CLINICAL

Management of uncomplicated crown fractures in the permanent dentition

Jason Smithson¹

The loss of a tooth at an early age has a lifetime impact. Traumatic dental injuries, commonly known as TDIs, often occur in children and young adults, comprising 5% of all bodily injuries, according to a 2013 Journal of Endodontics article. The incidence is higher in U.S. school children, where 25% of them experience dental trauma. And the number of adults experiencing trauma to their permanent dentition is 33%, with most injuries occurring before age 19.

The etiology of TDIs is broad and includes behavioral factors, such as risk-taking children, obesity, and amateur athletes, increased overjet with a protrusion, and other factors, like illness, learning difficulties, inappropriate use of teeth, or oral piercings.

Restorative dentists must be comfortable managing dental trauma cases such as uncomplicated crown fractures (https://pubmed.ncbi.nlm.nih.gov/12110103/) because proper diagnosis, treatment planning, and follow-up are essential to ensure a favorable patient outcome. They must also be comfortable communicating treatment options and the prognosis to patients and/or a patient's parents or legal guardians to obtain complete, informed consent for treatment.

Not accepting unscheduled emergency TDIs, can be a missed business opportunity when you consider the yearly treatment costs of oral injuries in the USA are estimated to be \$2 million to \$5 million per one million inhabitants. With crown fractures (https://pubmed.ncbi.nlm.nih.gov/12110103/) and luxation of the permanent dentition the most common injuries, knowing how to manage these complex cases and feeling comfortable with the process, can be a successful way to increase revenue for your practice.

Clinical examination and diagnostics of uncomplicated crown fractures

Crown fractures are classified as:

• Enamel Infractions: A crack, or crazing, of the enamel without loss of tooth structure.

• Uncomplicated Crown Fracture (enamel only): A coronal fracture involving enamel only with the loss of tooth structure.

• Uncomplicated Crown Fracture (dentin and enamel): A coronal fracture confined to enamel and dentin without pulp exposure.

A clinical TDI examination should have good lighting and transillumination to evaluate teeth for fractures and infractions. A sensitivity assessment using air should be performed before testing for tooth percussion, which is usually done with the handle of a mouth mirror.

¹ Jason Smithson

BDS (Lond), DipRestDentRCS (Eng), Private Practice, Cornwall, UK

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Figure 1: My 14-year-old son sustained an uncomplicated enamel-dentin crown fracture of his upper right central incisor after being hit in the mouth with his cell phone.



Figure 2: The upper left central incisor (2.1) sustained a small uncomplicated enamel fracture. The 1.1 was not TTP or mobile. Although the mesial pulp horn was visible clinically, the tooth tested vital to both electronic and thermal pulp testing.

To assess for a subluxation injury or root fracture, palpate the tooth and alveolus bi-manually. Tooth mobility is graded by applying pressure with the ends of two mouth mirrors (using fingers is unreliable since they are compressible) and attempting to move the tooth buccolingually.

According to the Grace and Smales Index, 1989, normal physiologic mobility is 0.25 mm, but an allowance should be made for pre-existing periodontal conditions. Mobility is graded as:

- Grade 0: no mobility
- Grade 1 : mobility < 1 mm buccolingually
- Grade 2: mobility >1 mm but >2 mm

• Grade 3: mobility >2 mm or compressibility within the socket.

Determining the location of the fulcrum is also essential since teeth that are mobile at a point halfway along the root or less are likely to have a root fracture. Finally, assess for tooth vitality with electronic and thermal tests.

Without any clinical evidence of root fracture, a periapical radiograph using the paralleling technique is necessary.

Film holders should be used to facilitate standardized and reproducible radiographs since the baseline image provides a reference for future comparisons at follow-up examinations. The recommended radiographs are:

1. A periapical radiograph to demonstrate the two maxillary central incisors through the midline.

2. Right and left periapical radiographs aimed at the lateral incisors also show the canine and central incisors.

3. A parallel periapical radiograph through the lower central incisors.

If the lost tooth fragment is not present, consideration should be given to imaging the soft tissues (e.g., the lips) to locate it.

Management of uncomplicated crown fractures Enamel Infraction

Usually, no treatment is needed except if the infraction is severe when etching and sealing with resin to prevent discoloration and bacterial contamination is considered. Does not require a follow-up.

