

Professional knowledge of accident and emergency doctors on the management of dental injuries

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Background: Accident and emergency (A&E) doctors are often the first to assess dental and dento-alveolar injuries. Early diagnosis and appropriate management is essential for a good long-term prognosis of restored dental aesthetics and function. **Objective:** To evaluate A&E doctors' knowledge of the management of dental injuries, and appropriate onward referral. **Design and Setting:** A cross-sectional survey using a questionnaire sent to A&E doctors of all grades at all nine A&E hospitals in South Wales over a consecutive five-month period. **Method:** Data relating to the level of knowledge of emergency management of dental trauma were analysed. The relationship between doctor's level of experience and previous training received on the management of common dento-alveolar trauma was considered. Data were analysed for Pearson correlation coefficients. **Results:** The response rate to the questionnaire was 72% (n=118). There was a negligible correlation between the career grade of the doctors and their knowledge of the management of dental injuries ($r=0.128$, $p<0.001$). A strong positive linear correlation ($r=0.928$, $p<0.001$) was found between those with prior training and their knowledge of dental injury management. **Conclusions:** The findings from this study suggest that A&E doctors have only partial knowledge of the management of dental injuries, though appropriate training can significantly increase knowledge.

Keywords: tooth injuries, tooth fracture, tooth avulsion, tooth luxation, maxillofacial injuries, emergency treatment

Introduction

Dental injuries may initially present to emergency doctors in Accident and Emergency (A&E) departments (Addo *et al.*, 2007; Bringhurst *et al.*, 1993; Patel and Driscoll, 2002; Pennycook *et al.*, 1993). The incidence of dental injuries has been reported in various studies; among them, a frequently cited analysis of a Danish population by Andreasen and Ravn (1972) reported an incidence of 30% of injuries to primary teeth and 22% of injuries to the permanent dentition, with the upper central incisor being the most commonly injured tooth, and Pennycook *et al.* (1993) revealed that over a six month period 0.3% of new attendances (107 patients) to the Glasgow Royal Infirmary A&E department were dental patients, with 19 (18%) of these patients suffering dental trauma.

The nature and degree of dental injuries range from dento-alveolar fractures, concussion, luxation injuries, and complete avulsion. Dento-alveolar fractures may involve the crown or root with various combinations of involvement of enamel, dentine, pulp and cementum. Luxation injuries include subluxation, lateral luxation, intrusion and extrusion. The long-term prognoses of these injuries greatly depend on appropriate early management (Andreasen *et al.*, 2002; Dewhurst *et al.*, 1998; Bringhurst *et al.*, 1993). Poor treatment outcomes as a result of inadequate or delayed management can be damaging to a patient due to dental aesthetic and functional defects which may also have a psychological impact.

The International Association of Dental Traumatology (IADT) has published guidelines for the manage-

ment of traumatic injuries, primarily aimed at dental professionals. These guidelines offer evidenced-based advice on treatment using the best current information from literature searches and expert opinion (DiAngelis *et al.*, 2012; Andersson *et al.*, 2012). These guidelines are available in many formats including publication in journals, an interactive online guide and in the form of mobile application software.

Despite existing adequate guidelines for dental professionals, a study by Stokes *et al.* (1992) demonstrated that A&E departments are perceived by the general public as the first place to seek treatment for avulsed teeth. A&E staff may therefore be the first to encounter dental injuries and will often need to triage, assess, diagnose and provide appropriate immediate management prior to referring the patients to a dentist or, if available, an on-call oral and maxillofacial team. While many countries, including the UK, have launched educational campaigns for the general public on emergency dental first aid (Booth, 1980; Hamilton *et al.*, 1997), these campaigns focus only on the need to re-implant avulsed permanent teeth as soon as possible before seeking appropriate medical help. Owing to these factors, there is a need for A&E doctors to be fully aware of diagnosis and treatment options for dental injuries.

Numerous studies have evaluated the knowledge of hospital doctors on the management of avulsed teeth (Addo *et al.*, 2007; Holan and Shmueli, 2003) and the basic dental knowledge of A&E senior house officers (Patel and Driscoll, 2002). Although a lack of knowledge may not directly lead to a poor treatment outcome,

correct management does require a good understanding of the assessment, triage and diagnosis of each injury. This allows patients to be prioritised and either treated immediately by the emergency doctor or referred to the appropriate speciality.

