

# Knowledge and Awareness of Emergency Medical Physicians on the Management of Traumatic Dental Avulsion at Sultan Qaboos University Hospital

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**ABSTRACT: Objectives:** This study aimed to assess the level of knowledge regarding traumatic dental avulsion management among emergency physicians at Sultan Qaboos University Hospital (SQUH), Muscat, Oman. **Methods:** This cross-sectional, survey-based observational study was conducted among emergency physicians at SQUH from August 2021 to October 2021. The data were collected through a standardised and validated questionnaire. Fisher's exact test and Mann–Whitney U tests were used to analyse the data. **Results:** A total of 18 completed questionnaire forms were received (response rate: 72.0%). The data revealed that 66.7% of the participants had prior knowledge of avulsion management, and 50% had received education on dental trauma. However, 83.0% of the participants did not feel comfortable replanting an avulsed tooth themselves. Regarding their knowledge level, 45.0% of the participating physicians demonstrated low knowledge, 22.2% demonstrated moderate knowledge and 33.3% demonstrated high knowledge. Thus, 94.0% of the participants were interested in acquiring information about avulsion management. **Conclusion:** The level of knowledge was significantly associated with receiving dental education and a higher clinical grade. As a result, it is crucial to include information about avulsion and its management in both medical undergraduate and post-graduate curricula.

**Keywords:** Avulsion; Knowledge; Dental Education; First Aid; Oman.

## ADVANCES IN KNOWLEDGE

- To the best of the authors' knowledge, this is the first study to assess the knowledge of avulsion management among emergency medicine physicians in Oman.
- This study demonstrated that there is a knowledge deficiency among emergency physicians in managing traumatic dental avulsion.

## APPLICATION TO PATIENT CARE

- More than 50.0% of emergency physicians come across dental avulsion cases in the emergency room. These cases require immediate management by these physicians for the favourable long-term survival of the tooth. Thus, dental avulsion and its management need to be integrated into the medical undergraduate and emergency medicine post-graduate programmes to graduate physicians with higher knowledge of managing avulsion.

THE MOST COMMON AMONG MAXILLOFACIAL injuries are traumatic dental injuries.<sup>1</sup> Traumatic dental avulsion is considered the most complex and severe injury among all traumatic dental injuries.<sup>2</sup> It is the total dislodge of the tooth from the socket.<sup>3</sup> The prevalence of avulsion among all traumatic dental injuries is between 0.5–16.0%.<sup>4</sup> Moreover, it is the most common type of traumatic dental injury seen in emergency departments (ED).<sup>5</sup> It is well documented that avulsion is more common among the age group of 7–9 years.<sup>6</sup> This is attributed to the lesser degree of alveolar bone mineralisation and low resilience of the periodontal ligament (PDL).<sup>7</sup> Additionally, avulsion occurs more frequently among children due to falls at home, sporting activities and fights.<sup>7</sup>

The prognosis of dental avulsion highly depends on immediate management provided at the injury

site.<sup>8</sup> Therefore, immediate replantation of the permanent avulsed tooth is the most appropriate first-aid management.<sup>4</sup> If the replantation is delayed, using a suitable storage medium till replantation can help maintain the PDL cells' vitality, which is an essential factor affecting the long-term survival of replanted avulsed teeth.<sup>9,10</sup> Additionally, to increase the possibility of sound healing, the reinserted tooth needs to be splinted to other teeth for 2 weeks. Finally, to ensure adequate healing and avoid complications, further reviews and assessments should be carried out regularly.<sup>11</sup>

In an emergency room, full-time dentists are not available, which is why emergency physicians should determine the type of dental injury as well as the tooth involved to provide immediate management for an avulsion.<sup>12</sup> Many studies have assessed the knowledge of avulsion management among physicians.<sup>4–6,9,13</sup>

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However, in the context of Oman, no data regarding the level of knowledge on avulsion management among emergency physicians has been reported. A study from Pakistan revealed that most (97.1%) of the included medical physicians had poor knowledge of avulsion management.<sup>9</sup> Furthermore, it showed that only 3.0% of medical doctors suggested immediate replantation of avulsed permanent teeth, and 8.6% correctly identified the suitable storage medium.<sup>9</sup> Another study reported that none of the medical physicians had high knowledge of tooth avulsion, although 73.3% (n = 22/30) had low knowledge.<sup>6</sup> In addition, this study found that 96.6% of the physicians had not received dental education.

