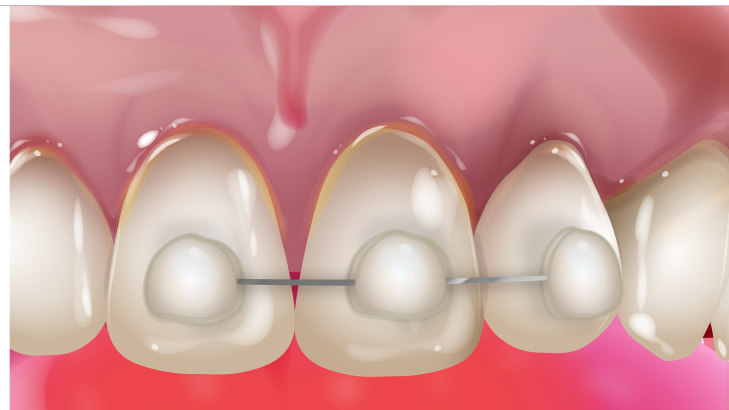
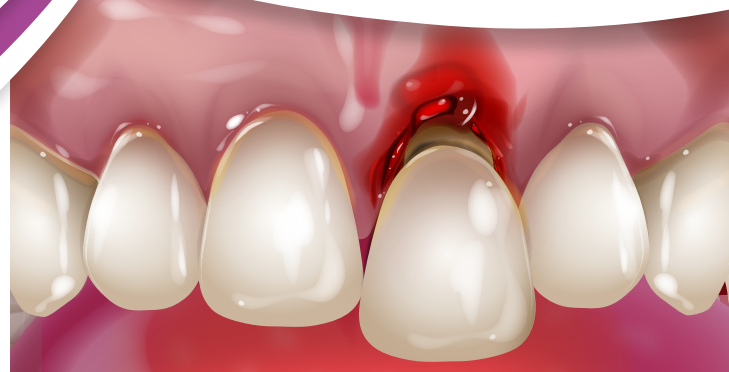


A guide to

Traumatic Dental Injuries of Permanent Teeth



Contributors

Editor and author

Maria Lessani BDS MFDS RCPS MClintDent (Endo) MRD RCS (Endo) PhD
Specialist in Endodontics, Private Practice, London
Clinical Lecturer in Endodontics, Eastman Dental Hospital (UCLH NHS Foundation Trust) /
University College London
Past President British Endodontic Society (2022-3)

Lead author

Rachel M Tomson BDS MFDS RCSEd MClintDent (Endo) MRD RCSEng (Endo)
Consultant and Specialist in Endodontics / Hon. Clinical Associate Professor
Clinical Lead in Endodontics
Eastman Dental Hospital (UCLH NHS Foundation Trust) / University College London

Other authors

Lyndon Meehan BDS BSc MJDF RCS (Eng) MSc Endo. MEndo RCS (Edin)
Specialist in Endodontics, Cowbridge Dental Specialists, South Wales
Consultant in Restorative Dentistry, Swansea Bay University Healthboard

Geoffrey St George BDS MSc DGDP (UK) FDSRCS (Edin) FDS (Rest Dent)
Consultant in Restorative Dentistry / Hon. Lecturer in Endodontology
Eastman Dental Hospital (UCLH NHS Foundation Trust) / University College London

Daniel Vaz De Souza LMD Dip Rest RCSEng MClintDent MEndo RCSEd
Specialist in Endodontics, Private Practice, East of England
Senior Clinical Teacher in Endodontics, King's College London
Vice President Elect, British Endodontic Society

Contributors

Other members of the BES Trauma Working Group

Sanjay Ardeshta BDS MSc MClinDent MFDS MRD RCSEd

Specialist in Endodontics, Private Practice London

Eastman Dental Hospital (UCLH NHS Foundation Trust) / University College London

British Endodontic Society Council Member

Arindam Dutta BDS MDS MFDS RCPS (Glasg) MEndo RCS (Edin) FDS (Rest Dent) RCS (Eng)
DDS (Edin) FDS (Edin)

Senior Clinical Lecturer in Endodontology / Hon. Consultant in Restorative Dentistry

Petros Mylonas BDS MFDS RCS (Edin) MPros RCS (Edin) FPros RCS (Edin) FDS (Rest Dent)
RCS (Glasg) MMedEd SFHEA PhD

Senior Clinical Lecturer / Hon. Consultant in Restorative Dentistry

Alison Qualtrough BChD MSc PhD FDS MRD (RCS Ed)

Professor, Division of Dentistry

University of Manchester Dental Hospital

Chair of the Endodontic Teachers Group of the British Endodontic Society

Contents

Chapter	Page
Preface	5
Introduction	6
1. Classification of dental trauma injuries	7
2. Dental Trauma History, Examination, Diagnosis and Treatment Planning Proforma	9
3. Simple guide to management of dental trauma injuries	16
Management of tooth injuries that do not require splinting	17
Management of tooth injuries with or without bone injuries that require splinting	21
Easy guide to step-by-step splinting and removal	26
4. Follow-up summary	31
Splinting and follow-up times at a glance	32
General signs of favourable outcome	33
General signs of adverse outcome – all luxation injuries	33
Overview of adverse outcomes associated with specific injuries	33

Preface

This booklet represents the culmination of dedicated work by the Dental Trauma Working Group of the British Endodontic Society. What began as a collaborative idea during my presidency of the Society in 2023 has developed into a practical and accessible resource for general dental practitioners and other clinicians who may be faced with managing dental trauma in a variety of clinical settings. The aim of this booklet is to provide straightforward, evidence-based guidance for the initial management of traumatic dental injuries of permanent teeth, with the goal of improving patient outcomes through timely and appropriate care.

It is important to highlight that this booklet is not intended to replace the detailed and comprehensive educational resources available by Dental Trauma UK* and the International Association of Dental Traumatology**. Instead, this resource is designed to act as a signpost and starting point, helping practitioners to navigate the initial stages of trauma management while encouraging engagement with the more extensive information available from these respected organisations. By raising awareness and promoting continued learning, we hope this booklet will support dentists in delivering highest standard of care for patients and feel well-informed.

I would like to take this opportunity to express my heartfelt gratitude to all those who contributed to the development of this booklet. The knowledge, experience, and dedication of each member of the Working Group have been instrumental in shaping the content and ensuring its clinical relevance. Their commitment to improving the management of traumatic dental injuries is deeply appreciated and has made this project both rewarding and meaningful. I am very grateful to Rachel Tomson, Geoff St George and the team at Clinical Illustration team of the Birmingham Community Healthcare Trust, Vicky Oakley and Bethan Reast.