The primary aim of the current study was to assess the current knowledge of all levels of A&E doctors in the management of common dental injuries and the secondary aim was to determine if past training improved doctors' knowledge.

Methods

Questionnaires were distributed to A&E departments in all nine South Wales hospitals with a 24-hour medical service. Prior to the distribution of questionnaires, agreement to take part in the study was obtained from A&E clinical directors at the hospital being surveyed. Invited to participate in the study were 163 A&E doctors working at the nine hospitals over a consecutive five-month period from May to September 2008. Their names were obtained from the individual A&E departments and each was sent a covering letter explaining the purpose of the study, the anonymous questionnaire and an assurance of confidentiality.

The questionnaire is reproduced in Figure 1. The first part of the questionnaire gathered biographical data and information on training received on the management of dental injuries. The second part investigated knowledge of the management of common dental trauma as well as

appropriate onward referral. The correct answers to the management of dental injuries were determined by using the IADT guidelines (DiAngelis *et al.*, 2012; Andersson *et al.*, 2012), information from reviews (Bringinghurst *et al.*, 1993; Dewhurst *et al.*, 1998; Skapetis and Curtis, 2010) along with consultation with an oral and maxillofacial consultant, as tabulated in Table 1. The correct answers and their scores are included in Figure 1. Half the possible maximum score, 7/14, was deemed satisfactory. Data were analysed using SPSS software for Pearson correlation coefficients with significance set at the 0.01 level.

Results

Of the 163 questionnaires sent to A&E doctors working at the nine hospitals in South Wales who were invited to participate in the study, 118 were returned giving a response rate of 72%. None of the A&E departments had written guidelines or protocols on the appropriate management of dental injuries.

The extent of oral and maxillofacial surgery (OMFS) cover varied between the nine hospitals. Only four hospitals provided 24-hour onsite OMFS cover. Two hospitals provided cover on weekdays between 9am-5pm. Out-of-hours patients were referred to the nearest hospital providing 24-hour OMFS access. The remaining three hospitals had no OMFS access at all and referred all their patients to the nearest unit providing this cover. Table 2 shows the extent of dental and OMFS service in all nine hospitals.

Management of Dental Injuries Questionnaire

PART 1

1. Year of graduation from medical school
2. Grade.....
At Hospital
3. Do you have a Maxillofacial unit on site?
Yes
No If no, where is your nearest Maxillofacial unit?.....
4. Have you ever received any training regarding the management of dental injuries?
Yes if yes, as an undergraduate?
In a current or previous post?
No If no, will you receive training in the next 6 months?.....

PART 2

5. a) Using the table below: Please indicate how you would best manage the following dental injuries for adult teeth (please tick one box for each injury)

Action taken	Chipped teeth	Loose teeth	Pushed in or out
No treatment needed	(0)	(0)	(0)
Treatment needed- Refer to dentist	(1)	(1)	(1)
Treatment needed- Refer to dental hospital	(0)	(1)	(1)
Treatment needed- Refer to local Maxfax unit	(0)	(1)	(1)

- b) For an avulsed (out of socket) adult tooth would you offer immediate treatment to re-implant it?

Yes (1)
No (0)

- c) For an avulsed (out of socket) adult tooth which of the following follow-up treatment would you advise?

Action taken	Avulsion (out of socket)
No follow up	(0)
Refer to dentist	(1)
Refer to dental hospital	(1)
Refer to local Maxfax unit	(1)

6. Would you consider prescribing antibiotics for dental injuries?

Yes (1) If yes, when?....Avulsion (1).....
What?....Tetracycline/Doxycycline/Penicillin V/Amoxicillin (1)..
No (0)

7. Do you think it is important to account for missing teeth/tooth fragments?

Yes (1) If yes, why?....Risk of aspiration/foreign body in soft tissue (1)
How would you do this?....Radiograph (1).....
No (0)

8. What is the best storage medium for an avulsed adult tooth (lost out of tooth socket)? (Please circle one)

None (0) Milk (2) Cling film (0) Betadine (0)
N.saline (0) Saliva (1) Chlorhexidine (0) Toothpaste (0)

9. How long following an injury do you think is acceptable to re-implant an avulsed (lost out of socket) adult tooth? (Please circle one)

Within: ½ hour (1) 1 hour (0) 2 hours (0) 6 hours (0) 12 hours (0) 24 hours (0)

Figure 1. Questionnaire with, in Part 2, correct answers and corresponding scores included in red

