

The occasional dental fracture

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INTRODUCTION

Approximately 6 million Canadians avoid visiting the dentist each year due to financial restrictions and often rely on emergency department (ED) physicians for the management of their acute dental complaints.¹ Painful dental problems typically seen in rural EDs include dental caries, trauma and abscesses.² Dental traumas, such as tooth fractures caused by sports-related injury, facial/intraoral trauma, or increased pressure to teeth with pre-existing dental caries, are often amenable to temporary filling performed by the emergency room physician (ERP) with timely follow-up with a dental professional.³ That being said, many Canadian physicians do not feel adequately prepared to manage dental emergencies due to poor access to dental emergency supplies, lack of training and minimal dental emergency consultant support—especially in a rural setting.⁴ The main goals of the ERP when treating a patient with a dental emergency include controlling pain, decreasing infection risk and preserving function.⁵ This article provides simple guidelines for the management of dental fractures/fillings in the ED using the modified International Association of Dental Traumatology

(IADT) description-based fracture classification system [Table 1].

ANATOMY

A clear understanding of dental anatomy plays a significant role in the appropriate management of dental emergencies. Dental tissues described from most external to internal include [Figure 1]:⁷

1. Enamel: White calcified protective external surface
2. Dentin: Majority of tooth tissue, provides support for enamel and periodontal ligament insertion
3. Cementum: Very thin layer that protects the roots of the tooth
4. Pulp: Connective tissue containing neurovascular supply.

Dental caries and fractures tend to impact the enamel and dentin and lesions are only considered emergent when the pulp is affected.⁹

Modified international association of dental traumatology description-based classification system

The 2012 IADT guidelines outline 9 types of dental fractures with complex diagnostic and management recommendations.¹⁰ In 2016, Chauhan *et al.* published modified

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Table 1: Summary of dental fractures using a descriptive injury system modified from the international association of dental traumatology guidelines

Injury type	Description	Management
Infarction [Figure 1: A]	Incomplete fracture of the enamel (crack). Not sensitive to temperature stimuli	File with emery board
Uncomplicated crown fracture [Figure 1: B]	Fracture of dentin and/or enamel without pulp exposure. Sensitive to temperature stimuli	Enamel only: File with emery board Enamel + dentin: File + fill with temporary cement (CaOH/ZnO) or 2-octyl cyanoacrylate (dermabond™)
Complicated crown fracture [Figure 1: F]	Fracture of dentin and enamel with pulp exposure. Pulp involvement is typically demonstrated by the presence of blood. Sensitive to temperature stimuli	File+fill with temporary cement (CaOH/ZnO) or 2-octyl cyanoacrylate
Uncomplicated crown-root fracture [Figure 1: G]	Fracture of enamel, dentin and cementum without pulp exposure. Painful and tender to palpation/temperature stimuli	File + fill with temporary cement (CaOH/ZnO) or 2-octyl cyanoacrylate
Complicated crown-root fracture [Figure 1: H]	Fracture of enamel, dentin and cementum with pulp exposure. Pulp involvement is typically demonstrated by the presence of blood. Painful and tender to palpation/temperature stimuli	Pulp capping (CaOH/ZnO)/partial pulpotomy

In all cases, ensure appropriate pain management and consider tetanus immunization administration⁶

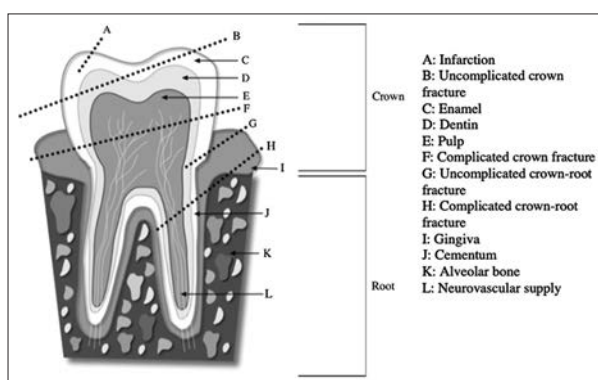


Figure 1: Dental anatomy including modified International Association of Dental Traumatology classification system. Based on Encyclopædia Britannica, Inc.⁸

IADT description-based guidelines simplifying the diagnosis and management of dental traumas¹¹ as described in [Table 1 and Figure 1].

If tooth mobility is noted on examination a temporary splint using 2-octyl cyanoacrylate + foil or metal nasal bridge from the mask can be applied as described below

Tetanus prophylaxis

Tetanus status should be determined, and prophylaxis should be considered for patients with dirty lacerations in the area surrounding the affected tooth.¹²

Considerations¹³

- Assess for associated injuries to the surrounding structures (mandible, facial bones, neck, etc.)
- Recognise situation as an opportunity to provide a tetanus shot
- Recognise patients with increased risk for aspiration: intoxicated, altered mental status, decline in functional capacity, significant facial trauma¹⁴
- Recognise signs of intimate partner/child abuse
- Arrange follow-up with a dental professional as soon as possible.

