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# Effect of dental trauma management resources on dental practitioners' confidence and knowledge: A pilot cross-sectional study

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## Abstract

**Background/Aim:** The knowledge of standardized care guidelines is critical to the confidence of practitioners in managing dental trauma. Therefore, the aim of this study was to assess the awareness, use and impact of the International Association of Dental Traumatology guidelines, and the online Dental Trauma Guide on general dental practitioners' self-reported confidence and knowledge in managing traumatic dental injuries in the primary and permanent dentitions.

**Materials and Methods:** A cross-sectional, pre-piloted, 27-item self-administered questionnaire survey was distributed electronically to general dental practitioners' working within five member states of the Gulf Cooperation Council countries (Kingdom of Bahrain, Kingdom of Saudi Arabia, Kuwait, Oman, and Qatar) between September and December 2020. Data were collected and analysed using descriptive statistics and Wilcoxon Signed Rank test analysis for relevant comparisons.

**Results:** A total of 294 respondents completed the survey, with the majority being from the Kingdom of Saudi Arabia (47.4%) and Qatar (27.3%). A lack of evidence-based knowledge in managing traumatic dental injuries was evident among more than half of the respondents. Respondents who were cognizant of the recent International Association of Dental Traumatology guidelines (2020) and those who use the Dental Trauma Guide routinely demonstrated a higher self-reported confidence level in managing both simple and complex primary dentition trauma, as well as simple traumatic dental injuries in the permanent dentition ($p < .05$).

**Conclusion:** This survey highlights critical deficiencies in the knowledge of a large number of the respondents in the management of dental trauma which is likely to cause irreversible long-term patient effects.

KEYWORDS
confidence, cross-sectional study, dental trauma, knowledge, resources

## 1 | INTRODUCTION

Traumatic dental injuries (TDIs) have recently been ranked as the second most frequent oral health problem of public health concern after dental caries, with a high prevalence among children and young adolescents.[1] In a recent comprehensive review, it was reported that more than one billion people worldwide had suffered TDIs, with an average worldwide prevalence of 22.7% and 15.2% in the primary and permanent dentitions respectively.[1]

Adequate diagnosis, treatment planning, and timely intervention are essential to improve the overall prognosis and success of the treatment of traumatized teeth.[2] Unfortunately, lack of treatment of TDIs, treatment delay, or poor treatment can significantly compromise the overall prognosis and ultimately lead to pulp necrosis,[3,4] consequently increasing long-term treatment costs.[5,6] To achieve optimal clinical success, high levels of evidence-based knowledge by dental health providers regarding the management of TDIs are essential. Unfortunately, previous studies have demonstrated a low to moderate level of knowledge amongst general dental practitioners' (GDPs) in the clinical management of TDIs worldwide.[6–11] Referrals of TDIs to dental specialists were reported to be specifically related to complications following the initial treatment, which was deemed clinically unsatisfactory or inappropriate.[12]

Therefore, to improve the management of TDIs, the International Association of Dental Traumatology (IADT) first developed evidence-based guidelines in 2001 to assist clinicians with the diagnosis, management, and treatment of TDIs in both the primary and permanent dentitions. These guidelines are periodically updated following knowledge advancements in the field, with the most recent update being in 2020.[13–16] The IADT guidelines are an extremely valuable source of information that guide clinicians toward the correct clinical decision making and ultimately improved patient outcomes.[17] Furthermore, an interactive web-based tool for evidence-based TDIs management is the Dental Trauma Guide (DTG), produced in cooperation between the Department of Oral and Maxillofacial Surgery at the University Hospital of Copenhagen and the Resource Centre for Rare Oral Diseases, which was developed in 2008. The DTG is regarded as an excellent scientific-based resource that is easy to use and it guides the clinician to the correct diagnosis and the appropriate treatment.[18] Additional advantages of the DTG include the provision of both visual and animated documentation of treatment steps, and it provides patients with prognosis estimations.

Although both of the above mentioned resources are widely utilized in the developed western countries, little is known about their use in five state members of the Gulf Cooperation Council countries (namely Kingdom of Bahrain, Kingdom of Saudi Arabia, Kuwait, Oman, and Qatar), excluding the United Arab Emirates. Therefore, the aim of this pilot cross-sectional study was to assess the awareness, use and impact of the IADT guidelines and the online DTG on GDPs self-reported confidence and knowledge in managing TDIs in the primary and permanent dentitions.

