Acute and Long-term Management of a severely displaced Mid-Third Horizontal Root Fracture

A clinical case report

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Abstract

Root fracture is an uncommon and often complicated to manage traumatic injury, accounting for around 2% of all dental trauma[1]. As with all traumatised teeth, the immediate management of acute dental trauma can improve the long term prognosis and outcomes for the patient.

This case report discusses the management of a 6 year old boy who presented acutely with a severely displaced mid third horizontal root fracture to his immature maxillary right central incisor. This case report highlights how the effective management can improve outcomes in even the most severe cases of dental trauma and details how to overcome difficulties in managing complex trauma in the developing dentition. The patient has been followed up for over 2 years post-trauma whereby the tooth has shown continued root development and remains vital to sensibility testing.

Introduction

A 6 year old boy attended as an acute emergency to the paediatric dental walk-in service at King's College Hospital (KCH) following dental trauma several hours earlier.

History

The patient had been playing on a trampoline at school 3 hours earlier when he accidentally kneed himself in his face. The incident was witnessed by the teachers who called the patient's mother. The teachers reported no loss of consciousness or head injury. The patient was taken to his General Dental Practitioner (GDP) and was subsequently referred to KCH for management.

The patient was complaining of mobility to his maxillary right central incisor (UR1) and stated it was painful every time he closed his mouth.

Medical history

Medically he is fit and well with no known drug allergies. He was up to date with all of his vaccinations.

Social history

The patient lives at home with his parents and his two pet gerbils. They live approximately one and a half hours from KCH.

Dental history

The patient had limited dental experience given his young age, and had only attended for examinations at his own GDP previously.

On Examination:

Extra-Orally

The patient had slight bruising to upper lips consistent with injuries sustained. Both the patient and his mother were understandably upset. Close examination of the patients knee revealed teeth marks consistent with the trauma history.

Intra-orally

Soft tissue bruising and bleeding of the gingivae around UR1.

The UR1 was grade II mobile and interfering with the occlusion. Both the ULB and URB were also grade II mobile. (Figure 1)

The patient was in the early mixed dentition and caries free.

Occlusion

The patient had a class I incisal relationship.

Figure 1: Intra-oral photograph showing traumatised UR1.

Radiographic examination

A periapical radiograph (figure 2) had been taken at the patients GDP so an upper standard occlusal radiograph (figure 3) was taken to assess the extent of the trauma.

These 2 radiographs were graded at the time as grade 1 (prior to FGDP guidance changes) and showed:

- Severely displaced mid third horizontal root fracture of UR1
- UR1 and UL1 have immature apices
- URB and ULB are close to exfoliation and developing permanent UR2 and UL2

Figure 2: - Periapical radiograph taken by patients GDP showing UR1 with a possible displaced root fracture and URB close to exfoliation

