KEY WORDS
Dental trauma, guidelines, IADT 2020, avulsion, permanent, splinting

LEARNING OBJECTIVES

- To highlight changes in International Association of Dental Traumatology (IADT) Guidelines, for permanent dentition
- To promote practical application of dental trauma guidelines based on evidence from available literature and expert opinion
- To signpost dental professionals to the latest guidelines, standardising care post injury throughout the required follow up period

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Prim Dent J. 2023;12(4):22-27

A REVIEW OF THE IADT 2020 GUIDELINES

ABSTRACT

Traumatic dental injuries (TDIs) are a relatively frequent occurrence, with roughly a third of adults experiencing a dental trauma at some time in their life.[1] TDIs may present to dental professionals working within primary or secondary care settings. Patients presenting at the time of acute injury will require immediate management and careful long term follow up. Patients may also present later reporting a history of TDI, with developing complications and onward management required. To support dental care professionals, the International Association of Dental Traumatology's (IADT) Guidelines are available globally as a standardised tool to aid the assessment, management and follow up of dental trauma. These easy to access guidelines were updated in 2020 with four distinct publications: *General Introduction*,[1] *Fractures and Luxations*,[2] *Avulsion of Permanent Teeth*,[3] and *Injuries in the Primary Dentition*.[4] The current guidelines represent the best evidence based on available literature and expert opinion.[1]

This paper aims to support dental professionals by specifically highlighting and describing updates in guidance, using the 2020 IADT published guidelines. By incorporating the 2020 guidelines into our everyday practice we aim to provide the most appropriate, standardised care, based on the highest level of available evidence to our patients.

The full published guidelines are available free online via the IADT website.

Introduction

Traumatic dental injuries (TDIs) are a relatively frequent occurrence, with roughly a third of adults experiencing a dental trauma at some time in their life.[1] TDIs may present to dental professionals working within primary or secondary care settings at the time of acute injury, requiring immediate management. Longer term, these patients will also require careful management to avoid and successfully treat potential developing complications. In order to improve both short-, medium- and long-term outcomes, it is essential that practitioners refer to latest evidence-based guidance. The International Association of Dental Traumatology's (IADT)

DOI: 10.1177/20501684231210394

Guidelines are available globally as a standardised tool in the assessment, management, and follow up of dental trauma. These guidelines encompass all aspects of required care. In 2020 the IADT guidelines were updated in the format of four publications. These are readily available, without charge, via the IADT website. These 4th edition updates cover *General Introduction*,[1] *Fractures and Luxations*,[2] *Avulsion of Permanent Teeth*,[3] and *Injuries in the Primary Dentition*.[4] This paper acts to publicise the updates relating to the permanent dentition, aiding understanding and application of the guideline changes. These changes are based on expert opinion and the best evidence, based on available literature searched on Embase, Medline, Pubmed, Scopus, and Cochrane databases. It is acknowledged by the IADT that treatment settings for TDIs can vary from primary to secondary and tertiary care, depending on complexity of care required. The core aim of the 2020 IADT guidelines, and indeed this paper, is to accurately detail how clinicians can support patients in achieving favourable outcomes, following a TDI, using the most widely accepted approaches.

The IADT first published guidelines in 2001, with updates in 2007 and 2012. The 2020 publication builds on previous editions, with specific changes highlighted and described within this paper.

In general, the guidance states that 33% of adults experience dental trauma, with the majority occurring before the age of 19.[1] In terms of risk of developing complications, combined injuries to the same tooth have a synergistic negative effect.[2] A tooth with multiple episodes of crown fracture is also noted as having significantly increased risk of pulpal necrosis.[2] This paper will particularly discuss changes in 2012–2020 guidelines.[1-5]

Reimplantation of permanent avulsed teeth

Permanent tooth avulsion equates to 0.5–16% of TDIs.[6,7] The strong message with regards rapid re-implantation of teeth, ideally within 15 minutes of injury, remains consistent in the updated guidelines. Prognoses of avulsed teeth is heavily dependent on the speed of action at the place of accident.[1] Before the 2020 update, the recommendation had been to rinse the tooth in water prior to re-implantation. This has now been updated to agitation in storage medium, such as milk or a stream of saline. If, however, re-implantation is not a feasible option (e.g. due to poor co-operation or other injuries) then appropriate storage media should be used. Storage media are listed with descending order of preference as: milk, Hanks' Balanced Salt Solution (HBSS), saliva or saline.[3] No treatment to the root surface is indicated prior to the re-implantation, other than gross removal of obviously damaged PDL tissue. It has also been recommended, if the tooth has not already been re-implanted or stored in a suitable storage media before patient attendance at the surgery, to place the avulsed tooth in storage medium during the initial history and clinical, radiographic assessment period.