Uncomplicated crown fracture (enamel only)

Treatment is dependent on whether the detached tooth fragment is available or not. If the fragment is available, it should be bonded back onto the tooth. Alternatively, depending on the location and magnitude of the fracture, a direct composite resin restoration (/spearreview/2020/03/4-burning-questions-on-restorations-with-ceramic-or-pfm-crowns) can be placed, or the fractured edges smoothed with a disc. Follow-ups at 6-8 weeks and one year should be scheduled with a clinical examination and periapical radiographs.

Uncomplicated crown fracture (enamel and dentin) If the detached fragment is available, it should be rebonded.

Before rebonding, the fragment should be soaked for 20 minutes in a saline solution to rehydrate it. Alternatively, the tooth can be restored with direct composite resin (https://online.speareducation.com/course/the-foundation-of-anterior-direct-resin-aesthetics) or indirect ceramic, dependent on the extent of the injury and the skillset of the operator. Does not require a follow-up.

Case 1: Fragment reattachment

Any biofilm and aprismatic enamel were removed from the tooth and the fragment with light hydro abrasion with 29-micron alumina at 2-3 bar pressure. The tooth and the fragment were etched with 37% phosphoric acid (Ultradent), and a fourth-generation dentin bonding agent (Kerr, OptiBond FL) was applied (the adhesive component was not light-cured.)

The fragment was luted to the tooth with heated chromatic

enamel shade composite (GC G-aenial A2 shade). The heater used was a Calset Warmer from Addent. The excess composite was cleaned with an interproximal carver from American Eagle and smoothed with a number three brush and modeling resin (Brush & Sculpt from Cosmedent).

Composite was heated because it gains lower viscosity to improve adaptation. Plus, heating increases the conversion of monomer to polymer, which improves the physical characteristics of the resin, such as flexural strength and wear resistance, according to research by Da Costa, Hilton, and Swift in 2011.

The resin was polymerized, and the oxygen-inhibited layer was removed with polymerization under glycerine.

The enamel fracture on 2.1 was untouched and will be managed in conjunction with esthetic (/spear-review /2013/08/evaluating-facial-esthetics-facial-profile) management of the white hypo calcification at a later time.



Figure 3: The tooth fragment was retained.



Figure 4: The 1.1 was anesthetized, and a rubber dam was applied.



Figure 5. The resin margin was polished with FlexiDiscs from Cosmedent and Astropol Polishing Points from Ivoclar.



Figure 6. After rehydration, esthetic integration is excellent, and the tooth remains vital.

Case 2: Restoration with direct composite resin

This 21-year-old male presented with an uncomplicated



Figure 7: All teeth tested vital to pulp testing.



Figure 9: All teeth tested vital to pulp testing.



Figure 11: The teeth were etched with 37% phosphoric acid, and a fourth-generation dentin bonding agent was applied.



Figure 13: A palatal shell was built with an achromatic enamel.

enamel-dentin fracture of the upper right central, lateral incisor, and canine following a fall.



Figure 8: All teeth tested vital to pulp testing.



Figure 10: The dentition was scanned, and a palatal stent was fabricated from a 3D printed model of the digital wax-up. After anesthesia, the teeth were isolated with a rubber dam, and floss ties were used to retract the tissue. And just like Case 1, hydro abrasion was used.



Figure 12: The teeth were etched with 37% phosphoric acid, and a fourth-generation dentin bonding agent was applied.



Figure 14: The layering proceeded with a dentin replacement, chromatic enamel, and effects.



Figure 15: The layering proceeded with a dentin replacement, chromatic enamel, and effects.



Figure 16: The layering proceeded with a dentin replacement, chromatic enamel, and effects.



Figure 17: Achromatic enamel at the incisal edge.



Figure 18: The restoration was then polished with FlexiDiscs and Astropol points.



Figure 19: The restoration was then polished with FlexiDiscs and Astropol points.

Summary

A busy dental office must know how to manage uncomplicated crown fractures of permanent dentition efficiently and effectively. Reviewing case studies such as this and discussing complex cases with your peers is a great way to feel more comfortable and significantly impact the outcome for the patient.

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Figure 20: Good esthetic integration was achieved on recall.

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