When to image

The treatment of most dental emergencies is not changed by the information provided by radiographs.¹⁵ X-rays (chest and facial views) or ultrasonography should be considered if a tooth fragment is missing and there are concerns about fragment aspiration or lodging in the surrounding mucosa.¹³ If a tooth fragment is located below the diaphragm on X-ray, there is no need to remove it; however, if it is located in a bronchus or the oesophagus, removal is

necessary through bronchoscopy or endoscopy.¹⁶ If there are concerns about facial bone trauma such as a mandibular fracture, or further assessment of dentition is required, a panoramic radiograph/orthopantomogram, limited facial series X-ray and/or a skull X-ray (Townes view) are recommended, if available.¹⁵

Pain management

Depending on the type of fracture and the patient's level of comfort, a dental block may be required for adequate pain management.¹³ If the affected tooth is located in the maxillary (upper) region, a suprapariosteal/infiltration block can be performed to directly target the individual tooth. If the affected tooth is located in the mandibular (lower) region, an inferior alveolar nerve block should be considered. In both scenarios, a mixture of lidocaine 1%–2% with epinephrine and bupivacaine is recommended. The total period of pain relief with using this combination is approximately 8 h. Contraindications for these procedures include an allergy to the anaesthetic being used, cardiac congenital abnormalities and an infected injection site.¹⁷

Refer to these videos for further instructions

- i. Suprapariosteal/infiltration block: <https://www.youtube.com/watch?v=jNAQUSqfK1A>¹⁸
- ii. Inferior alveolar nerve block: procedural explanation starts at 3:30 <https://www.youtube.com/watch?v=4-7WvBxQWn8>¹⁹ or at 0:15 <https://www.youtube.com/watch?v=r-ZucSksS07w>²⁰

Temporary filling materials

Temporary filling materials such as calcium hydroxide (CaOH) and zinc oxide (ZnO) are commonly used for the repair of dental traumas due to their antibacterial, antifungal and remineralisation properties.²¹ They are also relatively inexpensive, simple to use and provide a smooth surface to prevent damage to the tissues surrounding the affected tooth. In Canada, 3M Cavit G temporary filling material (or equivalent) is available from dental supply houses such as *Frontier Dental* or *Patterson Dental*.

Procedures

Equipment required for most standard dental procedures

- Gloves and appropriate personal protective equipment
- Headlamp for adequate visualisation
- Normal saline/water for cleansing/irrigation
- Gauze to create a bite block
- Local anaesthesia (lidocaine 1%–2% with epinephrine and bupivacaine)
- Five mL syringe and 25 gauge (or smaller) 1.5 inch-long needle
- Temporary filling material (CaOH, Dycal™) or ZnO
- Mixing board or any sterile flat surface (round bowl, kidney basin, metal tray)
- Stainless steel spatula or metal tissue forceps or a scalpel handle
- Aluminium foil
- Suction catheter and tubing.

Equipment required for dental procedures mentioned below

- 2-Octyl Cyanoacrylate (2-OCA)
- Oxygen mask or N95 respirator
- Bone file or grip on a set of tissue forceps
- One percentage or 2% lidocaine with epinephrine and bupivacaine (mix 1:1).

GENERAL RECOMMENDATIONS

- Palpate the affected tooth and surrounding areas to assess for tooth and/or tooth fragment mobility²²
- Once the tooth fragment is accounted for, preserve the fragment in either 50% dextrose, egg white, or saliva, as it can potentially be reattached²³
- Instruct the patient to hold suction to the area surrounding the affected tooth to ensure that the tooth remains dry enough to allow the proper adhesion of the temporary reparative materials²⁴
- If an object, for instance a gloved finger, gauze or equipment, becomes adhered to the patient's wound, apply pressure to the patient's skin adjacent to the edge of the object and gently roll the object away.²⁵ To avoid

unintentional adhesion to the patient's wound, use instruments such as a scalpel handle and wear 2 pairs of gloves in order to remove the top glove if it becomes stuck.

The use of 2-octyl cyanoacrylate or temporary filling material (calcium hydroxide/zinc oxide) to protect pulp and manage pain [Figure 2a and b]

Using 2-octyl cyanoacrylate

*Procedure*²⁴

1. Cleanse tooth, tooth fragment and surrounding areas with normal saline/water-soaked gauze
2. Dry tooth and surrounding area with gauze and allow patient to suction excess fluids from their mouth
3. Coat the lesion and associated tooth with 2-OCA to cover exposed dentin/pulp
4. If able, reattach tooth fragment by applying 2-OCA to both the fragment and the associated tooth, then push them together for approximately 20 s
5. Coat the area (tooth + reattached fragment) with 2-OCA
6. Roll up a piece of gauze to create a bite block and position it away from the affected tooth
7. Instruct patient to lightly bite down on gauze roll to prevent patient from disrupting the 2-OCA
8. Allow 2-OCA to dry for approximately 10 min.