The critical link between periodontal ligament (PDL) cell viability and extra alveolar dry time (EADT) is further detailed. If a tooth is re-implanted quickly, ideally within 15 minutes, PDL cells are considered "most likely viable". A total EADT under 60 minutes offers "viable but compromised" PDL cells.[3] For EADT greater than 60 minutes, PDL cells are "likely to be non-viable", regardless of whether the tooth has been in storage medium. This delayed reimplantation results in the necrosis of the PDL cells. These are not expected to regenerate, therefore, root resorption is likely.[3] Reimplanting an avulsed tooth is almost always deemed the best option, as in absence of developing endodontic complications or infra-occlusion, the tooth will preserve aesthetics, function, and alveolar bone.[3] This buys the patient time to consider alternative treatment options, should the tooth fail. The updated guidelines also consider the potential situation in which a patient presents to a clinical setting post re-implantation, where the tooth appears wrongly repositioned. In these cases repositioning is supported within 48 hours.[3] Acute, short and long term prognoses for avulsed permanent teeth is critically dependent on immediate management, at the scene of dental injury. The decision to not re-implant an avulsed tooth is irreversible. Public awareness in the immediate action required following dental injury and wider public education is encouraged by the 2020 guidelines. In support of this, the IADT ToothSOS mobile app is now available for members of the public to download.[8] This provides the lay person with first aid advice to improve management of TDIs at the scene of the accident.

Endodontic considerations for avulsed permanent teeth

This is a new section in the 2020 guidelines. Endodontics may be indicated by patient history, clinical and/or radiographic presentation. For teeth with EADT over 60 minutes, the recommendation for endodontic treatment out of the mouth has been removed. The guidelines also state endodontic treatment for all mature teeth must take place within a timeframe of two weeks. This phrasing allows the treating clinician to make a decision as to when it is appropriate to start treatment. This may be on the same day, or at a later appointment within two weeks. The decision is made on a patient-by-patient basis, appreciating the patient has just experienced a traumatic event.

The guidelines recommend the use of non-setting calcium hydroxide within the canal as an initial dressing for up to four weeks. Alternatively, corticosteroid and antibiotic paste for at least six weeks is suggested. Guidelines also discuss the importance of avoiding contamination of the coronal pulp chamber when utilising any intra-canal medicament. This reduces the risk of coronal discolouration.[9] As for any endodontic treatment, dental dam for isolation is strongly recommended.[3] and specific advice is given within the guidelines. It is suggested that the retainer of the dam is placed on a neighbouring un-traumatised tooth in order to prevent further injury to periodontal ligament. Metal dental dam clamps are discouraged, with the alternative being floss or stabilising cords.[2]

The 2020 guidelines promote the preservation of the pulp in immature permanent teeth to ensure healing with continued root development and apex formation.[2] A TDI to a tooth with an open apex can result in pulp canal obliteration (PCO).[2,3] This is a more

likely complication following severe injury, such as luxation injury, extrusion and intrusion. Root fractured teeth also commonly present with PCO, whereas teeth with subluxation or crown-fracture have a lower frequency of PCO.[1]

Updated terminology: Root Resorption

Updated terminology is used within the 2020 guidelines. "Inflammatory Root Resorption" has been changed to "Infection Related Root Resorption" and "Replacement Root Resorption" updated to "Ankylosis Related Root Resorption". Within the guidance both terms are used to reflect existing literature.