Maria Lessani

BDS MFDS RCPS MCLinDent (Endo) MRD RCS (Endo) PhD

Specialist in Endodontics, Private Practice, London

Clinical Lecturer in Endodontics, Eastman Dental Hospital (UCLH NHS Foundation Trust) /
University College London

Past President British Endodontic Society (2022-3)

* Dental Trauma UK

<https://www.dentaltrauma.co.uk/Index.aspx>

** International Association of Dental Traumatology

<https://iadt-dentaltrauma.org/>

Introduction

Dental trauma injuries affect over one billion people worldwide* with the global prevalence between 6-59%.** The diagnosis and management of dental trauma injuries related to permanent teeth can be challenging. Therefore, we have written a simple guide to dental trauma management of permanent teeth based on the International Association of Dental Trauma Guidelines 2020***.

We aim to simplify the management of dental trauma and make it accessible as a quick reference guide. This then can be supplemented with further reading where necessary with the International Association Dental Trauma Guidelines 2020.

Here is an overview of what is covered in the guide:

- Classification of dental trauma injuries
- A suggested proforma to use for patient history, examination, diagnosis and treatment planning
- Simple guide to management of dental trauma injuries
- Easy step-by-step guide to splinting and removal
- Splinting and follow-up times at a glance
- Signs of favourable outcome and unfavourable outcome

References

*Petti S, Glendor U, Andersson L. World traumatic dental injury prevalence and incidence, a meta-analysis-One billion living people have had traumatic dental injuries. *Dent Traumatol.* 2018 Apr;34(2):71-86. doi: 10.1111/edt.12389. PMID: 29455471.

**Lam R. Epidemiology and outcomes of traumatic dental injuries: a review of the literature. *Aust Dent J.* 2016 Mar;61 Suppl 1:4-20. doi: 10.1111/adj.12395. PMID: 26923445.

*** International Association of Dental Traumatology Guidelines 2020

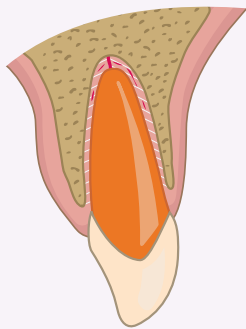
Levin L, Day PF, Hicks L, O'Connell A, Fouad AF, Bourguignon C, Abbott PV. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: General introduction. *Dent Traumatol.* 2020 Aug;36(4):309-313. doi: 10.1111/edt.12574. Epub 2020 Jun 22. PMID: 32472740.

Bourguignon C, Cohenca N, Lauridsen E, Flores MT, O'Connell AC, Day PF, Tsilingaridis G, Abbott PV, Fouad AF, Hicks L, Andreasen JO, Cehreli ZC, Harlamb S, Kahler B, Oginni A, Semper M, Levin L. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations. *Dent Traumatol.* 2020 Aug;36(4):314-330. doi: 10.1111/edt.12578. Epub 2020 Jul 17. PMID: 32475015.

Fouad AF, Abbott PV, Tsilingaridis G, Cohenca N, Lauridsen E, Bourguignon C, O'Connell A, Flores MT, Day PF, Hicks L, Andreasen JO, Cehreli ZC, Harlamb S, Kahler B, Oginni A, Semper M, Levin L. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. *Dent Traumatol.* 2020 Aug;36(4):331-342. doi: 10.1111/edt.12573. Epub 2020 Jun 13. PMID: 32460393.

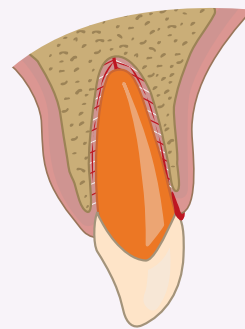
Chapter 1

Classification of dental trauma injuries



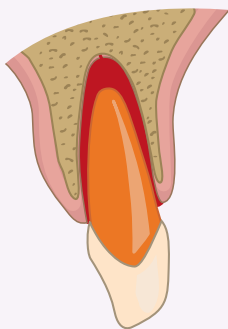
Concussion

No abnormal displacement or loosening.



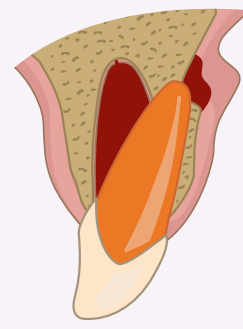
Subluxation

Abnormal loosening but no displacement.



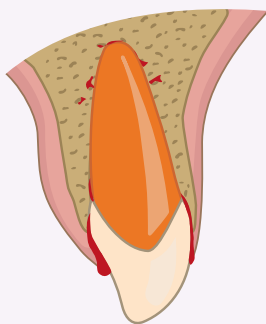
Extrusion

Partial displacement of the tooth out of socket in an incisal/axial direction.



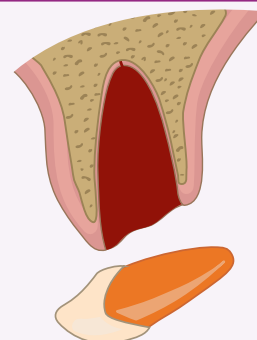
Lateral luxation

Displacement of the tooth in either a palatal or lingual direction and accompanied by comminution or fracture of alveolar bone.



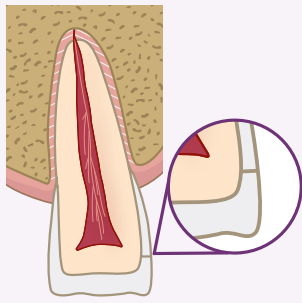
Intrusion

Displacement of the tooth into alveolar socket.

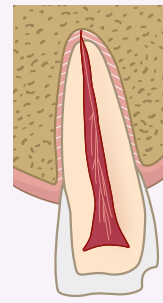


Avulsion

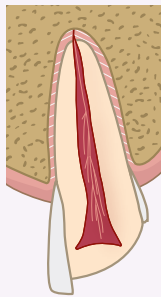
Total loss of the tooth from the socket.