Table 1. Immediate treatment of Permanent dental injuries modified from the IADT guidelines

<i>Injury Classification</i>	<i>Description of signs</i>	<i>IADT advice for dental professional for Permanent teeth</i>	<i>Immediate Action by A&E doctor</i>	<i>Follow up</i>
<i>Crown Fracture</i>	No displacement. Loosening of tooth. Not tender to percussion. Fracture below gingival margin	If pulp is not involved: restore with GIC as a temporary measure (if fragment is available it can be bonded to tooth). If red pulp is involved: Young patients with immature teeth: a pulp cap or partial pulpotomy. Older patients: root canal treatment	If not sensitive no immediate action required. Patient advised to see dentist to restore tooth. If sensitive refer to maxillofacial department/ dentist/dental hospital for a dressing if required.	Dentist for composite restoration and/or root canal treatment
<i>Crown-Root Fracture</i>	No displacement. Loosening of tooth. Not tender to percussion. Fracture below gingival margin	As an emergency stabilise loose fragment to adjacent teeth until definitive treatment at a later date.	Best treated within 24 hours of injury. Refer to maxillofacial department or emergency dentist	Maxillofacial department or Dental Hospital
<i>Root Fracture</i>	Tooth displacement with mobility. Signs of root fracture on Xray.	Rinse exposed root surface with saline. Reposition tooth (check on Xray) Stabilise with flexible splint for at least 4 weeks. Soft food for one week and good oral hygiene.	Best treated within 24 hours of injury. Refer to maxillofacial department or emergency dentist	Maxillofacial department or Dental Hospital
<i>Concussion</i>	No displacement. No loosening. Tender to percussion	Soft food for one week and good oral hygiene. No treatment.	Provide advice	Dentist to monitor tooth
<i>Subluxation</i>	No displacement. Loosening of tooth. Bleeding from gingival sulcus (gum around tooth).	Soft food for one week and good oral hygiene. No treatment.	Provide advice	Dentist to monitor tooth
<i>Alveolar Fracture</i>	Tooth or teeth displacement with mobility and several teeth move as a unit on palpation	Give LA Manually reposition the displaced segment with finger pressure labially and lingually. Clean area with saline. Suture any lacerations Splint for 4 weeks	Best treated within 24 hours of injury. Refer to maxillofacial department	Maxillofacial department
<i>Lateral Luxation</i>	Tooth displacement with no mobility. Tooth protruded or retruded (pushed forward or backward)	Clean exposed root surface with saline. Give local anaesthetic. Reposition tooth with forceps or finger pressure to disengage tooth from bone then reposition back into socket. Stabilise for 4 weeks with a flexible splint. Soft food for one week and good oral hygiene.	Best treated within 24 hours of injury. Refer to maxillofacial department	Maxillofacial department or Dental Hospital

Table 1. continued overleaf ...

Table 1. continued...

<i>Intrusion</i>	Tooth displacement with no mobility. Pushed into socket.	Treatment depends on extent of intrusion and age of patient. If the tooth is immature tooth (Xray shows OPEN apex) allow spontaneous repositioning if <7mm of intrusion. If >7mm consider surgical repositioning. If the tooth is mature (CLOSED apex on Xray) allow spontaneous repositioning if there is <3mm intrusion. If the tooth has intruded >3mm, consider surgical repositioning. Surgical repositioning involves: Clean exposed root surface with saline; Give local anaesthetic; Reposition tooth with forceps; Reposition bone with finger pressure; Stabilise tooth for 4-8 weeks with a flexible splint; Soft food for one week and good oral hygiene	Best treated within 24 hours of injury. Refer to maxillofacial department	Dentist for root canal treatment
<i>Extrusion</i>	Tooth displacement with mobility. Pushed out of socket. No signs of root fracture on Xray	Clean exposed root surface with saline. Gently reposition tooth back into socket with finger pressure (local anaesthetic not normally needed) Stabilise tooth for 2 weeks with a flexible splint. Soft food for one week and good oral hygiene.	Best treated within 24 hours of injury. Refer to maxillofacial department or follow these steps: Clean root surface with saline. Gently reposition tooth back into socket with finger pressure; Ask patient to bite on gauze to stabilise position; Refer to maxillofacial surgery on-call to place splint	Dentist or dental hospital to monitor tooth / remove splint and provide further treatment.
<i>Avulsion</i>	Total displacement of tooth out of socket	The prognosis depends on age of patient, length of time outside mouth and storage media. If the tooth has been out of the mouth for less than 60 min and stored in suitable medium the following should be advised: Do not touch root surface; Clean root surface and apical part with a stream of saline; Give Local anaesthetic; Examine socket- reposition bony walls if needed; Irrigate socket with saline; Replant tooth slowly with digital pressure, Apply flexible splint for 2 weeks; Prescribe systemic antibiotics; Consider tetanus booster; Advise to avoid contact sports; Soft diet for 2 weeks and good oral hygiene.	Best replanted within 30 minutes	Dentist or Dental Hospital to remove splint and provide further treatment.
			Replant tooth as soon as possible in the following way: Do not touch root surface; Clean root surface and apical part with a stream of saline; Give Local anaesthetic; Examine socket-reposition bony walls with suitable instrument if needed; Irrigate socket with saline; Replant tooth slowly with digital pressure; Ask patient to bite on gauze to stabilise position; Refer to Maxillofacial on-call for further treatment and to apply splint; Prescribe systemic antibiotics; Consider tetanus booster.	