Periapical imaging is suggested as an appropriate monitoring tool for resorption. Immediate endodontic intervention is indicated, and should be initiated, when Infection Related Root Resorption is evident on radiographs. Guidelines suggest non-setting calcium hydroxide as the intra-canal medicament of choice. If corticosteroid or a mixture of corticosteroid and antibiotic intra-canal medicament is used, then this should be followed by calcium hydroxide. Identifying Infection Related Root Resorption at an early stage and treating quickly is critical, as the progress of resorption is rapid and so patient compliance with follow up is strongly recommended.[3]

Splinting teeth

Splint timings are provided as a guide. When dealing with multiple traumatic injuries in the same patient, the duration of splint suggested for the most severe of the injuries should be followed. At the recommended review interval, composite should initially be removed from the most severely traumatised tooth only. This tooth should be assessed for mobility and then the decision made if the tooth is now stable enough to completely de-bond the splint. If mobility is persisting, then the tooth should be re-splinted, and the splint left in situ for a longer duration. The 2020 guidelines indicate suggested splinting times of two or four weeks for all injuries, with the exception of cervical third root fractures which may be splinted for up to four months. There is also emphasis on the use of flexible passive wire, ideally stainless-steel orthodontic wire up to 0.4mm or 0.016 inches. Step by step photographs of application and removal of composite and wire splint are provided elsewhere in this issue of *Primary Dental Journal*. Splinting aims to allow healing of the injured periodontal ligament by stabilising and immobilising teeth. Splinting also helps to prevent further potential damage to the apical neurovascular bundle, improving patient comfort. This is achieved by fixing the traumatised tooth/teeth to at least one neighbouring tooth either side of the injured teeth. The composite and wire should ideally be placed centrally on the labial surface of each tooth. With the wire (at each tooth only) encased in composite material, ensuring no sharp wire ends. Figure 1 illustrates this clearly. Gingival margins and proximal regions should remain clear of both wire and composite, as demonstrated in Figure 1. This is to ensure the splint is comfortable and cleansable, thereby optimising plaque control and healing response. Labially placed composite and wire splints also have the benefit of clear palatal access, if prior to debond initiation of endodontics is indicated. Table 1 summarises the current recommended splinting times for different types of TDIs.

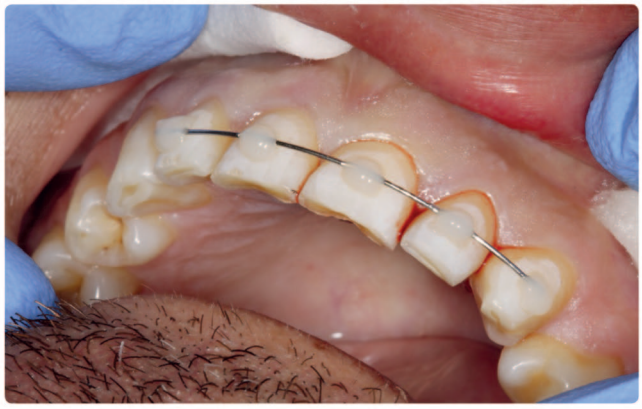

Figure 1: Splinting of teeth 12–23 following lateral luxation of 21 and subluxation/ concussion injuries 12, 11, 22. Note stainless steel orthodontic wire (0.016"), smooth composite fully encasing the adjacent wire, and free of the gingival margins and interproximal regions

TABLE 1

SPLINTING TIMES FOR PERMANENT DENTAL TRAUMA

Traumatic injury	Duration of splint (weeks)
Subluxation (if clinically indicated, e.g. mobility or tenderness)	2
Extrusion (following best possible repositioning)	2
Avulsion (following re-implantation)	2
Lateral luxation (following best possible repositioning)	4
Intrusion	4
Dento-alveolar fracture (following best possible repositioning)	4
Root fracture: mid/apical third (following best possible repositioning)	4
Root fracture: cervical third (following best possible repositioning)	Up to 16 (4 months)

Permanent intrusive luxation injury

Discreet changes in guidelines have been made with regards to intrusive injuries for the permanent dentition. Comparing 2012 guidelines with the 2020 update there is now the recommendation that regardless of the extent of an intrusion injury, teeth with incomplete root formation are allowed four weeks for spontaneous repositioning.[2] If no re-eruption is noted

TABLE 2

RECOMMENDED REVIEW INTERVALS FROM IADT 2020 GUIDELINES – PERMANENT DENTITION[1]