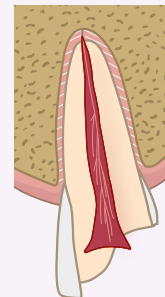
Enamel infraction



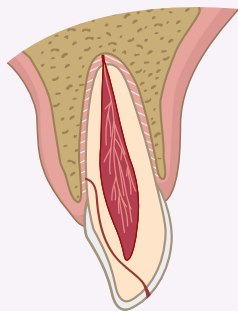
Enamel fracture



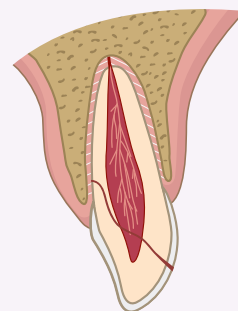
Enamel-dentine fracture



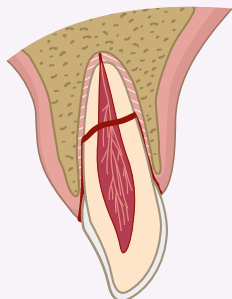
Enamel-dentine fracture with pulp involvement



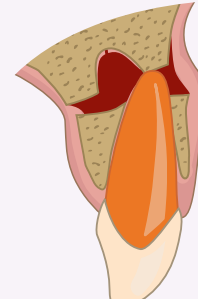
Crown-root fracture with no pulp involvement



Crown-root fracture with pulp involvement



Root fracture (cervical, mid-third, apical-third root fractures)



Dentoalveolar fracture

Chapter 2

Dental Trauma History, Examination, Diagnosis and Treatment Planning Proforma

The following proforma (page 11) is suggested to be used when examining a dental trauma patient and covers the salient points.

Please note that the forces imparted on teeth during a traumatic incident which cause dental/dentoalveolar injuries are significant. These forces can also result in injury to adjacent structures which are not immediately obvious.

The following should be checked when the mechanism of injury suggests more extensive trauma:

- Head injury – loss of consciousness, nausea, vomiting etc
- C-spine – neck injury
- Mandibular/maxillary/zygomatic fracture (paraesthesia and occlusal derangement)
- Vision – checking for diplopia, subconjunctival haemorrhage and its limit, Pupils, Equal, Round and Reactive to Light and Accommodation (PERRLA)
- Facial lacerations and intra-oral lacerations
- Unaccounted tooth/tooth fragments

Where appropriate refer to A &E/Oral and Maxillofacial Surgery Department

Soft tissue radiographs may be required where soft tissue injury has occurred and there are missing tooth fragments.

If there is a suspicion that missing tooth fragments or teeth may have entered the respiratory tree or if the patient is experiencing respiratory distress (coughing/wheezing) then immediate referral for a chest radiograph may be indicated.

The following table summarising suggested imaging for different dental trauma injuries from the International Association of Dental Trauma Guidelines for permanent teeth 2020.

Table 1: Summary of suggested imaging for different dental trauma injuries.

Injury	One parallel periapical radiograph unless other injuries are present	• One parallel periapical radiograph • Two additional radiographs of the tooth at varied vertical or horizontal angles • Occlusal radiograph	Could consider a CBCT	Could consider an OPT
Enamel infraction	✓			
Enamel fracture	✓			
Enamel dentine #, +/- pulp exposure	✓			
Crown/root fracture +/- pulp exposure		✓	✓	
Root fracture		✓	✓	
Alveolar fracture		✓	✓	✓ *
Concussion	✓			
Subluxation		✓		
Extrusion		✓		
Lateral luxation		✓	**	
Intrusion		✓		
Avulsion		✓		

* An OPT should be considered if other images provide insufficient information and detail e.g. condylar fractures or parasymphseal especially if a CBCT is not available.

** A CBCT scan might be useful, when checking if the apex has been displaced labially. As lateral luxation injuries are often associated with alveolar fractures.

Dental Trauma History and Examination Proforma



Date

Patient's name

Patient's date of birth

Patient's age

Occupation

Smoker

☐

No

☐

Yes

Amount

☐

Stopped

■ Medical History (MH)

Fit and healthy

☐

Yes

☐

No

Tetanus status

Relevant MH (include allergies, medical conditions and medications)

Referred by

☐

Emergency department

☐

Emergency dentist

☐

Another hospital

☐

Own dentist

☐

Walk-in/Self-referral

Radiographs taken elsewhere

☐

Yes

☐

No

Details

Treatment carried out elsewhere

Date of trauma

Time of trauma

Where?

How?

Avulsed teeth

☐ Yes ☐ No Extra oral dry time

Storage media (specify media) / time in media

■ Complaints and reported conditions

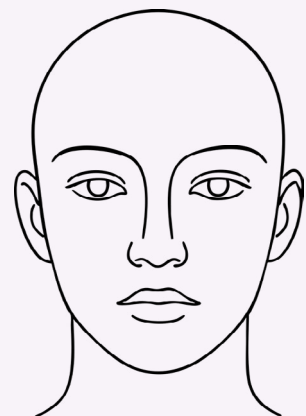
- | | |
|--|---|
| ☐ Altered orientation/mental status | ☐ Pain on opening/closing mouth |
| ☐ Headache/nausea/vomiting | ☐ Abnormal/painful occlusion |
| ☐ Haemorrhage from ears/nose | ☐ Spontaneous dental pain |
| ☐ Loss of consciousness | ☐ Tooth sensitive to air |
| ☐ Neck pain | ☐ Displaced or loosened tooth |
| ☐ Wheezing/coughing/gagging | ☐ Fractured tooth/teeth |
| ☐ Other bodily injuries | ☐ Missing tooth fragment located |
| ☐ Use of oral appliance | ☐ Previous dental trauma |

Details

■ Extra oral examination (select all observed)

- | | |
|---|--|
| ☐ Lacerations | ☐ Evidence of facial fractures/step deformities |
| ☐ Contusions | ☐ Paraesthesia/anaesthesia |
| ☐ Bruising | ☐ Subconjunctival haemorrhage |
| ☐ Visual disturbance | ☐ Facial swelling/asymmetry |

Annotate the diagram as needed and add any supporting details below



■ Soft tissue examination

- ☐ Tongue
 ☐ Lips
 ☐ Fauces
 ☐ Buccal mucosa
☐ Hard/soft palate
 ☐ Gingiva
 ☐ Floor of mouth
 ☐ Sublingual/buccal sulcus haematoma

Details

■ Hard tissue examination

- ☐ En-bloc alveolus movement
☐ Presence of alveolar fracture/gingival tears/step deformities
☐ Anterior open bite (posterior teeth only occluding)
☐ Palatal movement/gingival tears

Details

■ Intra oral examination

Restored dentition

- ☐ Unrestored
 ☐ Minimally
 ☐ Moderately
 ☐ Heavily

General condition of the mouth/oral hygiene

- ☐ Excellent
 ☐ Good
 ☐ Fair
 ☐ Poor

Active periodontal disease?