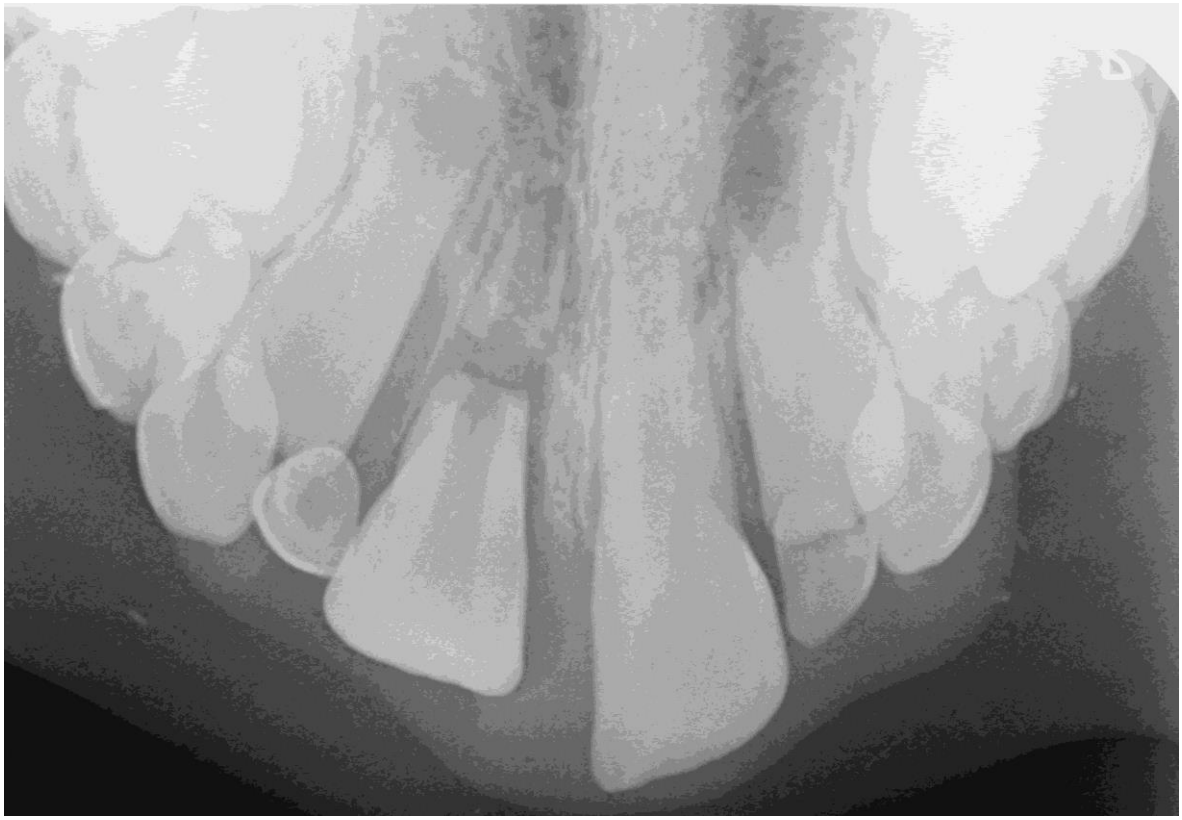

Figure 3: - Upper Standard occlusal radiograph showing the extent of the displacement of the UR1 root fracture.

Sensibility testing

This was not completed at acute presentation.

Diagnoses

The following diagnoses were made based on the clinical and radiographic findings:

- UR1- Immature tooth with a severely displaced mid- third horizontal root fracture.
- URB and ULB close to exfoliation

Treatment

Immediate management

Following recommendation of the International Association of Dental Trauma (IADT) guidelines, the teeth were repositioned as best possible under local anaesthetic and a flexible splint (0.16 stainless steel wire) was applied for 3months (figures 5 and 6). The URB was extracted as this tooth was grade II mobile and interfering with adequate splint placement. The splint therefore extended from URC to ULC excluding ULB as this tooth was also mobile. A Post splinting radiograph was taken (figure 7) to check for coronal fragment assimilation to the apical portion

Figure 5: Immediately post splinting of teeth showing splint in situ.

Figure 6: Anterior photograph immediately post-splinting of teeth showing splint in situ.

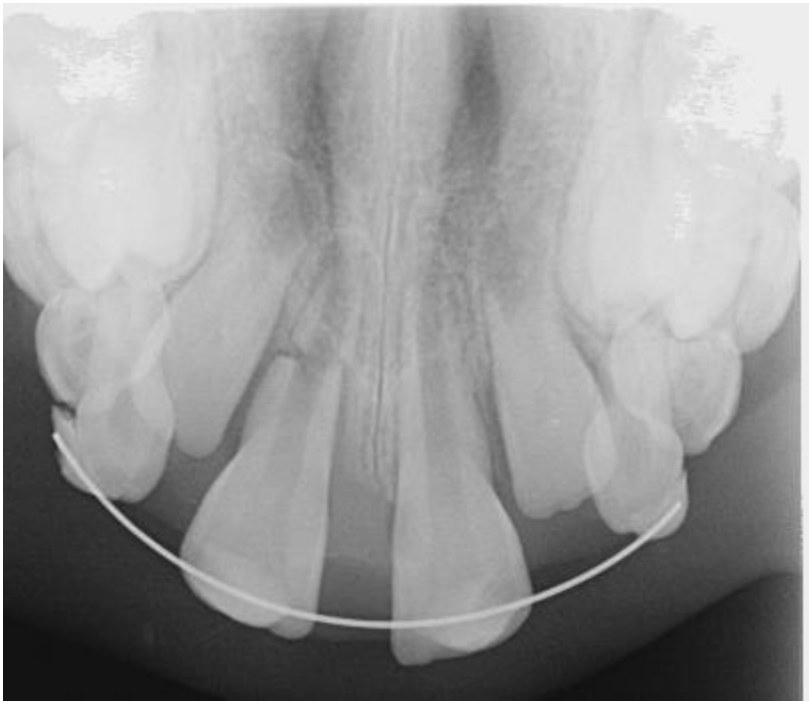

Figure 7:- Post-splinting Upper standard Occlusal radiograph showing close assimilation of the coronal and apical portions of the UR1.

Intermediate management

The patient was reviewed initially 2 weeks post trauma to assess for soft tissue healing. Subsequent follow ups occurred 4 weeks post-trauma, and thereafter monthly until splint removal occurred at 3 months post-injury, (figure 8)

Figure 8:- Periapical radiograph prior to splint removal (3 months post-injury).

Sensibility testing post-splint removal				
		UR1	**UL1**	
Colour		Normal	Normal	
Swelling/Sinus		Nil	Nil	
TTP		Nil	Nil	
Mobility		G1	nil	
Ethyl Chloride		-ve	-ve	
Electric Pup Test		No response	No response	

Long-term management

6 month post-injury review

The patient was followed up at 6 months post-injury where radiographic (figure 9) and clinical examination was undertaken.