Table 2. The extent of dental and maxillofacial service in the hospitals

<i>Hospital</i>	<i>Maxillofacial cover</i>
Morrison Hospital, Swansea	24-hour cover
Prince Charles General Hospital, Merthyr Tydfill	24-hour cover
Royal Gwent Hospital, Newport	24-hour cover
University Hospital of Wales, Cardiff	24-hour cover
Princess of Wales Hospital, Bridgend	Weekdays 9am-5pm. Then nearest is Morrison Hospital (26 miles)
Wrexham Maelor Hospital, Wrexham	Weekdays 9am-5pm. Then nearest is Glan Clwyd Hospital (39 miles)
Neville Hall Hospital, Abergavenny	No cover. Nearest is Royal Gwent Hospital (20 miles)
Prince Philip Hospital; Llanelli	No cover. Nearest is Morrison Hospital (12 miles)
Withybush Hospital, Haverfordwest	No cover. Nearest is Morrison Hospital (55 miles)

Table 3. Percentage of A&E doctors giving correct and incorrect responses to aspects of the management of the common dental injuries in permanent teeth

<i>Action taken</i>	<i>Chipped</i>	<i>Loose teeth</i>	<i>Pushed in or out</i>	<i>Avulsion (out of socket)</i>
No treatment needed	17%	2%	22%	22%
Treatment needed, refer to dentist	<u>83%</u>	<u>71%</u>	<u>38%</u>	<u>35%</u>
Treatment needed, refer to dental hospital	0%	<u>5%</u>	<u>29%</u>	<u>16%</u>
Treatment needed, refer to local maxillofacial unit	0%	<u>22%</u>	<u>11%</u>	<u>27%</u>

Note: Underscoring marks the correct responses.

Most commonly (48%) respondents were junior doctors who had graduated between one and ten years previously. A further 29% graduated between 11 and 20 years ago, 14% between 21 to 30 years ago and 9% between 31 to 40 years ago. The greatest proportion of the doctors were senior houseofficers, 27%, followed by: house officers, 22%; specialist registrars, 21%; consultants, 14%; staff grades, 11%; and associate specialists, 5%. There was a negligible correlation between the career grade of the A&E doctors and their knowledge of the management of dental injuries ($r=0.128$, $p<0.001$).

Eighty-two (69%) doctors indicated they had no previous training in the management of dental injuries. Of the remaining 36 who stated they had prior training in the management of dental injuries, 7 (19%) said that was at undergraduate level, 21 (58%) in their previous post and 8 (22%) in their current post. There was a strong positive correlation ($r=0.928$, $p<0.001$) between those who had prior training and knowledge of dental injury management as shown by overall knowledge scores in the questionnaire.

The accuracy of A&E doctors' knowledge regarding the management of the common dental injuries is presented in Table 3. When asked about fractured teeth (chipped teeth), the majority of doctors (83%) who realised treatment was required, stated they would advise the patient to contact their dental practitioner for further management.

The response regarding the management of loose teeth (which could be a sign of a crown fracture, a crown root fracture, subluxation or extrusion) showed that 71% of doctors ($n=84$) would advise the patient to contact their dentist for treatment, 5% ($n=6$) would refer the patient to the dental hospital and 22% ($n=26$) would refer the patient to a local maxillofacial unit. Only two doctors thought no treatment was needed.