- ☐ Yes
 ☐ No

Teeth involved (mark 'y' where relevant):

Caries																
Displaced teeth																
Mobile teeth																
Fractured teeth																
Teeth numbers	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Fractured teeth																
Mobile teeth																
Displaced teeth																
Caries																

Details

Special investigations

Tooth																	
Occlusal interference Mark: + or -																	
Mobility Add grade: 1, 2 or 3																	
Discoloured Mark: + or -																	
Tenderness to palpation If yes, tick and add if: buccal, palatal/lingual																	
Tenderness to percussion If yes, tick and note if: occlusal or lateral																	
Endo frost Mark: + or -																	
EPT																	

Radiographic examination

☐ Periapical
 ☐ Occlusal
 ☐ Soft tissue
 ☐ Bitewings
 ☐ DPT
 ☐ CBCT

Report

Diagnosis

- | | |
|--|--|
| ☐ Concussion | ☐ Enamel fracture |
| ☐ Subluxation | ☐ Enamel-dentine fracture |
| ☐ Extrusion | ☐ Enamel-dentine fracture with pulp involvement |
| ☐ Lateral luxation | ☐ Crown-root fracture with no pulp involvement |
| ☐ Intrusion | ☐ Crown-root fracture with pulp involvement |
| ☐ Avulsion | ☐ Root fracture (cervical, mid-third, apical-third) |
| ☐ Enamel infraction | ☐ Dentoalveolar fracture |

Tooth type	Diagnosis	Prognosis (mark 'y' where relevant)			
		Good	Fair	Guarded	Poor

■ Post operative advice and warnings given

- | | | |
|--|---|---|
| ☐ Need for root canal treatment | ☐ Damage to developing tooth | ☐ Risk of tooth discolouration |
| ☐ Tooth loss | ☐ Risk of resorption | ☐ Patient information leaflet |

■ Photography consent form signed and images taken

☐ Yes ☐ No

■ Treatment today

■ Future treatment plan

Next review date

Splint removal date

Details

Onward referral/secondary opinion

- | | | | | | |
|--------------------------------------|---|-------------------------------------|--------------------------------------|---------------------------------------|--|
| ☐ Endodontist | ☐ Paediatric dentist | ☐ Maxfax/A+E | ☐ Own dentist | ☐ Orthodontist | ☐ Restorative dentist |
|--------------------------------------|---|-------------------------------------|--------------------------------------|---------------------------------------|--|

Details if referred (date, time, referred and referral sent)

Name

Dentist's
signature

Dental Trauma History and Examination Proforma

British Endodontic Society

Website: www.britishendodonticsociety.org.uk

Chapter 3

Simple guide to management of dental trauma injuries

The management of dental trauma injuries described below are based on the International Association of Dental Trauma Guidelines 2020. For ease of description of how to manage these injuries they will be subdivided into separate categories below:

Management of tooth injuries that do not require splinting

- General points
- Management and follow-up of tooth injuries that do not require splinting (table 2)

Management of tooth injuries with or without bone injuries that require splinting

- General points
- Management and follow-up of tooth injuries with or without bone injuries that require splinting (table 3)
- Easy guide to step-by-step splinting and removal

■ Management of tooth injuries that do not require splinting

General points

- Check tetanus status where relevant as may need updating.
 - » Check medical history and deal with medical history appropriately.
- Tooth fragments should be accounted for.
 - » If any soft tissue laceration, consider checking for tooth fragment and taking soft tissue radiographs.
 - » If there is a possibility of tooth and/or tooth fragment being inhaled send to A&E for a chest radiograph.
- Traumatic injuries need to be followed up clinically and radiographically, see table 2 for suggested times of follow-up for each injury.
- The British Endodontic Society recommends saving the pulp by carrying out Vital Pulp Therapy (VPT). Ideally using non-staining hydraulic calcium silicates cements, if not available calcium hydroxide.
- If the pulp could not be saved Root Canal Treatment (RCT) should be carried out.
- Both VPT and RCT should be carried out with adherence to aseptic techniques, including dental dam and sodium hypochlorite.
- Unfavourable outcomes in teeth with pulpal injury would present as:
 - » Symptomatic
 - » Pulp necrosis and infection
 - » Apical periodontitis
 - » Lack of further root development in immature teeth

■ Management of tooth injuries that do not require splinting (continued)

Table 2 Immediate management and follow-up of tooth injuries that do not require splinting (✓ Follow-up clinically and radiographically).

Injury	Immediate management	2 weeks	4 weeks	6–8 weeks	3 months	4 months	6 months	1 year	Yearly (5 years)
Concussion	No treatment		✓					✓	
Subluxation	In general, no treatment. If there is fremitus consider splinting for 2 weeks. See below in splinting section for details.	Splint removal if relevant			✓		✓	✓	
Enamel infraction	In general, no treatment. If infraction severe consider placing resin.* No follow-up needed unless the infraction is associated with another injury.								
Enamel fracture	Treatment either/or: • Bond tooth fragment • Smooth fracture • Place composite restoration			✓				✓	

* If infraction extensive, then consider acid-etching and applying bonding resin to reduce staining.

Table continued over page >>

Injury	Immediate management	2 weeks	4 weeks	6–8 weeks	3 months	4 months	6 months	1 year	Yearly (5 years)
Enamel dentine fracture	Treatment either/or: • Bond tooth fragment (consider rehydrating the fragment in saline for 20 mins prior to bonding) • Place composite restoration If exposed dentine close to the pulp but not exposed, place calcium hydroxide followed by glass ionomer and then place composite restoration.			✓				✓	
Enamel dentine fracture with pulp exposure	Conservative pulp therapy is indicated. • Mature teeth (closed apex) • Partial pulptomy Immature teeth closed apex, either: • Partial pulptomy • Pulp cap Pulp therapy materials, either/or: • Calcium hydroxide • Non-staining hydraulic calcium silicate Restore either/or: • Bond tooth fragment • Place composite restoration			✓	✓		✓	✓	✓