## 2 | MATERIALS AND METHODS

This cross-sectional observational study was approved by the Institutional Review Board Committee at Princess Norah Bint Abdulrahman University, Kingdom of Saudi Arabia (Reference no. 20-0182). An electronic questionnaire comprising 27 closed ended questions was designed using Online Surveys (previously known as Bristol Online Survey tool) and piloted on a small group of GDP's and specialists for face and content validity prior to use.

The questionnaire consisted of two parts. Part I addressed the professional and socio-demographic profiles of the respondents, including gender, age, main practice setting, years of experience, attendance at continuing education courses on dental trauma, and self-reported confidence in the management of TDIs affecting the primary and permanent dentitions (on a 5-point Likert scale, from 1 being a complete lack of confidence to 5 being very confident). The self-confidence responses were computed for simple (uncomplicated and complicated crown fractures, concussion, and subluxation injuries) and complex (crown-root fracture, root fracture, alveolar bone fracture, lateral luxation, intrusion, extrusion, and avulsion) injuries using average self-reported confidence responses. Additional information collected included the respondents' awareness of the recent update of the IADT guidelines (2020) as well as their awareness and use of the online DTG. Part II of the questionnaire consisted of two clinical case scenarios, the aim was to assess the respondents' knowledge on the evidence-based management of traumatized primary and permanent teeth according to the IADT guidelines.

The questionnaire was circulated electronically to GDPs working within the five member states of the Gulf Cooperation Council countries through, where possible, the country's official registration bodies such as the Kuwaiti Dental Council, the Saudi Commission for Health Specialities, and the Qatari Department of Healthcare Professionals. Circulation of the survey in Oman was conducted through social media/personal contact lists, while in Bahrain, circulation was done through the DLS Bahrain Conferences and Exhibitions organization member's contact list. As a recent knowledge-based survey was conducted in the United Arab Emirates,[7] it was not included in this survey and relevant comparisons will be discussed. This survey was conducted between September and December 2020, with a reminder email sent in November 2020. Participation in the study was voluntary, all responses were anonymous, and no individual follow-up was carried out.

Descriptive statistics were used to summarize the characteristics of survey respondents and their responses. Self-reported confidence levels of the management of simple and complex cases were compared using Wilcoxon Signed Rank test. Statistical analysis was performed using STATA 15 (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC.), with statistical significance set at $p < .05$.

## 3 | RESULTS

Following the exclusion of non-GDP respondents and data cleaning, 294 responses were eligible for final analysis. The majority of the respondents were from the Kingdom of Saudi Arabia (47.4%) and Qatar (27.3%), with small numbers from the Kingdom of Bahrain, Kuwait, and Oman (Figure 1).

The professional and demographic profiles of the respondents are presented in Table 1. More than half of the respondents (59%, $n = 147$) worked in private practice and the remaining respondents either practised in governmental health care sectors (33.3%, $n = 83$) or university settings (7.6%, $n = 19$). Exposure to dental trauma cases was generally low among respondents with the majority (78.7%, $n = 196$) treating on average 0–4 trauma cases over the immediate past 3-months period. In addition, three-quarters of the respondents (74.3%, $n = 185$) had reported no previous structured training in dental trauma management while 69.1% ($n = 172$) had not attended dental trauma continuing education courses over the immediate past year. Of interest, pediatric dental specialist's support was available in the individual's workplace for 41.8% ($n = 104$) of respondents.

For ease of reporting and analysis, TDIs were grouped into simple (uncomplicated and complicated crown fractures, concussion, and subluxation) and complex (crown-root fracture, root fracture, alveolar bone fracture, lateral luxation, intrusion, extrusion, and avulsion) injuries. Self-reported confidence levels of the respondents toward the management of simple and complex TDIs in the primary and permanent dentitions are presented in Table 2. Overall, self-reported confidence levels were significantly lower for the management of complex injuries compared with simple injuries in both the primary and permanent dentitions ($p < .05$). Furthermore, respondents were significantly less confident in managing primary teeth injuries compared with permanent teeth ($p < .05$).

The results also revealed that respondents working in government sectors and private practices had higher self-reported confidence levels in comparison with those in university settings. In addition, significantly higher self-reported confidence levels for the management of permanent dentition complex TDIs were seen in those with >28 working hours per week, > five years of experience, or those who were exposed to more trauma cases, received dental trauma training, and had attended dental trauma continuing education courses over the past year.

The respondents' knowledge of the evidence-based management of TDIs affecting the primary and permanent dentitions was also evaluated using two common clinical scenarios. A lack of evidence-based knowledge on the appropriate management of complicated crown fractures in permanent teeth and intrusion of primary teeth was demonstrated in 49.4% ($n = 123$) and 43.8% ($n = 109$) of the respondents, respectively (Table 3).