For the management of avulsed teeth, 92 (78%) doctors suggested they would re-implant the tooth and follow this with a referral to an appropriate body. This included a dentist (35%), dental hospital (16%) or maxillofacial team (27%). Figure 2 demonstrates the time A&E doctors thought was acceptable for a tooth to be left outside a medium prior to re-implantation, the greatest proportion, 46% ($n=42$), incorrectly stated that an avulsed tooth could be left out for up to six hours.

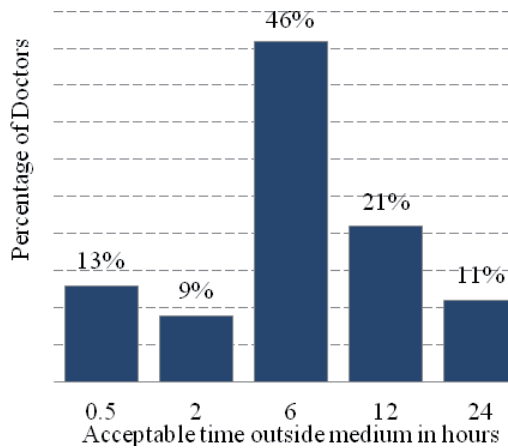
One important aspect in the management of avulsed teeth is the type of storage medium the tooth is kept in before re-implantation. The results from the 92 respondents who stated they would re-implant an avulsed tooth are shown in Figure 3. Only doctors who received training in their current post or in their immediate previous post answered this question correctly.

Adjunctive antibiotic treatment was recommended by 16% of doctors following re-implantation of an avulsed tooth. Of these, 11% would prescribe a seven-day course of co-amoxiclav 500/125mg three times a day, as the first line of treatment. The remaining 5% would recommend a seven-day course of amoxicillin 500mg three times a day.

Some 69% of the doctors ($n=82$) felt it was important to account for missing teeth or tooth fragments. The reasons provided were due to the risk of aspiration, the risk of swallowing, foreign body embedment in soft tissue, mediastinitis, and for medico-legal reasons. Investigations that were suggested included detailed history and physical examination, chest x-rays, flexible nasendoscopy and bronchoscopy.

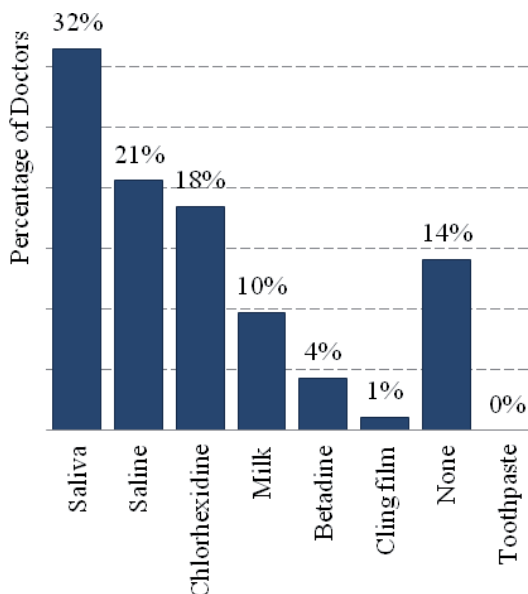
Discussion

The primary aim of this cross-sectional survey was to investigate the knowledge of the management of common dental injuries amongst A&E doctors in Wales. The



NB 26 doctors would not re-implant. The correct response is half an hour.

Figure 2. Time thought acceptable by A&E doctors for the tooth to be out of its socket before re-implantation



NB 26 doctors would not re-implant. The correct responses were Milk (scored 2) or Saliva (scored 1).

Figure 3: Storage methods chosen by A&E doctors (n=92)

survey response rate was 72%. To improve response rate, those who did not respond initially were contacted by a letter and telephone call, and if this was unsuccessful, questionnaires were handed to doctors personally, as suggested by Holan and Shmueli (2003).

This present study did not demonstrate a strong association between knowledge of management of dental injuries and career grade. However, a significant strong positive correlation was demonstrated between doctors who recalled receiving training (31%) and those who did not.