Table continued over page >>

Injury	Immediate management	2 weeks	4 weeks	6–8 weeks	3 months	4 months	6 months	1 year	Yearly (5 years)
Crown root fracture without pulp exposure	Depending on the extent of the fracture. If fragment mobile can either/or: • Bond fragments back together • Or remove fragment and restore tooth. If the fracture or fractures too extensive, can bond fragments temporarily or stabilise to adjacent teeth. For teeth with extensive fractures the following treatment options could be considered however would need to be carried out on a case by case basis: • Surgical or orthodontic extrusion and then restore • Crown lengthening and then restore • Bury the root and place an appropriate prosthodontic replacement • Extraction and an appropriate prosthodontic replacement	Follow-up 1 week ✓	✓	✓		✓	✓	✓	✓
Crown root fracture with pulp exposure	Immature teeth ideally should undergo VPT by placing either calcium hydroxide or non-staining hydraulic calcium silicates. Mature teeth may undergo VPT or RCT using contemporary techniques if VPT is feasible, carry out a partial pulpotomy by placing either calcium hydroxide or non-staining hydraulic calcium silicates, and bond fragments back together and review. If the fracture or fractures too extensive, can bond fragments temporarily or stabilise to adjacent teeth. Teeth with extensive fractures the following treatment options could be considered and would need to be carried out on a case by case basis: • Surgical or orthodontic extrusion and then restore • Crown lengthening and then restore • Bury the root and place appropriate prosthodontic replacement • Extraction and an appropriate prosthodontic replacement	Follow-up 1 week ✓	✓	✓		✓	✓	✓	✓

■ Management of tooth injuries with or without bone injuries that require splinting

General points

- Check tetanus status where relevant; update if needed.
- Review and address any relevant medical history.
- Reposition displaced teeth using local anaesthetic (buccal and palatal/lingual infiltration).
- Confirm tooth position with a radiograph post-repositioning.
- Splinting: use a flexible splint with 0.16 inch / 0.4 mm round stainless steel wire and composite. Extend to at least one stable teeth on either side. See easy guide to step-by-step splinting and removal, page 26.
- Post-Treatment care: soft diet, mouthwash (e.g. chlorhexidine mouthwash) for 1 week, brush with a soft toothbrush
- If root canal treatment is required, place calcium hydroxide as an intracanal medicament for up to four weeks, then obturate provided there is no evidence of resorption. Where there is concern about external inflammatory (infection-related) resorption, a corticosteroid-antibiotic paste may be used instead and should be left in situ for at least six weeks. As these pastes can cause tooth discolouration, they should be confined strictly to the root canal and avoided within the access cavity.

■ Management of tooth injuries with or without bone injuries that require splinting (continued)

Special notes

- Subluxation
 - Splinting is generally not required and is therefore not included in Table 3. However, in cases where occlusion is unfavourable, splinting may be indicated for up to 2 weeks.
- Root fractures
 - If the pulp becomes necrotic, RCT should be carried out only up to the level of the root fracture, as typically only the coronal portion becomes necrotic.
- Avulsion injuries
 - Need to note:
 - If the extra-oral dry time is less than 60 mins or more than 60 mins?
 - Has the tooth a closed or open apex?
 - Essential to:
 - Hold the tooth by the crown so as not to damage the PDL
 - Rinse tooth with a stream of saline to remove contaminants
 - Systemic antibiotics – options
 - Amoxicillin or penicillin if not allergic
 - Tetracycline or doxycycline twice daily for 7 days not for under 12 yrs.
 - If associated dentoalveolar or jaw bone fracture a more rigid splint for 4 weeks
- Traumatic injuries need clinical and radiographic follow-up. See table 3 for immediate management of injuries that need splinting and their follow up protocol and timing of the splint removal, with table 4 outlining the summary of the splinting times whilst table 5 gives an overview of adverse outcomes associated with specific injuries.

The only injuries that need root canal treatment started within 2 weeks are as follows:

- Mature/closed apex teeth avulsion injuries
- Intrusion
- Severe lateral luxation injuries with closed apices, however less severe lateral luxation injuries with closed apices should be assessed on an individual basis
(see notes under lateral luxation (closed apex) in table 3)

Otherwise, root canal treatment intervention is only indicated by clinical and radiographic signs such as symptomatic teeth, pulp necrosis, infection, apical periodontitis, or resorption.

■ Management of tooth injuries that require splinting

Table 3 Immediate management and follow-up of tooth injuries that require splinting (✓ Follow-up clinically and radiographically)

Injury	Immediate management	2 weeks	4 weeks	6–8 weeks	3 months	4 months	6 months	1 year	Yearly (5 years)
Extrusion	Reposition and splint	Remove splint If marginal bone breakdown splint for a further 4 weeks ✓	✓	(Note if there was marginal break down remove splint that was placed for the extra 4 weeks) ✓	✓		✓	✓	✓
Lateral luxation (closed apex)	Reposition and splint	Make an endodontic assessment, depending on the severity of the injury, however most mature teeth will go necrotic, therefore start RCT within 2 weeks if indicated.	Remove splint If marginal bone breakdown splint for a further 4 weeks ✓	✓	✓		✓	✓	✓
Lateral luxation (open apex)	Reposition and splint	Make an endodontic assessment, the goal is revascularisation. Therefore monitor only signs of pulp necrosis or resorption then RCT is indicated.	Remove splint If marginal bone breakdown splint for a further 4 weeks ✓		✓		✓	✓	✓

Table continued over page >>

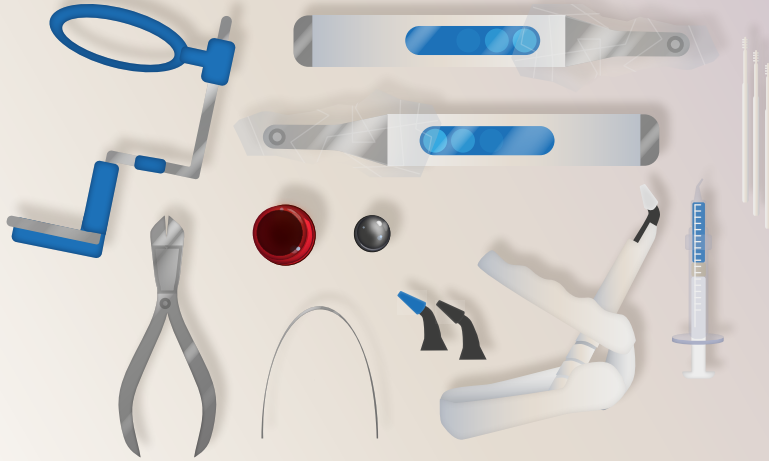
Injury	Immediate management	2 weeks	4 weeks	6–8 weeks	3 months	4 months	6 months	1 year	Yearly (5 years)
Intrusion (closed apex)	Reposition and splint	Start RCT - 2 weeks	Remove splint ✓	✓	✓		✓	✓	✓
Intrusion (open apex)	Allow spontaneous repositioning to take place	✓	No movement in 4 weeks recommend orthodontic repositioning Monitor pulp Pulp revascularisation may occur Signs of pulp necrosis start RCT to stop inflammatory external resorption ✓	✓	✓		✓	✓	✓