In addition, almost half of the respondents (48.6%, $n = 121$) expressed an interest in attending online dental trauma management courses with 32.1% ($n = 80$) more inclined toward hands-on courses, while only 16.5% ($n = 41$) preferred traditional face-to-face lectures.

Respondents awareness of both the updated IADT guidelines (2020), and the DTG was also assessed (Figure 2). More than half of the respondents (54.6%, $n = 136$) were unaware of the recent IADT updated guidelines, and only 12.9% ($n = 32$) had read the recent guidelines. With regard to the DTG, a similar pattern was seen where 55.0% ($n = 137$) of the respondents were unaware of this online tool and only 21.7% ($n = 54$) were aware of, and utilized this guide.

Respondents who were cognizant of the recent IADT guidelines update (2020) as well as those who use the DTG routinely in their practice demonstrated a higher self-reported confidence level in managing both simple and complex primary dentition trauma, as well as simple TDIs in the permanent dentition ($p < .05$).

The frequency of DTG use among respondents for the management of different traumatic dental injury types is illustrated in Figure 3. Overall, a higher frequency of use for the permanent dentition compared with the primary dentition was evident. In addition, of those who use the DTG, a combined higher frequency of use for complex cases, such as lateral luxation (87.1%, $n = 47$) and extrusion injuries (85.3%, $n = 46$) compared with simple cases, such as uncomplicated crown fractures (59.4%, $n = 32$), was apparent.

The respondents who were aware of the DTG but did not use it indicated various reasons with the majority reporting low numbers of dental trauma cases seen in their daily practice (75.9%, $n = 44$)

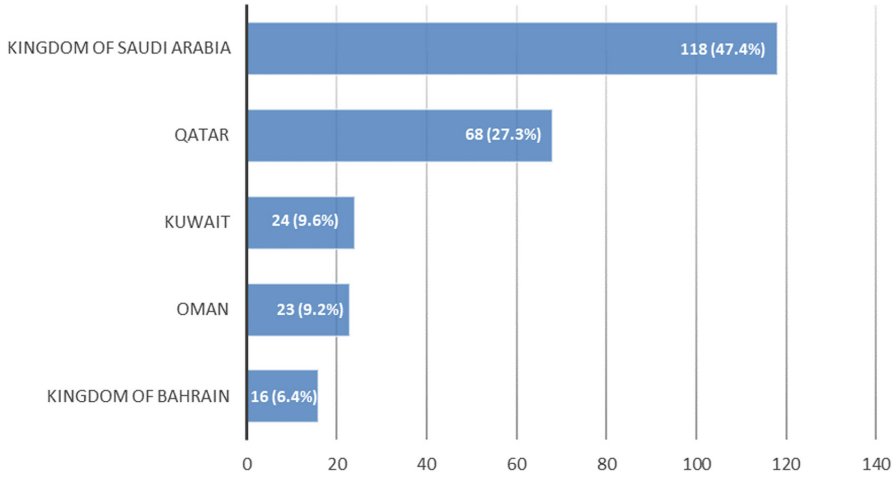



**FIGURE 1** Bar chart representing the respondents' country of practice

**TABLE 1** Demographic and professional profiles of the respondents

| Demographic/professional profiles | Frequency (%) |
|---|---|
| Gender | |
| Female | 154 (61.8%) |
| Male | 95 (38.2%) |
| Age | |
| 20–30 | 78 (31.3%) |
| 31–40 | 96 (38.6%) |
| 41–49 | 49 (19.7%) |
| 50 and above | 26 (10.4%) |
| Place of practice | |
| Government sector | 83 (33.3%) |
| Private practice | 147 (59.0%) |
| University teaching hospital | 19 (7.6%) |
| Number of hours in practice per week | |
| Up to 7 h | 23 (9.2%) |
| Between 8–14 h | 22 (8.8%) |
| Between 15–21 h | 15 (6.0%) |
| Between 22–28 h | 24 (9.6%) |
| Between 29–35 h | 165 (66.3%) |
| Years of experience | |
| Less than 5 years | 81 (32.5%) |
| 6–10 years | 51 (20.5%) |
| 11–20 years | 75 (30.1%) |
| More than 21 years | 42 (16.9%) |
| Number of trauma cases over a 3-month period | |
| 0–4 cases | 196 (78.7%) |
| 5–12 cases | 41 (16.5%) |
| 13–24 cases | 8 (3.2%) |
| More than 24 cases | 4 (1.6%) |
| Total | 249 (100%) |

as shown in Figure 4. In addition, respondents who were unaware of the DTG mainly used guidance from a local protocol for trauma management (62%, $n = 85$), or they used physical copies of the IADT guidelines either on their own (14.6%, $n = 20$) or in combination with local protocols (24.1%, $n = 33$). The remainder used resources such as textbooks or they did not refer to any of the above.