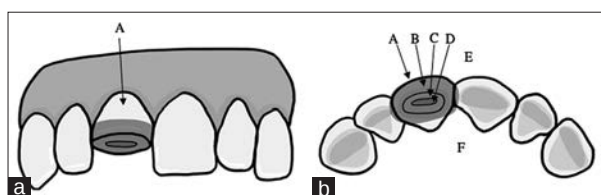


Figure 2: (a) Front view of a complicated fracture of the maxillary right central incisor with pulp involvement repair with 2-Octyl Cyanoacrylate or temporary filling material. Based on Dental Care Professionals.²⁶ (b) Upper occlusal view of a complicated fracture of the maxillary right central incisor with pulp involvement repair with 2-Octyl Cyanoacrylate or temporary filling material. Based on Bunkerhill Dentistry.²⁷ A: Maxillary right central incisor, B: Enamel, C: Dentin, D: Pulp, E: Labial/Buccal surface, F: Lingual/palatal surface

Using calcium hydroxide or zinc oxide

*Procedure*²⁸

1. Cleanse tooth, tooth fragment and surrounding areas with normal saline/water-soaked gauze
2. On a mixing board, mix equal parts of the catalyst (if available) and base using a spatula for approximately 20–40 s (until mixture thickens)
 - The amount of mixture prepared should be enough to cover the entire lesion
3. Dry tooth and surrounding area with gauze and allow patient to suction excess fluids from their mouth
4. Scoop up mixture using the flat blade of the spatula and apply it to the dental lesion using the spatula to cover the exposed dentin and pulp. Remove excess filling material to ensure appropriate shape and rounded edges
5. Roll up a piece of gauze to create a bite block and position it away from the affected tooth
6. Instruct patient to lightly bite down on gauze roll to prevent patient from disrupting the temporary filling material
7. Allow cement to dry for approximately 10–15 min.

Create temporary flexible bridge/splint—to be used in scenarios where the tooth is not only fractured, but also mobile within the socket²⁹ [Figure 3a and 3b]

*Procedure*²⁹

1. Cleanse tooth and surrounding areas with normal saline/water-soaked gauze
2. Dry tooth and surrounding area with gauze and allow patient to suction excess fluids from their mouth
3. Apply 2-OCA to either edge of the affected tooth and the gingiva in order to adhere the affected tooth to the surrounding teeth
4. Remove the metal nasal bridge from a N95 respirator or oxygen mask
5. Measure and cut the metal nasal bridge to the desired size (long enough to cover one or more teeth on either side of the affected tooth)
6. Round the edges of the metal nasal bridge using a bone file to prevent further injury

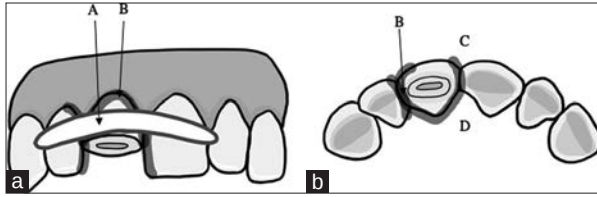


Figure 3: (a) Front view of a complicated fracture of the maxillary right central incisor with pulp involvement repair demonstrating 2-octyl cyanoacrylate and a metal nasal bridge splint application. Based on Rosenberg.²⁹ (b) Upper occlusal view of a complicated fracture of the maxillary right central incisor with pulp involvement repair demonstrating 2-octyl cyanoacrylate and a metal nasal bridge splint application. Based on Bunkerhill Dentistry.²⁷ A: Metal nasal bridge splint to upper labial/buccal surface, B: 2-Octyl cyanoacrylate, C: Labial/buccal surface, D: Lingual/palatal surface

7. Apply 2-OCA to the metal nasal bridge, affected tooth and the neighbouring teeth
8. Adhere the bridge to the affected and neighbouring teeth
9. Hold splint under pressure for approximately 1 min.

The splint can be applied to either the lingual/palatal (inner) surface or the labial/buccal (outer) surface, depending on the location of the injury and the patient's occlusion. If the injury is to the upper teeth and the patient's occlusion is normal, or the injury is to the lower teeth, a splint applied to the lingual/palatal surface is preferred. If the injury is to the upper teeth and the patient's occlusion is tight, a splint applied to the labial/buccal surface would prevent increased pressure to the splint from further damaging the patient's dentition.

CONCLUSION

Initial management of dental fractures can be successfully accomplished in a rural ED or clinic environment using equipment commonly found in a community setting. The previously described procedures provide temporary relief but it is essential that a prompt follow up with a dental professional is scheduled.

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