Table continued over page >>

Injury	Immediate management	2 weeks	4 weeks	6–8 weeks	3 months	4 months	6 months	1 year	Yearly (5 years)
Avulsion (closed apex)	Reposition and splint. See special notes about systemic antibiotics and splinting.	Start RCT within 2 weeks Remove splint	Remove splint If there was an associated dentoalveolar/jaw bone fracture ✓	✓	✓		✓	✓	✓
Avulsion (open apex)	Reposition and splint. See special notes about systemic antibiotics and splinting.	Remove splint The goal is revascularisation , therefore monitor. If signs of pulp necrosis or resorption, which can happen rapidly in immature teeth, then RCT is indicated.	Remove splint If there was an associated dentoalveolar/jaw bone fracture ✓	✓	✓		✓	✓	✓
Dentoalveolar fracture	Reposition and splint	✓	Remove splint ✓	✓	✓		✓	✓	✓
Mid third root fracture	Reposition and splint	✓	Remove splint ✓	✓	✓		✓	✓	✓
Cervical third root fracture	Reposition and splint	✓	✓	✓	✓	Remove splint ✓	✓	✓	

■ Easy guide to step-by-step splinting and removal

Step 1



Be prepared – checklist of items:

- Ideally camera to take photographs
- Cheek retractors and mirror
- Pre-operative Radiograph
- Local anaesthetic
- Cotton wool rolls
- Gauze
- Etch
- Bond/primer
- Composite
- Micro brushes
- Wire cutters
- 0.16inch/0.4mm round wire generally for most injuries. In certain severe cases injuries, rectangular more rigid wire may be required (e.g. severe dentoalveolar fracture and cervical third root fracture)
- Ideally two fast-cure composite lights

Step 2



Photography

- Ask the patient if they have a photo of how their teeth were before the dental trauma.
- Take photos to record injuries.

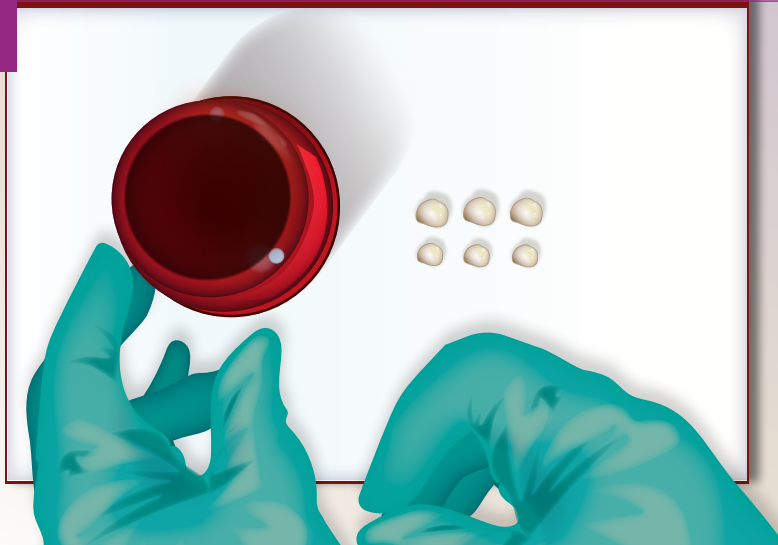
Step 3



Know how many teeth need to be included in the splint and cut wire

- Choose appropriate wire (0.16 inch / 0.4mm round wire generally).
- In certain severe injuries, rectangular rigid wire may be required (e.g. severe dentoalveolar fracture and cervical third root fracture).
- Cut stainless steel wire to appropriate length.
- Ensure splint is extended to at least one stable tooth on either side.

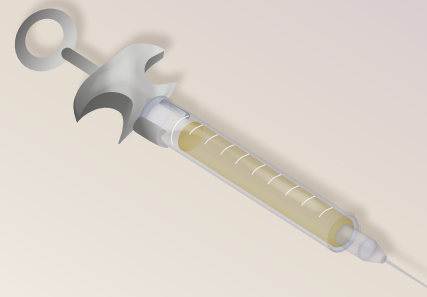
Step 4



Prepare composite for splinting

- Prepare composite balls into large and small sizes for each of the teeth involved in the splint e.g. if 3 teeth are involved in the splint, then 3 larger composite balls and 3 smaller composite balls are required.
- Place all of these on a mixing pad under a dappens pot to protect from the light, to stop it curing.
- Your nurse could prepare the composite for splinting once appropriately trained.

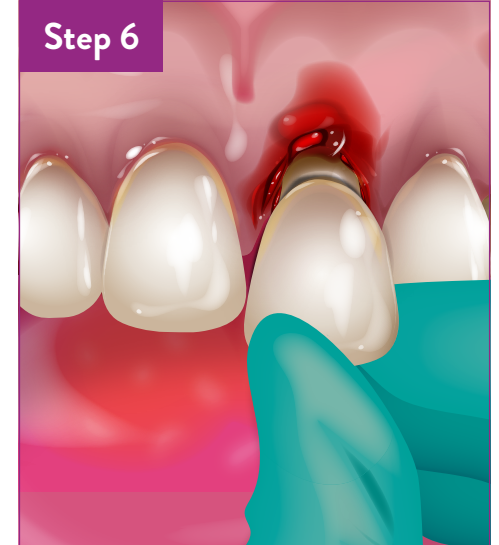
Step 5



Reassess pre-operative radiographs and administer local anaesthetic

- Make sure you have viewed your pre-operative radiographs.
- Administer local anaesthetic making sure you administer buccal and palatally/lingually as indicated.

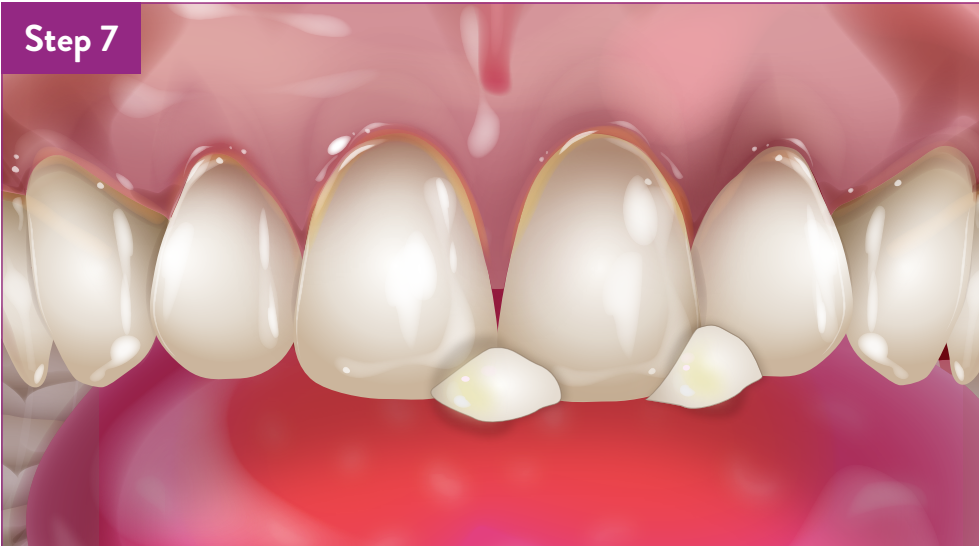
Step 6



Reposition tooth or teeth

- Ideally reposition with fingers. Gauze over the tooth's incisal edge can help the operator be more comfortable.