## 4 | DISCUSSION

Despite the high worldwide prevalence of TDIs, there is a paucity of information on the impact of dental trauma management resources on GDPs self-reported confidence and knowledge in the management of TDIs in developing countries. This cross-sectional study design was the first to evaluate the awareness, use and the impact of IADT guidelines, and the online DTG on GDPs self-reported confidence and knowledge in managing TDIs of GDPs who work within the five member states of the Gulf Cooperation Council countries (excluding the United Arab Emirates).

The clinical adoption and adherence to an evidence-based approach in dental trauma management is of paramount importance.[17] The IADT guidelines are widely recognized as the gold standard evidence-based dental trauma management guidelines,[17] and they have been adopted by several dental organizations such as the British Society of Paediatric Dentistry, the American Academy of Paediatric Dentistry, and the European Academy of Paediatric Dentistry. These guidelines are translated into 16 languages in order to improve access and utilization of dentists worldwide. The interactive online DTG, developed by experts on the management of dental trauma and based on the current IADT guidelines, aims to help busy dentists easily obtain specific trauma management steps without having to read through pages of information.

The results of this survey highlighted the positive impact of the online IADT guidelines and DTG online resources on respondents' self-reported confidence in managing complex dental trauma cases. To the best of the authors' knowledge, no studies to date have assessed GDPs self-reported confidence in management of dental trauma, with the focus of assessment within the available literature being on practitioners' knowledge rather than confidence. While having the correct knowledge in management of traumatic injuries is extremely important, if this is not combined with confidence during the management process, it can negatively impact the overall treatment outcome as practitioners may hesitate during treatment or refer the case due to their lack of confidence. This is especially pertinent during scenarios where treatment time is a crucial factor which consequently affects prognosis. The availability of online easily accessible resources can help boost GDPs confidence in managing TDIs. This is essential and beneficial, especially since emergency treatment for TDIs often has to be fitted into a busy clinical schedule.

The results of this survey highlight a concerning lack of knowledge demonstrated by a large proportion of the respondents. The first clinical scenario focused on treatment of an immature permanent tooth with a complicated crown fracture 2 days after the injury. An alarming number of GDPs (28.9%, $n = 72$) would remove the pulp from this immature tooth which otherwise could have been simply treated using a partial pulpotomy. When the same clinical scenario was presented in a survey in the United Arab Emirates, a similarly low level of knowledge was reported in which only 33% ($n = 98$) of the respondents answered correctly.[7] Removing the pulp from an immature tooth at such an age would result in a lifelong burden as a result of the high chance of cervical root fractures associated with root-treated immature teeth. Currently used management techniques such as calcium hydroxide apexification and the mineral trioxide aggregate apical plug technique do not improve the crown-root ratios and may result in tooth loss.[19,20] The use of regenerative endodontic treatment, although promising, remains unpredictable.[21,22]

For the second clinical scenario, which focused on the treatment of an intruded primary tooth, a large number of respondents (35.8%, $n = 89$) reported that they would extract the intruded primary tooth.

**TABLE 2** Confidence levels of the respondents toward the management of simple and complex traumatic dental injuries in the primary and permanent dentitions