	2W	4W	6–8W	3M	4M	6M	1Y	Annual for at least 5Y
Infraction	No follow up							
Enamel fracture			*R				*R	
Enamel/dentine fracture			*R				*R	
Crown fracture			*R	*R		*R	*R	
Crown/root fracture			*R	*R		*R	*R	*R
Root fracture (apical 1/3, mid 1/3)		*S*R	*R		*R	*R	*R	*R
Root fracture (cervical 1/3)		*R	*R		*S*R	*R	*R	*R
Alveolar fracture		*S*R	*R		*R	*R	*R	*R
Concussion		*R					*R	
Subluxation		(*S) *R		*R		*R	*R	
Extrusion	*S*R	*R	*R	*R		*R	*R	*R
Lateral luxation	*R	*S*R	*R	*R		*R	*R	*R
Intrusion	*R	(*S) *R	*R	*R		*R	*R	*R
Avulsion (mature)	*S*R	*R		*R		*R	*R	*R
Avulsion (immature)	*S*R	*R	*R	*R		*R	*R	*R

after four weeks, then orthodontic repositioning can be initiated. Teeth with complete root formation which are intruded by less than 3mm are now given eight weeks for spontaneous re-eruption before surgical repositioning or alternatively orthodontic repositioning before ankylosis develops.[2] Splinting times are the same, once a tooth is repositioned surgically or orthodontically it should be splinted for four weeks.

Permanent complicated crown fracture

Updated guidance promotes more conservative initial management. Extirpation is no longer the treatment of choice for patients with mature apical development, unless intracanal retention is required due to lack of remaining coronal tooth structure to facilitate restoration, e.g. a post is required. Pulp capping or partial pulpotomy is the indicated treatment choice where crown fracture involves the pulp. In these circumstances the guidance states isolation may be challenging but should be attempted.[2] Dental dam clamps can be considered, with careful tooth selection to avoid traumatised teeth. Alternatively, floss or interproximal cord can be used, again with careful consideration to tooth selection.

Follow up

Follow up is a fundamental element of the IADT guidelines. There is increased emphasis within the 2020 publication stating follow up is required for at least five years. The latest edition simplifies recommended review guidelines into a table, as shown in Table 2.

Patients may present to a variety of locations with acute TDI. Some may be managed within emergency dental services, or in maxillofacial departments and will normally require reviews with their general dental practitioner, as follow up is mandatory following a TDI.[2] At every follow up appointment, clinical review should be consistent. This allows accurate comparison of outcome indicators, allowing identification of potential developing complications, which when detected and managed early improves prognosis.[2] The following core outcome set are relevant to all TDIs. These generic outcomes include: periodontal healing (to include bone loss, gingival recession, mobility, ankylosis and resorption), pulpal healing, pain, discolouration, tooth loss (including premature loss of primary teeth), quality of life, aesthetics (patient perception), trauma-related dental anxiety and the number of clinic visits.[3,10] Quality of life is measured as a social outcome to include days off work, school or sport. Recording of this data during acute and longer term follow up is new and as such will demonstrate the impact TDIs have on patients and their families.[10] The following radiographic findings should also be reported: bone loss, ankylosis, resorption, and signs of endodontic infection. Where multiple or combined injuries are present, follow up

Figure 2: (a) Medical photography illustrating the acute presentation of a patient suffering from a concussion injury. TDI affecting upper right and upper left central incisors, with pink discolouration noted and vertical cracks present on labial surface; (b) the same patient at follow up two years later, illustrating change from pink to slight brown discolouration

is as per the most severe injury, i.e. a patient suffering from crown fracture and luxation injury, would be followed up as indicated for luxation injury.[2]

Photography

Guidance now encourages the use of photography in patient care, including requesting available images of the patient following their TDI prior to clinical attendance. This change is representative of the now wide availability of technology. Photographs aid in communication with the patient, medical record keeping, medico-legal documentation and crucially, post trauma monitoring.[2] It is recommended clinical photographs are taken at initial presentation and at follow up clinical reviews. An example of use is monitoring the position of an intruded tooth or discolouration (Figure 2).