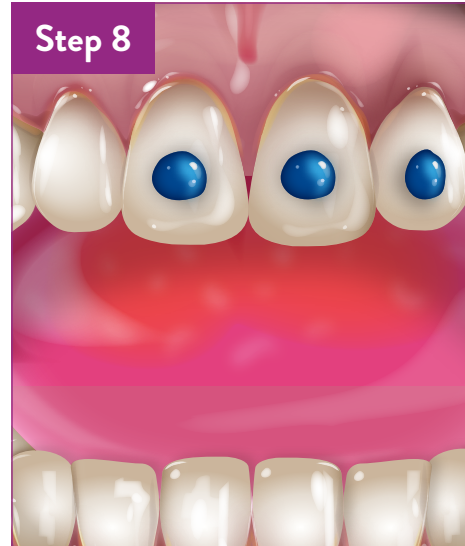
Step 7



Stabilise repositioned tooth (if needed) and take/check periapical radiograph

- If needed, the tooth could be stabilised temporarily using composite without etch and bond which aims to stabilise the tooth for splinting and a check radiograph.
- The composite could be placed approximately 1/3 of the way onto the incisal edges and very slightly buccal, palatal/lingual of the tooth and adjacent teeth.
- A very dark shade or light shade composite can be useful to use.
- If the teeth are correctly positioned following the check radiograph, then go to Step 8.

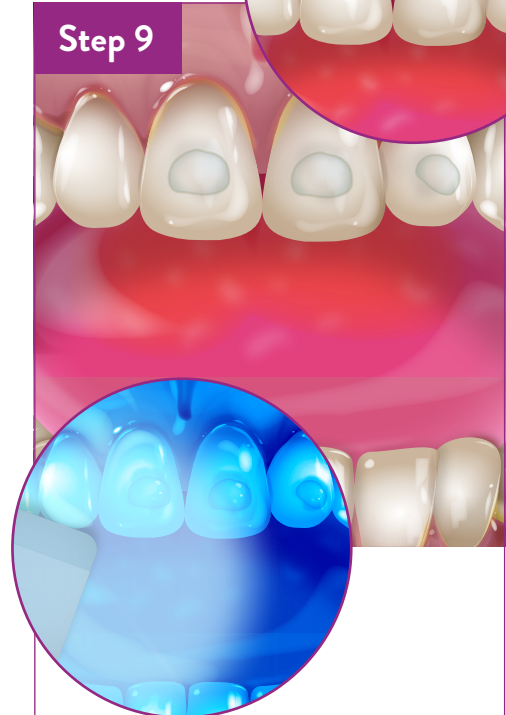
Step 8



Spot etch, wash dry

- Spot etch, wash and dry teeth involved in the splint.
- Ensure any etching gel and rinsing water is kept away from the gingival tissues.

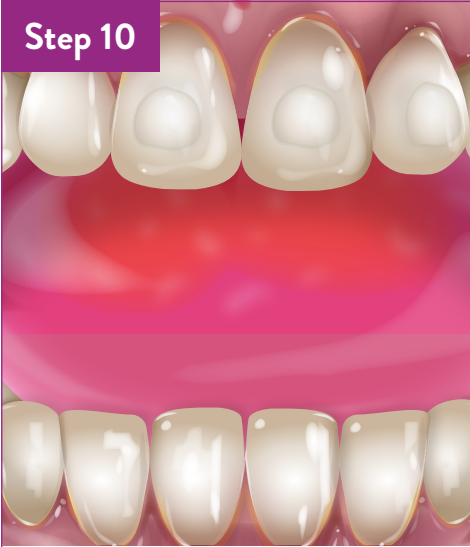
Step 9



Apply bonding agent/primer and cure

- Apply bonding agent/primer and cure to where spot etching has taken place.

Step 10



Place large composite balls on to teeth

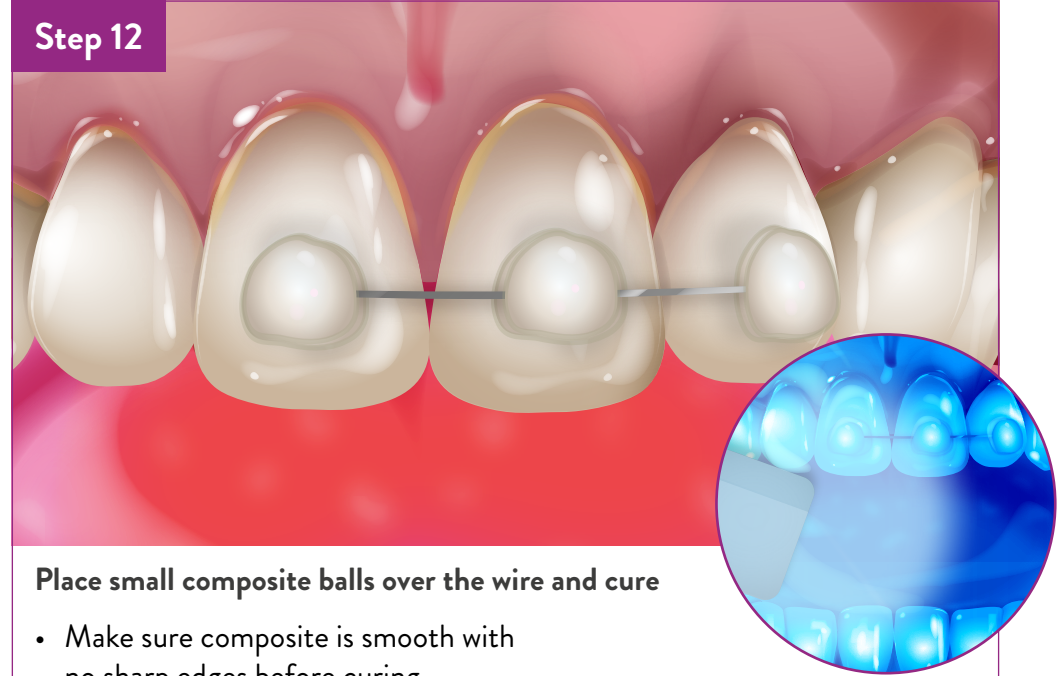
- Place large composite balls on teeth.
- Keep away from direct overhead light to stop it curing.