| | Primary teeth | | | Permanent teeth | | | *p*-value | |
|---|---|---|---|---|---|---|---|---|
| | Simple injuries | Complex injuries | *p*-value | Simple injuries | Complex injuries | *p*-value | | |
| | Median (IQR) | Median (IQR) | (simple vs complex) | Median (IQR) | Median (IQR) | (simple vs complex) | Primary vs permanent teeth (simple injuries) | Primary vs permanent teeth (complex injuries) |
| Total | 3.8 (1.3) | 3.1 (1.4) | <.001 | 4.0 (1.3) | 3.3 (1.6) | <.001 | <.001 | <.001 |
| Place of practice | | | | | | | | |
| Government sector | 4.0 (1.3) | 3.1 (1.6) | <.001 | 4.3 (1.5) | 3.3 (1.4) | <.001 | .003 | .302 |
| Private practice | 4.0 (1.3) | 3.1 (1.6) | <.001 | 4.0 (1.0) | 3.3 (1.4) | <.001 | <.001 | .005 |
| University teaching hospital | 3.5 (1.3) | 2.1 (0.6) | <.001 | 4.0 (1.3) | 2.3 (1.6) | .008 | .001 | .038 |
| *p*-value | .026 | <.001 | | .129 | .002 | | | |
| Number of hours in practice per week | | | | | | | | |
| < 28 hours | 3.5 (1.0) | 2.7 (1.4) | <.001 | 4.0 (1.4) | 3.0 (1.4) | <.001 | <.001 | .127 |
| ≥ 28 hours | 4.0 (1.3) | 3.3 (1.4) | <.001 | 4.0 (1.3) | 3.4 (1.1) | <.001 | <.001 | .002 |
| *p*-value | .012 | .003 | | .105 | .003 | | | |
| Years of experience | | | | | | | | |
| Less than 5 years | 3.5 (1.0) | 2.4 (1.1) | <.001 | 4.0 (1.5) | 2.4 (1.4) | <.001 | <.001 | .297 |
| 6–10 years | 4.0 (1.8) | 3.3 (1.4) | <.001 | 4.0 (2.0) | 3.1 (1.4) | <.001 | .035 | .183 |
| 11–20 years | 3.8 (1.3) | 3.1 (1.3) | <.001 | 4.0 (1.3) | 3.6 (1.1) | <.001 | <.001 | .002 |
| More than 21 years | 4.1 (1.0) | 3.9 (1.1) | <.001 | 4.4 (1.0) | 4.0 (1.0) | <.001 | .160 | .326 |
| *p*-value | .003 | <.001 | | .028 | <.001 | | | |
| Number of trauma cases over a 3-month period | | | | | | | | |
| ≤ 4 cases | 3.8 (1.3) | 3.1 (1.6) | <.001 | 4.0 (1.3) | 3.1 (1.6) | <.001 | <.001 | .008 |
| > 4 cases | 4.0 (1.3) | 3.4 (1.4) | <.001 | 4.0 (1.0) | 3.7 (1.6) | <.001 | .209 | .023 |
| *p*-value | 0.884 | 0.090 | | 0.942 | 0.035 | | | |
| Attended training on dental trauma management | | | | | | | | |
| No | 3.8 (1.5) | 3.1 (1.6) | <.001 | 4.0 (1.3) | 3.1 (1.6) | <.001 | <.001 | .002 |
| Yes | 4.0 (1.0) | 3.4 (1.4) | <.001 | 4.4 (1.3) | 3.6 (1.3) | <.001 | .001 | .123 |
| *p*-value | .072 | .008 | | .024 | .035 | | | |

(Continues)

TABLE 2 (Continued)

| | Primary teeth | | | Permanent teeth | | | *p*-value | |
|---|---|---|---|---|---|---|---|---|
| | Simple injuries | Complex injuries | *p*-value | Simple injuries | Complex injuries | *p*-value | | |
| | Median (IQR) | Median (IQR) | (simple vs complex) | Median (IQR) | Median (IQR) | (simple vs complex) | Primary vs permanent teeth (simple injuries) | Primary vs permanent teeth (complex injuries) |
| Attended continuing education courses in the past year | | | | | | | | |
| No | 3.8 (1.5) | 3.0 (1.5) | <.001 | 4.0 (1.0) | 3.1 (1.6) | <.001 | <.001 | .001 |
| Yes | 4.0 (1.3) | 3.4 (1.6) | <.001 | 4.3 (1.5) | 3.6 (1.7) | <.001 | .039 | .319 |
| *p*-value | .010 | .001 | | .064 | .012 | | | |
| Availability of paediatric dental specialist support | | | | | | | | |
| No | 3.8 (1.3) | 3.1 (1.4) | <.001 | 4.0 (1.3) | 3.1 (1.4) | <.001 | <.001 | .001 |
| Yes | 4.0 (1.3) | 3.1 (1.6) | <.001 | 4.0 (1.1) | 3.3 (1.7) | <.001 | <.001 | .133 |
| *p*-value | .400 | .980 | | .444 | .796 | | | |
| Awareness of the IADT guidelines (2020) | | | | | | | | |
| Aware and have not read it | 4.0 (1.3) | 3.3 (1.3) | <.001 | 4.0 (1.0) | 3.4 (1.1) | <.001 | <.001 | .015 |
| Aware and have read it | 4.4 (1.4) | 3.9 (1.9) | .004 | 4.8 (1.1) | 4.0 (2.7) | <.001 | .235 | .826 |
| Unaware | 3.8 (1.4) | 3.0 (1.4) | <.001 | 4.0 (1.1) | 3.1 (1.4) | <.001 | <.001 | .008 |
| *p*-value | .031 | .013 | | .023 | .092 | | | |
| Awareness of the online DTG | | | | | | | | |
| Unaware | 3.8 (1.3) | 3.0 (1.4) | <.001 | 4.0 (1.0) | 3.1 (1.4) | <.001 | <.001 | <.001 |
| Aware and use it | 4.1 (1.5) | 3.7 (1.7) | <.001 | 4.5 (1.3) | 3.6 (2.1) | <.001 | .026 | .843 |
| Aware but do not use it | 4.0 (1.3) | 3.4 (1.1) | <.001 | 4.0 (1.5) | 3.4 (1.1) | <.001 | .102 | .309 |
| *p*-value | .004 | .004 | | .004 | .165 | | | |