Radiology

Radiographic investigation and monitoring are key components of both the 2012 and 2020 IADT guidelines and are necessary to thoroughly

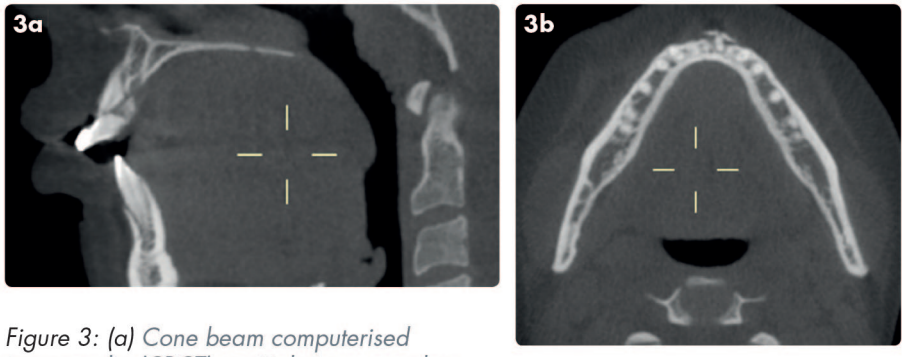

Figure 3: (a) Cone beam computerised tomography (CBCT) sagittal view: complex crown root fracture 21, with comminuted dento-alveolar fracture and loss of labial cortex; (b) CBCT axial view: labial cortex 32–41 comminuted fracture displaced labially

diagnose TDIs and any developing complications.[2] Updates in the 2020 guidelines include the use of small volume cone beam computerised tomography (CBCT) if justified. CBCT should be considered in order to visualise the traumatic injury and help to localise any displaced teeth or bony segments, as demonstrated in Figure 3. Imaging will also aid treatment planning and understanding treatment options. For example, in an uncomplicated crown-root fracture a CBCT may, as stated in the guidelines, help determine the direction, extent and location of a fracture,[11-13] while additionally evaluating crown:root ratio.[2] Clear imaging is also an extremely useful tool in facilitating discussion around injury diagnosis and management required with patients, improving communication and consent process. The value of radiographs at different vertical and or horizontal angulations in diagnosis of root fractures is highlighted.[2]

Pulp sensibility testing

Sensibility testing determines the neural activity of the pulp. This is not however, a factor to be considered in isolation. The temporary loss of sensibility is a frequent finding during post traumatic pulp healing[14] therefore a negative sensibility test is not conclusive for pulpal necrosis in a traumatised tooth.[15-18] However, serial comparison of sensitivity testing, in combination with patient reported symptoms, clinical examination and radiographs, may help to indicate a deterioration in the condition of the pulpal tissue and need for intervention. Examples of such tests are cold tests (ethyl chloride on cotton wool) and electric pulp testing. It is advised that no endodontic treatment is initiated based on a negative sensibility test result alone, even if this persists over three months. This is supported with the understanding that a negative response can be expected for several months, which is a change from the previous Guidelines, where three months was stated as the maximum duration of negative testing, before intervention was recommended.

Antibiotics

As we act to ensure safeguarding of antibiotics to prevent antibiotic resistance, guidance now states their use should only be considered when there is soft tissue involvement or there is contamination of root surfaces during trauma. In these situations, systemic antibiotics are recommended. Topical antibiotics lack evidence to support their use. It is important to consider the circumstances in which the injury has occurred, when making a decision regarding the need for systemic antimicrobials, e.g. systemic antibiotics may be recommended in relation to an avulsed, reimplanted tooth, where the tooth is avulsed on a dirty football pitch, versus the same injury occurring at home. Antimicrobial use reduces the risk of infection and the occurrence of infection related resorption[3] Amoxicillin 500mg three times daily for five days is now the first line recommendation from the IADT for systemic coverage, with doxycycline prescribed to patients with a penicillin allergy. However, doxycycline is not recommended for patients under the age of 12,[19] due to potential tooth discolouration. In these cases, seek confirmation of alternatives from local guidance, e.g. Scottish Dental Clinical Effectiveness Programme (SDCEP)

guidelines.[20] There is no evidence to support the use of antibiotics in root fractured teeth.[2]

Conclusion

The freely available IADT 2020 guidelines are an accessible tool, available online to all dental professionals. They are practical guidelines appropriate for application in any clinical setting where trauma may present, including primary and secondary care. The guidelines cover each stage of the patient journey and allow clinicians to provide high quality acute injury management, standardising care with monitored long term outcomes. The review of the parameters suggested in the core outcome set, helps to identify complications at an early stage, directing appropriate intervention, and ultimately improving outcomes for patients.