Sensibility testing 6 month review				
		UR1	**UL1**	
Colour		Normal	Normal	
Swelling/Sinus		Nil	Nil	
TTP		Nil	Nil	
Mobility		G1	nil	
Ethyl Chloride		-ve	-ve	
Electric Pup Test		No response	No response	

Figure 9- Periapical radiograph showing continued root development. UR1

12 months post-injury review

Sensibility testing 12 month review				
	UR2	**UR1**	**UL1**	**UL2**
Colour	Normal	Normal	Normal	Normal
Swelling/Sinus	Nil	Nil	Nil	Nil
TTP	Nil	Nil	Nil	Nil
Mobility	Nil	G1	Nil	Nil
Ethyl Chloride	+ve	+ve	+ve	+ve
Electric Pup Test	10	35	23	10

Figure 10:- Periapical radiograph 12 months post-injury, showing continued root development UR1 and absence of pathology

Figure 11:- Anterior photograph with teeth in occlusion 12 months post-injury, showing good colour of teeth and absence of soft tissue pathology. The UR2 is now partially erupted and UL2 is fully erupted.

30 months post-injury review

Sensibility testing 30 month review				
	UR2	**UR1**	**UL1**	**UL2**
Colour	Normal	Normal	Normal	Normal
Swelling/Sinus	Nil	Nil	Nil	Nil
TTP	Nil	Nil	Nil	Nil
Mobility	Nil	G1	Nil	Nil
Ethyl Chloride	+ve	+ve	+ve	+ve
Electric Pup Test	20	45	27	15

Figure 12:- Periapical radiograph 30 months post-injury, showing continued root development UR1, with some evidence of pulp canal obliteration and the absence of pathology,

Figure 13:- Anterior photograph of teeth in occlusion. 30 months post-injury, showing good colour of teeth and absence of soft tissue pathology and fully erupted upper lateral incisors.

Figure 14 a-d:-Assimilation of periapical radiographs from left to right (Prior to splint removal, 6 months post trauma, 12 months post trauma and 30 months post-trauma) highlighting continued root development and absence of pathology.

Discussion

This case demonstrates the importance of effective acute trauma management in a young patient. Any delay in presentation may have meant the coronal fragment was harder to assimilate and the tooth had a poorer long term prognosis. The case highlights the importance of taking 2 radiographic views at different angulations when assessing root fractures. In this case the extent of the root fracture is not as clearly visible on the periapical radiograph as it is on the upper standard occlusal.

The patient had not previously had any operative dental treatment completed before and consideration was given to pharmacological management with inhalation sedation, however the patient coped extremely well with non-pharmacological behavioural management techniques and local anaesthetic alone. In this case keeping the patient calm and taking a social history was important as he enjoyed talking about his gerbils and this worked well as a distraction technique.

Healing of root fractures

Root fractures can heal in different ways including by hard tissue healing, soft and hard tissue healing, soft tissue healing or non-healing[2]. Hard tissue healing, as demonstrated in this case, is said to occur in around one third of cases[2]. Immature teeth, those repositioned soon after injury and those with less displacement as more likely to exhibit pulpal and hard tissue healing[3,4]. This case was favourable in the some aspects (immature tooth and repositioned quickly post-trauma) and unfavourable in others (severe displacement).

Root fractured teeth can given false sensibility readings for several months post injury[5]. This, coupled with the fact that sensibility tests are notoriously unreliable in children mean

it is important to use all clinical and radiographic information before initiation of root canal treatment. The UR1 did not respond until 12 months trauma. Upon further questioning, the patient admitted to stating he could not feel the ethyl chloride spray as he believed that if he could feel the spray "something bad might have happened." This demonstrates the importance of thorough explanation to children before sensibility testing and consideration to all clinical/radiographic signs before the commencement of endodontic treatment.

Splinting considerations

The International Association of Dental Traumatology guidelines[6] recommend splinting for a minimum of 4 weeks up to a period of 4 months for root fractures depending upon their position. In this case consideration was given to the immaturity of the tooth at presentation and the extent of displacement (figure 3) as well as the fact that the splint was a longer span to the maxillary primary canines given the maxillary primary lateral incisors were close to exfoliation.

Future considerations

The patient will ideally now be followed up yearly for a 5 year period. The 2 year follow up was delayed to 30 months due to the COVID-19 pandemic. The patient has been discharged back to their GDP for ongoing care due to the large distance they have to travel to attend appointments at KCH.

The parents and GDP have been informed of the guarded long term prognosis and possible endodontic management if the tooth was to become non-vital in the future. Care has also been advised with any possible orthodontic treatment in the future[7].

Conclusion

This case highlights how immediate, effective management of acute traumatic dental injuries can result in a positive long-term outcome. In this case a severely displaced immature root fracture has continued to show root development and has maintained vitality. In the developing dentition this is crucial to maintaining aesthetics, function and alveolar bone where other treatment options are limited.

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