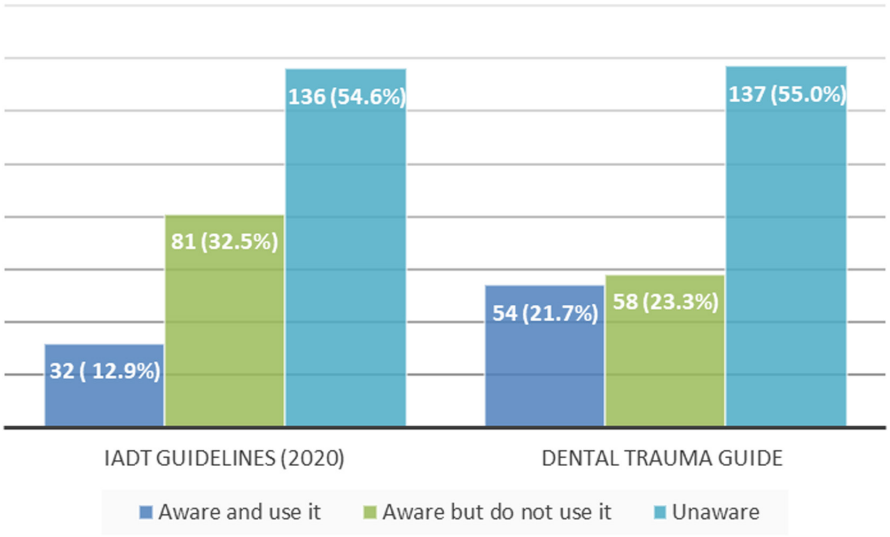
Abbreviations: DTG, Dental Trauma Guide; IADT, International Association of Dental Traumatology; IQR, interquartile range.

TABLE 3 Assessment of the respondents' knowledge toward the management of two specific clinical cases

| **Case 1: A 7-year-old boy fell at the school 2 days ago. Clinical and radiographic examination revealed a complicated crown fracture affecting the permanent upper left central incisor. What is your pulp management for the above case?** | |
|---|---|
| **Options** | **Frequency (%)** |
| Direct pulp capping | 47 (18.9%) |
| Partial (Cvek) pulpotomy | 126 (50.6%) |
| Pulp extirpation | 72 (28.9%) |
| I do not know | 4 (1.6%) |
| **Case 2: A 4-year-old child fell at school and intruded his upper right central incisor, what would be your recommended treatment?** | |
| **Options:** | **Frequency (%)** |
| Allow the tooth to spontaneously reposition itself, irrespective of the direction of displacement | 137 (55.0%) |
| Extract the intruded tooth | 33 (13.3%) |
| Extract the tooth if intruded lingually | 56 (22.5%) |
| I do not know | 20 (8.0%) |
| Other | 3 (1.2%) |

*Note*: Other: Allow it to erupt spontaneously unless the direction of intrusion is toward the successor path or impinging on it, then it should be extracted; Pulpotomy; Follow-up.

FIGURE 2 Bar chart representing the awareness and usage of dental trauma resources among the respondents




Intruded primary teeth usually re-erupt spontaneously, therefore, extraction is not recommended. Interestingly, a better overall proportion of respondents had correctly answered a similar question in the United Arab Emirates (94.9%, $n = 281$).[7] This difference might be associated with the differences between the two surveys, in which a proportion of specialist pediatric dentists were also included in the above mentioned survey.[7] The IADT guidelines in regard to the management of intruded primary teeth changed in 2020 where spontaneous eruption was recommended. This highlights the need for dental practitioners, irrespective of their level, to keep up to date with the latest guidelines.[14] The unnecessary extraction of such teeth in pre-school children would likely be associated with the use of protective stabilization and/or general anaesthesia with unnecessary cost, risk, and long-term psychological burden on the child and the family.[23]

This study mirrors the results of other knowledge-based surveys undertaken in other parts of the world,[8,24,25] where GDPs were reported to have poor knowledge of evidence-based management of TDIs. Furthermore, in this study, a statistically significant low confidence level among respondents toward the management of complex dental trauma cases compared to simple cases in the primary and permanent dentitions was reported. This might be associated with the low prevalence of complex trauma cases in comparison with simple trauma cases. The higher confidence in managing TDIs reported by those with higher exposure to trauma cases supports this assumption.