However, few studies have reported that most physicians (64.0%) knew about the nature of avulsion, whereas 33.0% misdiagnosed avulsion as displacement or fracture of the tooth.<sup>13</sup> Furthermore, a study from the USA demonstrated that 89.0% of the physicians identified the appropriate avulsion management strategy. Besides, most participants (80.0%) in this study received training on avulsion management during their dental courses.<sup>5</sup> The findings from previous studies reveal that physicians who received education on avulsion management during their medical training had better knowledge of the management of avulsion than those who did not.<sup>4-6,9,13</sup>

As there is no data available from Oman, this study aimed to assess the level of knowledge regarding traumatic dental avulsion management among emergency physicians in a tertiary healthcare hospital.

## Methods

This cross-sectional, survey-based observational study that was conducted in the emergency department (ED) in Sultan Qaboos University Hospital (SQUH), a tertiary healthcare hospital in Muscat, Oman, from August 2021 to October 2021. This study included all physicians working at the ED in SQUH who were willing to participate in the study. Clinical attachment trainees and doctors from other medical and surgical specialties attending the ED at SQUH were excluded from the study.

The sample size for this study was calculated to be 78 participants with a 99% confidence level using a mathematical formula based on the study that assessed the first-aid knowledge of avulsion:<sup>9</sup>

$$N = (z^2 p[1-p])/d^2$$

where N = sample size, z = statistic corresponding to the level of confidence, p = expected prevalence and d = precision (corresponding to effect size). In this study, z = 2.58, p = 3, 0.03, d = 0.05 and n = 78.

A standardised and validated questionnaire adopted from a study by Bahammam was used for the data collection after obtaining the author's consent.<sup>12</sup> The questionnaire consists of 20 closed-ended (multiple-choice) English questions, which are divided into three parts. Part I (6 questions) contains demographic questions; part II (8 questions) assesses the knowledge of avulsion management; and part III (6 questions) evaluates the participants' attitudes towards receiving more information. E-mail addresses were provided in the survey for any inquiries from the participants.

The questionnaires were distributed among all emergency physicians at SQUH in two ways. A link to the e-survey (Google Forms<sup>®</sup>, Google LLC, Menlo Park, California, USA) was e-mailed to emergency physicians and distributed through social media professional groups; in addition, paper forms were handed out personally with the help of the SQUH cooperative. This study initially used electronic forms as precautionary measures necessitated by the COVID-19 pandemic and to reduce paper waste. However, paper forms had to be used due to the low response rate from the e-surveys.

Data were analysed using Statistical Package for the Social Sciences (SPSS), Version 27.0 (IBM Corp., Armonk, New York, USA). A standardised scoring method was used to measure each physician's actual levels of knowledge regarding avulsion management. This method was adopted from Abu-Dawoud *et al.*<sup>6</sup> A score of 8 points was calculated for each participant by using 8 questions from the questionnaire. The interpretation of the score of each physician was as follows: a score from 6–8 = high level of knowledge, a score from 3–5 = moderate level of knowledge and a score from 0–2 = low level of knowledge.

Finally, all participants' overall knowledge level was determined to find the association between the categorised variables, and Fisher's exact test was performed. Furthermore, the Mann-Whitney U test was performed to compare the means of the continuous variables. The descriptive statistics were presented as mean, median, range and standard deviation for the continuous variables; the categorised variables were presented as frequency and percentages.

Consent to participate in the study was taken from each subject via the questionnaire form. This form contained a description of the study, its aim and how it would be conducted. In addition, it informed the participants that anyone could exit the survey without penalty and all information provided would be used only for the purposes of this study. This study was conducted after receiving ethical approval (SQU-EC-487-2021) from the Medical Research and Ethics

Committee (MREC) at the College of Medicine and Health Science (CoMHS) at Sultan Qaboos University on 26 July, 2021 (#2542).

## Results

Out of 25 emergency physicians in SQUH, a total of 18 (response rate: 72.0%) completed the questionnaire, and more than half (55.6%) completed the forms electronically.