At present there appears to be an inconsistency in the level of training of emergency doctors in the management of dental injuries which may be due to the lack of clinical dentistry in the undergraduate medical curriculum. The current study revealed that 69% (n=82) of doctors

had no recollection of any training in the management of dental injuries. This agrees with Patel and Driscoll's (2002) finding that only 6% of senior house officers recalled that they had training in dental management as part of their undergraduate education, with 52% stating they had no previous training in examination of the mouth. A recent study by Trivedy *et al.* (2012) also reveals the a lack of appropriate training, with only 11% of doctors stating that had received formal training in dental trauma management and 12% responding that they had not received any training at all. The benefit of training is supported in our study by the strong correlation between doctors' prior training and high scores for knowledge in the questionnaire.

This study demonstrated that 78% of doctors would re-implant an avulsed tooth and follow this with a referral to an appropriate body. This is similar to a finding, from a study involving London A&E staff, that 74% would provide appropriate treatment of avulsed teeth (Addo *et al.*, 2007). Holan and Shmueli (2003) found that only 4% would provide an appropriate initial management of avulsed teeth. That study suggested that A&E staff should always attempt re-implantation of the avulsed permanent tooth, even if the re-implanted tooth were to serve as a provisional solution due to the likely occurrence of external inflammatory resorption as a common side effect. Ideally the re-implanted tooth would reattach to the supporting periodontal tissues, however if this is not feasible, the tooth can act as a natural space maintainer and preserves the height and width of the alveolar bone to facilitate future placement of implants.

One critical factor for the success of re-implantation includes the length of time the tooth is out of its socket (Andersson *et al.*, 2012; Andreasen *et al.* 1981, 2002). Studies have advised that appropriate treatment during the initial 30 minutes provides the best prognosis for traumatically avulsed teeth (Andersson *et al.*, 2012; Stokes *et al.*, 1992; Trope, 2002). Out of the 92 that would re-implant, only 12 (13%) doctors stated that the tooth should be re-implanted within half an hour following avulsion.

Another vitally important factor for the success of re-implantation is the storage medium the tooth is kept in prior its re-implantation. Suitable storage media that have been suggested are ViaSpan (a cold organ transplant storage medium), Hank's Balanced Salt Solution, milk saline, saliva, or water (Andersson *et al.*, 2012; Malhotra, 2011; Stokes *et al.*, 1992; Trope, 2002). Our study revealed that only 10% (n=9) of those who would re-implant a tooth (n=92) thought milk was an appropriate storage medium. Significantly 13 doctors (14%) thought that no storage medium was required, suggesting that they thought the tooth was best stored dry. A limitation of the study is that ViaSpan and Hank's Balanced Salt Solution were not included as options for storage. These are considered the best storage media and have been shown to preserve the root surface periodontal ligament cell viability (Hiltz and Trope, 1991).

Systemic antibiotic administration when re-implanting an avulsed tooth has been shown to prevent inflammatory root resorption experimentally, although further clinical studies are required. It has been suggested the first choice of antibiotic cover for patients over 12 years

old is tetracycline in the form of doxycycline. However clinicians must consider the side effect of discolouration of permanent teeth before prescription of systemic tetracycline in children. Alternative antibiotics include penicillin V or amoxicillin (Andersson *et al.*, 2012; Hammarstrom *et al.*, 1986; Trope, 2002). Our results show only 16% of doctors would prescribe antibiotics, with only amoxicillin and co-amoxiclav considered as suitable antibiotics. This indicates the need for prescribing guidelines for management of avulsion.

Taken together, these results highlight that the A&E doctors surveyed only have partial knowledge on the management of dental injuries. Although treatment outcome has not been assessed, it can be assumed that this lack of detailed knowledge would form a significant but not the only barrier to the doctors' management and optimal prognosis of the dental traumas they encounter.

Conclusion

A&E doctors are often the first to examine dental trauma patients. The findings from this study suggest that knowledge of the management of dental injuries among A&E doctors is only partial, however appropriate training can significantly increase this knowledge. The authors suggest that this training should be provided both at undergraduate and postgraduate levels. The diagnosis and management of dental injuries should be part of the undergraduate medical curriculum. Then, postgraduate training should be provided at the A&E departmental induction and regularly thereafter to maintain knowledge and to keep up-to-date with current practice. Advice on antibiotic prescription for dental avulsion should be included in local prescription guidelines. In addition, we suggest it is advisable to have a formal protocol relating to the management of dental trauma, perhaps as a poster or in a handbook for A&E staff.

Further studies are required to compare A&E doctors' knowledge of the management of dental injuries before and after the introduction of different training methods developed specifically for A&E doctors such as participatory training courses, seminars or interactive software.

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