The low knowledge and self-reported confidence in the management of dental trauma reported in this survey could stem from several reasons such as the lack of a clinician's prior adequate training and experience in managing dental trauma cases, in addition to

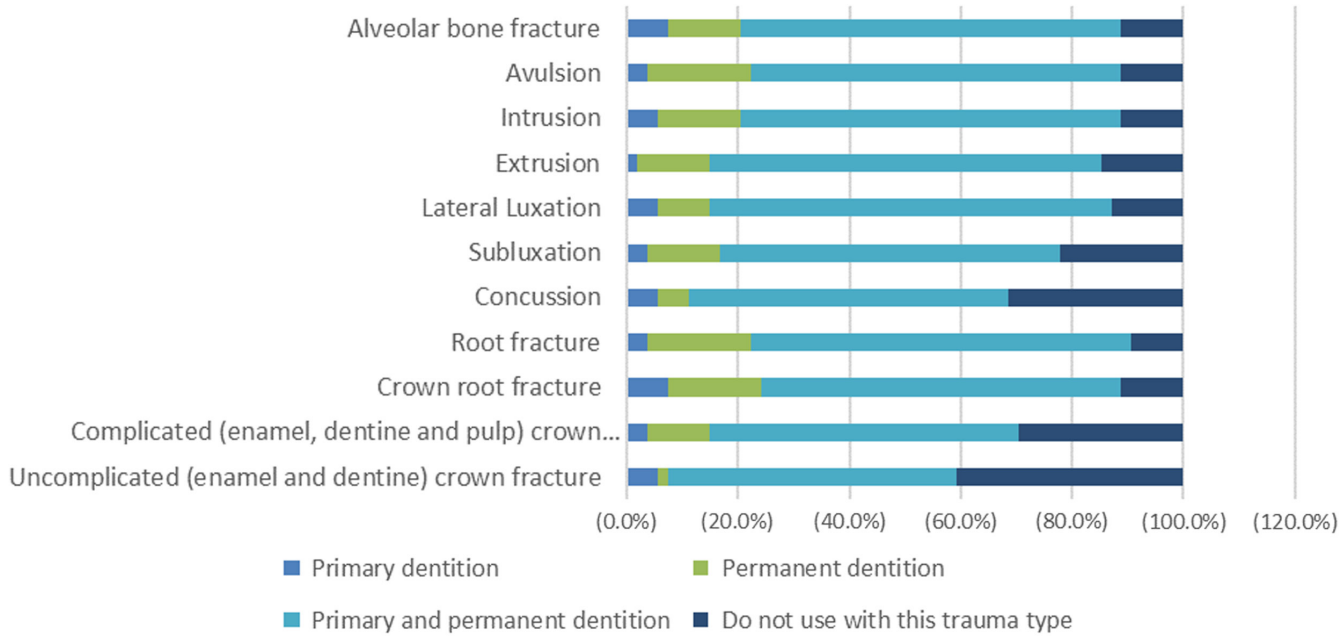



FIGURE 3 Chart representing the frequency of the Dental Trauma Guide use among respondents for the management of various traumatic dental injuries