In order to provide appropriate and effective care to our patients, the highest level of evidence should support our day-to-day practice. Guidelines such as those provided by IADT help us to achieve this. Changes, such as those highlighted herein, must be acknowledged by clinicians, with appropriate modification of practice, to ensure we are keeping up to date. Changes in guidance reflect progress in research and developing professional opinion. They also reflect advances in technology and equipment available in the clinical settings. Application of these guidelines helps to ensure best clinical care for our patients, maximising the likelihood of favourable outcomes.

REFERENCES

1 Levin L, Day PF, Hicks L, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: General introduction. Dent Traumatol. 2020;36(4):309-313.

2 Bourguignon C, Cohenca N, Lauridsen E, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations. Dent Traumatol. 2020;36(4):314-330.

3 Fouad AF, Abbott PV, Tsilingaridis G, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. Dent Traumatol. 2020;36(4):331-342.

4 Day PF, Flores MT, O'Connell AC, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 3. Injuries in the primary dentition. Dent Traumatol. 2020;36(4):343-359.

5 International Association of Dental Traumatology (IADT). Dental Trauma Guidelines, Revised 2012. [Internet]. San Diego: IADT; 2012. Available at https://www.iadt-dentaltrauma.org/1-9%20%20iadt%20guidelines%20combined%20-%20lr%20-%2011-5-2013.pdf [Accessed Sept 2023].

6 Andreasen JO, Andreasen FM, Tsilingaridis G. Chapter 20: Avulsions. In: Andreasen JO, Andreasen FM, Andersson L. (Eds.) Textbook and color atlas of traumatic injuries to the teeth. 5th ed. Oxford: Wiley Blackwell; 2019. p. 486-520.

7 Glendor U, Halling A, Andersson L, et al. Incidence of traumatic tooth injuries in children and adolescents in the county of Västmanland, Sweden. Swed Dent J. 1996;20(1-2):15-28.

8 ToothSOS [Mobile application software]. (Version 1.0.29). San Diego, USA: International Association of Dental Traumatology (IADT). (2023).

9 Day PF, Duggal MS, High AS, et al. Discoloration of teeth after avulsion and replantation: results from a multicenter randomized controlled trial. J Endod. 2011;37(8):1052-1057.

10 Kenny KP, Day PF, Sharif MO, et al. What are the important outcomes in traumatic dental injuries? An international approach to the development of a core outcome set. Dent Traumatol. 2018;34(1):4-11.

11 Cohenca N, Silberman A. Contemporary imaging for the diagnosis and treatment of traumatic dental injuries: a review. Dent Traumatol. 2017;33(5):321-328.

12 Cohenca N, Simon JH, Mathur A, et al. Clinical indications for digital imaging in dento-alveolar trauma. Part 2: root resorption. Dent Traumatol. 2007;23(2):105-113.

13 Cohenca N, Simon JH, Roges R, et al. Clinical indications for digital imaging in dento-alveolar trauma. Part 1: traumatic injuries. Dent Traumatol. 2007;23(2):95-104.

14 Bastos JV, Goulart EMA, de Souza Côrtes MI. Pulpal response to sensibility tests after traumatic dental injuries in permanent teeth. Dent Traumatol. 2014;30(3):188-192.

15 Dummer PM, Hicks R, Huws D. Clinical signs and symptoms in pulp disease. Int Endod J. 1980;13(1):27-35.

16 Kaletsky T, Furedi A. Reliability of various types of pulp testers as a diagnostic aid. J Am Dent Assoc. 1935;22(9):1559-1574.

17 Teitler D, Tzadik D, Eidelman E, et al. A clinical evaluation of vitality tests in anterior teeth following fracture of enamel and dentin. Oral Surg Oral Med Oral Pathol. 1972;34(4):649-652.

18 Zadik D, Chosack A, Eidelman E. The prognosis of traumatized permanent anterior teeth with fracture of the enamel and dentin. Oral Surg Oral Med Oral Pathol. 1979;47(2):173-175.

19 Andreasen JO, Storgård Jensen S, Sae-Lim V. The role of antibiotics in preventing healing complications after traumatic dental injuries: a literature review. Endod Topics. 2008;14(1):80-92.

20 Scottish Dental Clinical Effectiveness Programme (SDCEP). Drug Prescribing For Dentistry: Dental Clinical Guidance. 3rd ed. [Internet]. Dundee: SDCEP; 2016. Available at https://www.sdcep.org.uk/published-guidance/drug-prescribing/