Step 11



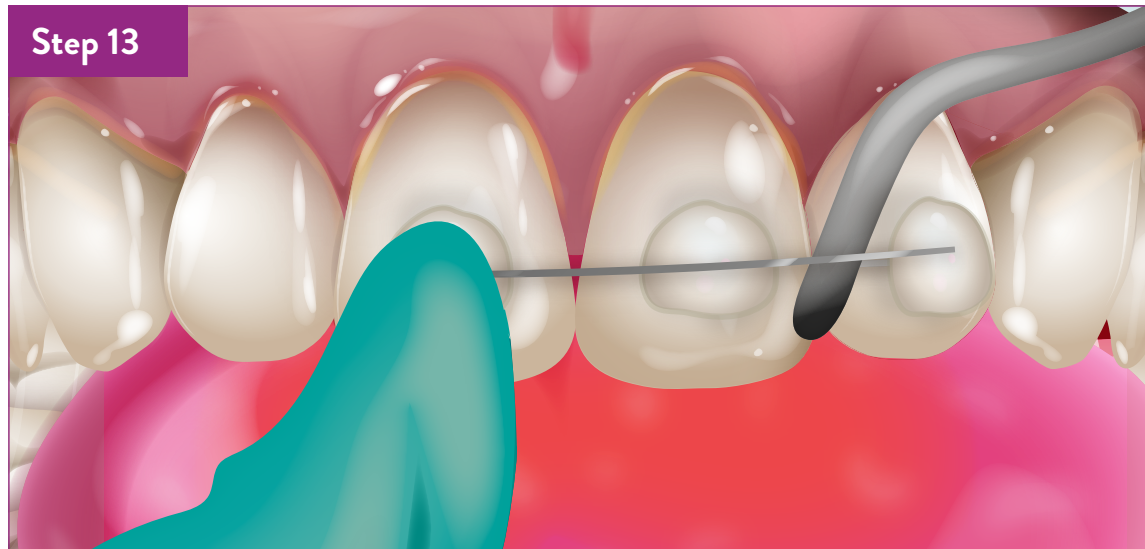
Embed the precut stainless steel wire into the composite balls and cure the composite

Step 12



Place small composite balls over the wire and cure

- Make sure composite is smooth with no sharp edges before curing.
- Composite can be manipulated using a micro-brush dipped in bonding resin.
- Avoid adjusting the composite with burs or abrasive discs to prevent debris entering the gingival sulci of teeth, e.g. avulsed and luxated teeth.



Splint removal

- Splint removal should be considered at the appropriate time along with clinical and radiographic follow-up. The removal normally does not require use of local anaesthetic, but some patients may benefit from its use.
- The splint removal should be as atraumatic as possible. The easiest way to do this is to start with a diamond bur and remove the superficial layer of composite covering the stainless steel wire.
- Once the wire is exposed on each tooth, its removal is facilitated by using a blunt instrument. The removal of the remaining composite should then be carried out using diamonds burs and abrasive discs, with water coolant to prevent overheating of the tooth.

Chapter 4

Follow-up summary

Follow-up of dental trauma injuries is of great importance.

In this section the following is included:

- Summary of splinting and follow-up times at a glance (table 4)
- General signs of favourable outcome
- General signs of unfavourable outcome – all luxation injuries
- Overview of adverse outcomes associated with specific injuries (table 5)

It is recommended in patients with multiple injuries the follow up protocol should be based on the worst injury.

■ Splinting and follow-up times at a glance

Table 4 Summary of splinting times and follow-up review times of these injuries

Injury	2 weeks	4 weeks	6–8 weeks	3 months	4 months	6 months	1 year	Yearly (5 years)
Concussion		✓					✓	
Subluxation	✓S?			✓		✓	✓	
Extrusion	✓S	✓	✓	✓		✓	✓	✓
Lateral luxation	✓	✓S	✓	✓		✓	✓	✓
Intrusion	✓	✓S	✓	✓		✓	✓	✓
Avulsion (Mature)	✓S	✓		✓		✓	✓	✓
Avulsion (Immature)	✓S	✓	✓	✓		✓	✓	✓
Dentoalveolar fracture		✓S	✓		✓	✓	✓	✓
Mid third root fracture		✓S	✓		✓	✓	✓	✓
Cervical third root fracture		✓	✓		✓S	✓	✓	✓

✓ Follow-up clinically and radiographically

S Splint removal recommended time

S? Splint removal – only if splint originally indicated (see previous notes)

■ General signs of favourable outcome

- Asymptomatic
- Clinical and radiographic signs of normal or healed periodontium
- Continued root formation (open-apex)
- Positive response to sensibility tests (may get false negative for several months)
- Pulp obliteration – particularly certain injuries
- Marginal bone height the same after repositioning
- No resorption

■ General signs of adverse outcome – all luxation injuries

- Symptomatic
- Pulp necrosis/infection/apical periodontitis
- Arrest of root development with immature roots
- External resorption (inflammatory or replacement/ankylosis)
- Internal resorption
- Marginal bone breakdown
- Persistent / chronic pain e.g. persistent dento-alveolar pain (PDAP), persistent idiopathic dento-alveolar pain (PIDP)

■ Overview of adverse outcomes associated with specific injuries

Adverse outcome and their consequences would need to be judged on a case by case basis and managed with the treatment plan.

Table 5 Overview of adverse outcomes associated with specific injuries

Injury	Breakdown in marginal bone may need to splint for further 4 week period	External inflammatory resorption (infection related)	External replacement resorption/Ankylosis
Concussion			
Subluxation		* (in rare circumstances)	
Extrusion	*	*	
Lateral luxation	*	*	*
Intrusion	(+/- in some cases)	*	* (+/- Ankylotic sounds)
Avulsion	*	*	* (+/- Ankylotic sounds)

* Any of these adverse outcomes may occur.

A guide to Traumatic Dental Injuries of Permanent Teeth

British Endodontic Society

Website: www.britishendodonticsociety.org.uk