The study cohort ranged in age from 25–52 years. The female-to-male ratio among these physicians was 1.25 (1:0.8). Almost all of the study population contained an equal number of different clinical grades (27.8% each grade) but there were fewer consultants (16.7%). In addition, most of the participants (77.8%) graduated from an institution in Oman [Table 1].

The avulsion knowledge was variable among the emergency physicians. A total of 59.0% of the participants reported having come across avulsion cases. A total of 66.7% of the emergency physicians reported having prior avulsion knowledge, and sources of this knowledge were variable. Moreover, half of the emergency physicians reported having received dental trauma education. Furthermore, 55.6% of emergency physicians considered medical books to be their primary source of knowledge for this information. Conversely, undergraduate and post-graduate dental education were the primary sources of knowledge for 33.4% of the participants. There was a significant

**Table 1:** Characteristics of included emergency physicians from Sultan Qaboos University Hospital, Muscat, Oman (N = 18)

Characteristic	n (%)
Mean age in years ± SD (range)	36 ± 7 (25–52)
<b>Gender</b>	
Male	8 (44.4)
Female	10 (55.6)
<b>Experience in years</b>	
≤15	9 (50.0)
>15	9 (50.0)
<b>Country of graduation</b>	
Oman	14 (77.8)
Others	4 (22.2)
<b>Clinical grade</b>	
House officer - Senior house officer	5 (27.8)
Resident	5 (27.8)
Specialist - Senior specialist	5 (27.8)
Consultant - Senior consultant	3 (16.7)

SD = standard deviation.

association ( $P = 0.029$ ) between the reported level of information and previous dental courses [Table 2].

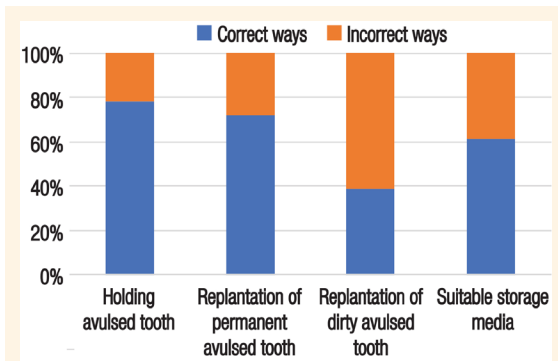
Many factors can determine an emergency physician's actual level of knowledge of avulsion management [Figure 1]. More than 60.0% of all participants had determined the correct ways of managing the avulsion, including the suitable media, the correct way of holding the avulsed tooth and the correct way of replanting the clean tooth. On the other hand, only 39.0% determined the suitable way of replanting the dirty avulsed teeth. Moreover, only 17.0% of the emergency physicians could replant the avulsed tooth themselves.

Among the emergency physicians, 45.0% had low-level knowledge of avulsion management (0–2 correct answers), 22.2% had a moderate level of knowledge (3–5 correct answers) and 33.3% had a high level of knowledge (6–8 correct answers). Fisher's exact test showed a significant association between the measured level of knowledge and knowing that

**Table 2:** Prevalence and associations of education, knowledge and its sources among participants with the reported level of information on avulsion management

Questions and answers	n (%)			P value*
	Total	Adequate information	Inadequate information	
<b>Have you received dental trauma education?</b>				<b>0.029</b>
Yes	9 (50.0)	5 (55.6)	4 (44.4)	
No	9 (50.0)	0 (0.0)	9 (100.0)	
<b>Do you have prior avulsion management knowledge?</b>				<b>0.114</b>
Yes	12 (66.7)	5 (41.7)	7 (58.3)	
No	6 (33.3)	0 (0.0)	6 (100.0)	
<b>What is the better source of information?</b>				<b>0.522</b>
Medical books	10 (55.6)	4 (40.0)	6 (60.0)	
<b>Education courses</b>				
Under-graduate dental education courses	3 (16.7)	0 (0.0)	3 (100.0)	
Post-graduate dental education courses	3 (16.7)	1 (33.3)	2 (66.7)	
Others	2 (11.1)	0 (0.0)	2 (100.0)	

\*Using Fisher's exact test.