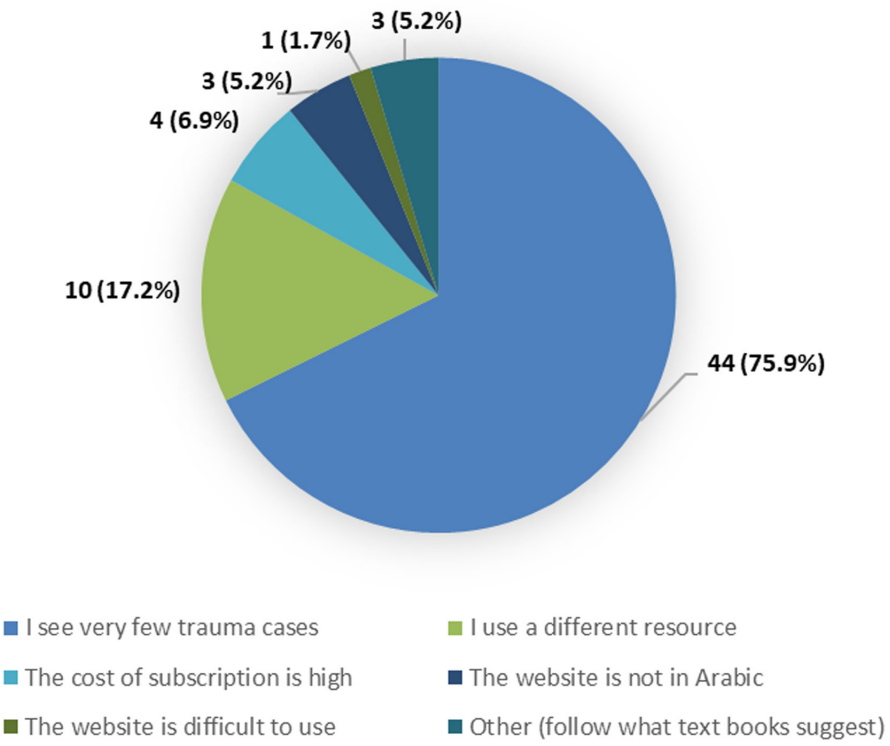



FIGURE 4 Pie chart depicting the reasons given by respondents who were aware of the Dental Trauma Guide but do not use it

the low exposure specifically with more complex cases. In terms of training and education, additional dental trauma education has been reported as a significant positive influence among undergraduate health students,[26] which is in line with the results of this survey where a positive impact of dental trauma training and recent attendance at dental trauma continuing education courses enhanced respondents' overall confidence in managing TDIs. Therefore, GDPs should be encouraged to attend regular dental trauma education courses, including hands-on workshops. A recent survey has highlighted a degree of insufficient undergraduate dental education in the management of TDIs in the pediatric population across the Arabian region.[27] Teaching of dental traumatology to undergraduate students is challenging as presentation of acute dental trauma cases cannot be predicted (or created) to allow adequate hands-on experience for the undergraduate student. Dental students typically learn manual skills by practical training on models, followed by

exposure to live cases in the clinics. There is currently a lack of an interface to teach students (the "hands-on") aspects of dental trauma management before they manage a real-life clinical case. While it is possible to practice some procedures (such as repositioning and splinting of teeth) on a cadaver, there is a limitation of supply and high costs involved. Therefore, the education of recent graduates in dental trauma should ideally be adequate to enable them to react quickly and render the most appropriate treatment to the patient. Other methods, apart from direct clinical exposure, need to be explored to enhance the undergraduate students' understanding and confidence in the management of dental trauma. The DTG website (https://dentaltraumaguide.org) offers an interactive easy access to trauma management information and illustrations which may be an alternative method that can enhance dental trauma management and education beyond graduation. Therefore, incorporation of such resources into the undergraduate curriculum could support GDPs in deciding the appropriate treatment of patients after graduation.

Despite the authors' attempt to obtain a higher response rate through the use of local governmental official communication, local general dental practitioner societies, and social media, the response rate was much less than anticipated. The survey questionnaire was circulated towards the end of 2020 during which several countries worldwide were experiencing restrictions as a result of the coronavisus disease 2019 (COVID-19) pandemic. Dentists across the world were shown to experience higher levels of stress, anxiety, and depression, which is likely to have resulted in a lack of engagement with survey studies.[28,29] Other limitations which the authors acknowledge include the introduction of selection bias as a result of the various data collection methods and the inherent problems associated with questionnaire surveys such as bias and subjectivity. In addition, the use of more clinical scenarios with a wider range of complexity in the primary and permanent dentitions is needed for future assessment of the impact of the online resources on GDPs knowledge in managing dental trauma. Within the limitations of this pilot cross-sectional survey, the authors recommend:

- Further assessment of GDPs self-reported confidence worldwide and in the Gulf Cooperation Council countries region to consolidate these findings.
- Engagement of the IADT with local and regional dental organizations in organizing regular dental trauma management training courses.
- Translation of the DTG online resources into the Arabic language.
- Incorporation of the IADT online resources into undergraduate dental student education.

## 5 | CONCLUSIONS

The results highlight critical deficiencies in the knowledge of a large cohort of GDPs in the management of dental trauma that is likely to cause irreversible long-term patient effects, which otherwise could be saved using conservative treatment approaches in line with the IADT guidelines. Therefore, there is urgent need to promote continuing education on evidence-based dental trauma management to improve awareness and utilization of online resources such as the IADT guidelines and the online DTG in the region.

## AUTHOR CONTRIBUTIONS

All the authors have made substantial contributions to the manuscript. All the authors have read and approved the final version of the manuscript.

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## CONFLICTS OF INTEREST

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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