evaluation of knowledge among general dentists in treatment of traumatic injuries in primary teeth: A cross-sectional questionnaire study. *Eur J Dent.* 2017; 11:232-237.
11. Kostopoulou MN, Duggal MS. A study into dentists' knowledge of the treatment of traumatic injuries to young permanent incisors. *Int J Paediatr Dent* 2005; 15:10–19.
12. Re D, Augusti D, Paglia G, Augusti G, Cotti E. Treatment of traumatic dental injuries: evaluation of knowledge among Italian dentists. *Eur J Paediatr Dent* 2014; 15:23-8.
13. Hussien M., Waly N., El Shiekh M. Evaluation of Knowledge- Attitude- Practice (KAP) of Intern Dentists in Emergency Management of Traumatic Dental Injuries in Primary Anterior teeth: A Cross-sectional Study. *ADJC.* 2021; 3: 54-62.
14. Sample Size Calculator. <https://www.calculator.net/sample-size-calculator.html>. Accessed 15 Dec 2022.
15. Akhlaghi N, Nourbakhsh N, Khademi A, Karimi L. General Dental Practitioners' Knowledge about the Emergency Management of Dental Trauma. *Iran Endod J.* 2014;9:251-6.
16. Garcia-Godoy F, Pulver F. Treatment of trauma to the primary and young permanent dentitions. *Dent Clin North Am.* 2000;4:597-632.
17. Krastl G, Filippi A, Weiger R. German general dentists' knowledge of dental trauma. *Dent Traumatol.* 2009;25:88-91.
18. Townsend, J., King, B., Ballard, R., Armbruster, P. & Sabey, K. Interdisciplinary approach to education : preparing general dentists to manage dental trauma. 2017;33:143–148.
19. Alyasi M, Al Halabi M, Hussein I, Khamis AH, Kowash M. Dentists' knowledge of the guidelines of traumatic dental injuries in the United Arab Emirates. *Eur J Paediatr Dent.* 2018;19:271-6.
20. Krastl G, Filippi A, Weiger R. Initial management of dental trauma: musts, shoulds, and cans. *Quintessence International* 2020;51:763–74.
21. Cvek M, Mejare I, Andreasen JO. Conservative endodontic treatment of teeth fractured in the middle or apical part of the root. *Dent Traumatol.* 2004;20:261-9.
22. Andreasen JO, Bakland LK, Andreasen FM. Traumatic intrusion of permanent teeth. Part 3. A clinical study of the effect of treatment variables such as treatment delay, method of repositioning, type of splint, length of splinting and antibiotics on 140 teeth. *Dent Traumatol.* 2006;22:99-111.
23. Zhao Y, Gong Y. Knowledge of emergency management of avulsed teeth: a survey of dentists in Beijing, China. *Dent Traumatol.* 2010;26:281-4
24. 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;28:88-96
25. Andreasen JO, Andreasen FM, Mejare I, Cvek M. Healing of 400 intra-alveolar root fractures. 2. Effect of treatment factors such as treatment delay, repositioning, splinting type and period and antibiotics. *Dent Traumatol.* 2004;20:203-11.
26. Andreasen JO, Andreasen FM, Skeie A, Hjørting-Hansen E, Schwartz O. Effect of treatment delay upon pulp and periodontal healing of traumatic dental injuries—a review article. *Dent Traumatol.* 2002;18:116-28.
27. Hamilton FA, Hill FJ, Holloway PJ. An investigation of dento-alveolar trauma and its treatment in an adolescent population. Part 2: Dentists' knowledge of management methods and their perceptions of barriers to providing care. *Br Dent J.* 1997;182:129-33.
28. Loh T, Sae-Lim V, Yian TB, Liang S. Dental therapists' experience in the immediate management of traumatized teeth. *Dent Traumatol.* 2006;22:66-70.
29. Jackson NG, Waterhouse PJ, Maguire A. Management of dental trauma in primary care: a postal survey of general dental practitioners. *Br Dent J.* 2005;198:293-7.