**Figure 1:** Awareness of factors determining correct ways of management of avulsion as per participating physicians.

**Table 3:** The association of factors affecting the level of knowledge of AVULSION management with the measured level of knowledge

Factors affecting the level of avulsion management knowledge	Measured level of avulsion management knowledge, n (%)		P value*
	High-moderate knowledge	Low knowledge	
Correct suitable media (n = 11)	8 (72.7)	3 (27.3)	0.145
The correct way of replanting the dirty avulsed tooth (n = 7)	4 (57.1)	3 (42.9)	1.000
Replanting the permanent avulsed tooth (n = 13)	10 (76.9)	3 (23.1)	0.007
The correct way of holding the tooth (n = 14)	9 (64.3)	5 (35.7)	0.275

\*Using Fisher's exact test.

the replantation of the avulsed tooth is essential ( $P = 0.007$ ) [Table 3]. Furthermore, the level of avulsion management knowledge is significantly associated with higher clinical grade ( $P < 0.05$ ).

While 87.5% of specialists to senior consultants had high knowledge of avulsion management, only 30.0% of the rest had high knowledge of avulsion management ( $P = 0.025$ ). While comparing the physicians' mean ages in two groups for the level of avulsion management knowledge, a significant difference ( $P = 0.032$ ) was found; older physicians were found to have a higher level of avulsion management knowledge than younger physicians. Other characteristics were not significantly associated with avulsion management knowledge [Table 4].

A total of 72.0% of the physicians indicated that their level of knowledge regarding avulsion management was inadequate; consequently, most

**Table 4:** Comparison and association of the measured avulsion management knowledge with different characteristics

Characteristic	n (%)		P value
	Level of knowledge		
	High-moderate	Low	
<b>Gender</b>			0.664*
Male	5 (62.5)	3 (37.5)	
Female	5 (50.0)	5 (50.0)	
<b>Age in years</b>			0.032†
Mean ± SD	41 ± 6.8	32 ± 6.4	
Median	39	29	
<b>Clinical grade</b>			0.025*
House officer-Resident	3 (30.0)	7 (70.0)	
Specialist -Senior specialist	7 (87.5)	1 (12.5)	
<b>Country of graduation</b>			1.000*
Oman	8 (57.1)	6 (42.9)	
Others	2 (50.0)	2 (50.0)	
<b>Experience in years</b>			0.477*
≤15	8 (50.0)	8 (50.0)	
>15	2 (100.0)	0	

\*Using Fisher's exact test. †Using Mann-Whitney U test.

(94.0%) were interested in improving their knowledge; all participants were united in their opinion regarding the importance of learning about avulsion.

## Discussion

In recent years, the number of avulsion cases in EDs has been increasing, and several studies have evaluated emergency physicians' knowledge of avulsion management.<sup>5,6,9,11,13</sup> However, to the best of the authors' knowledge, such data is not available for emergency physicians in the context of Oman. Therefore, this study aimed to assess the knowledge of avulsion management among ED physicians at SQUH in Oman.

Notably, the response rate in this study was higher (72.0%) than in previous studies conducted at EDs, which varied between 40–60%.<sup>7,9</sup> This higher response rate can be attributed to the two methods of distributing the questionnaire forms (online and paper forms). A higher response rate (81.3%) was achieved by a study in Saudi Arabia, which included physicians from 8 hospitals.<sup>12</sup>

More than half (66.7%) of the participants in the present study had prior knowledge of avulsion management, whereas a previous study reported that

only 16.7% of physicians had information on managing avulsion.<sup>6</sup> The difference between the findings of the present study and the previous study can be attributed to the age of the studied populations. This study contained more senior clinicians who graduated between 1994 and 2021, whereas the other study included a limited range of young physicians who graduated between 2000 and 2004.

Numerous sources are available to improve the knowledge of avulsion management. Half (50.0%) of the participants in the present study received undergraduate and post-graduate dental courses, whereas previous studies reported that only 3–6% of physicians had received dental education.<sup>6</sup> These findings could be attributed to the undergraduate oral health course in the MD curriculum at the CoMHS. Furthermore, the Fisher's exact test revealed that the level of knowledge is significantly associated with previous dental education, which is consistent with the results reported by another study.<sup>5</sup>

The present study was conducted to evaluate the level of physicians' knowledge in avulsion management and focused on the key factors that determine avulsion management, based on the International Association of Dental Traumatology guidelines.<sup>8</sup> This study showed that holding an avulsed tooth by the crown is the appropriate way to save the PDL, and 78.0% of emergency physicians were found to have adequate knowledge of this fact. This finding is consistent with the results of a study conducted by Jyothi *et al.*, where 72.8% of the participants correctly identified the appropriate method of holding an avulsed tooth.<sup>14</sup>

The need for immediate replantation was identified by 72.0% of the physicians, but only 17.0% were confident enough to replant it themselves. As for managing a dirty avulsed tooth, only 39.0% of the physicians identified the correct way to clean it (i.e. with a stream of saline before replantation). In contrast to the present study, a study conducted in Saudi Arabia showed that a higher percentage of physicians (79.5%) agreed to replant an avulsed tooth and 48.4% of them were confident in doing so themselves.<sup>12</sup> In a 2018 study, the study population in Bahammam, which had a higher percentage of older physicians, also showed a greater ability to replant avulsed teeth themselves. Although there was no difference in the age range between the present study and the Saudi Arabian study, the Saudi Arabian study included 12 physicians over the age of 50, whereas the present study included only one.<sup>12</sup>

Saving an avulsed tooth in an appropriate storage medium is crucial for preserving the vitality of the PDL and enhancing the tooth's long-term survival, since replantation may be delayed. Therefore,

knowledge of the appropriate storage medium is a fundamental factor in determining a physician's avulsion management expertise. The present study found that 61.0% of the physicians chose saline as the appropriate storage medium, which is readily available in the ED compared to other recommended media. Furthermore, the physicians in the present study demonstrated better knowledge of the suitable storage media than those in a previous study conducted in Pakistan, where only 8.6% of the physicians were found to be aware of the appropriate storage medium.<sup>9</sup> This better understanding could be attributed to the participants of the present study receiving more dental courses and information.

The study found that only 33.3% of the ED physicians demonstrated a high level of knowledge, and 22.2% showed moderate knowledge of avulsion management. These findings are generally higher than those of previous studies conducted in neighbouring countries, which ranged from 10–12%.<sup>1,6,9</sup> The age factor may explain the difference, as the present study included older participants than previous studies. However, the results of this study significantly differed from those of a previous study conducted in the USA, which found that 89.0% of the physicians were able to identify appropriate avulsion management strategies. This difference can be attributed to the training on avulsion management during dental courses, which most participants (80.0%) in the USA study had received.<sup>5</sup>

Furthermore, 44.4% of the physicians in the present study had insufficient knowledge, which is higher than in a previous study conducted by Abu-Dawoud *et al.*, where only 26.6% had insufficient knowledge of avulsion management.<sup>6</sup> The present study identified that the level of knowledge can be improved by enhancing education. However, the junior clerkship phase of the MD programme at SQU does not include avulsion management in the oral health rotation.

The present study also found a significant association between the measured level of knowledge and the understanding that the avulsed tooth needed to be replanted ( $P = 0.007$ ). Improving knowledge on this topic is critical for emergency physicians to provide appropriate care for patients with avulsion.

Overall, only 33.3% of ED physicians showed a high level of knowledge, while 22.2% showed moderate knowledge and 44.4% had insufficient knowledge. The study found that the level of knowledge regarding avulsion management was significantly associated with higher clinical grade and the older age of the physicians. However, the level of knowledge was not significantly associated with the number of years of

experience. The study also found that all physicians agreed on the importance of avulsion management knowledge and 94.0% were interested in increasing their knowledge.

It should be noted that logistical barriers and the recent unstable circumstances caused by COVID-19 affected the flexibility in researching other medical centres in the country. Therefore, the participants in this study only included emergency physicians at SQUH, which limited the study's population and affected the results. Consequently, many findings in this study cannot be generalised.

## Conclusion

Avulsion management needs to be integrated into medical programmes to help graduate physicians with higher knowledge manage avulsions in Oman. Moreover, emergency physicians also need to improve their knowledge to have better outcomes regarding avulsion management.

## AUTHORS' CONTRIBUTION

SAB and AAM designed the study. SAB reviewed the literature and collected as well as analysed the data. SAB and AAM drafted the manuscript, and AAM supervised the work. Both authors approved the final version of the manuscript.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## FUNDING

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## References

1. Raoof M, Vakilian A, Kakoei S, Manochehrifar H, Mohammadalizadeh S. Should medical students be educated about dental trauma emergency management? A Study of physicians and dentists in Kerman Province. Iran. *J Dent Educ* 2013; 77:494–501. <https://doi.org/10.1002/j.0022-0337.2013.77.4.tb05495.x>.
2. Holan G, Shmueli Y. Knowledge of physicians in hospital emergency rooms in Israel on their role in cases of avulsion of permanent incisors. *Int J Paediatr Dent* 2003; 13:13–19. <https://doi.org/10.1046/j.1365-263X.2003.00414.x>.
3. Westphalen VPD, Martins WD, Deonizio MDA, da Silva Neto UX, da Cunha CB, Fariniuk LF. Knowledge of general practitioners dentists about the emergency management of dental avulsion in Curitiba, Brazil. *Dental Traumatology* 2007; 23:6–8. <https://doi.org/10.1111/j.1600-9657.2005.00392.x>.
4. Çalışkan S, Delikan E, Kızılaslan S, Özbek Ö. Knowledge of dental avulsion among emergency physicians: A survey study. *J Pediatr Res* 2021; 8:62–8. <https://doi.org/10.4274/jpr.galenos.2020.98705>.
5. Needleman HL, Stucenski K, Forbes PW, Chen Q, Stack AM. Massachusetts emergency departments' resources and physicians' knowledge of management of traumatic dental injuries. *Dent Traumatol* 2013; 29:272–9. <https://doi.org/10.1111/j.1600-9657.2012.01170.x>.
6. Abu-Dawoud M, Al-Enezi B, Andersson L. Knowledge of emergency management of avulsed teeth among young physicians and dentists. *Dent Traumatol* 2007; 23:348–55. <https://doi.org/10.1111/j.1600-9657.2006.00477.x>.
7. Ulusoy AT, Önder H, Çetin B, Kaya Ş. Knowledge of medical hospital emergency physicians about the first-aid management of traumatic tooth avulsion. *Int J Paediatr Dent* 2012; 22:211–16. <https://doi.org/10.1111/j.1365-263X.2011.01178.x>.
8. Fouad AF, Abbott PV, Tsilingaridis G, Cohenca N, Lauridsen E, Bourguignon C, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. *Dent Traumatol* 2020; 36:331–42. <https://doi.org/10.1111/edt.12573>.
9. Qazi SR, Nasir KS. First-aid knowledge about tooth avulsion among dentists, doctors and lay people. *Dent Traumatol* 2009; 25:295–9. <https://doi.org/10.1111/j.1600-9657.2009.00782.x>.
10. Subhashraj K. Awareness of management of dental trauma among medical professionals in Pondicherry, India. *Dent Traumatol* 2009; 25:92–4. <https://doi.org/10.1111/j.1600-9657.2008.00714.x>.
11. Cagetti MG, Marcoli PA, Berengo M, Cascone P, Cordone L, Defabianis P, et al. Italian guidelines for the prevention and management of dental trauma in children. *Ital J Pediatr* 2019; 45:157. <https://doi.org/10.1186/s13052-019-0734-7>.
12. Bahammam LA. Knowledge and attitude of emergency physician about the emergency management of tooth avulsion. *BMC Oral Health* 2018; 18:57. <https://doi.org/10.1186/s12903-018-0515-5>.
13. Venkataramana M, Pratap K, Padma TM, Kalyan VS, Bhargava A, Varma LSC. Knowledge and attitude of medical professionals towards emergency management of avulsed tooth in a teaching medical hospital, Khammam Town, South India. *J Indian Assoc Public Health Dent* 2015; 13:183. <https://doi.org/10.4103/2319-5932.159062>.
14. Jyothi KN, Venugopal P, Nanda S, Shah MK. Knowledge and attitude of medical doctors towards emergency management of avulsed tooth-a cross sectional survey. *J Dent Sci Res* 2015; 2:156–67. <https://doi.org/10.1186/s12903-018-0515-5>.