Management of a Transverse Cervical Root Fracture

Alice Duke Core Trainee Restorative & Mrs Beth Burns Consultant Restorative
Glasgow Dental Hospital & School
alice.duke@ggc.scot.nhs.uk

INVOLVEMENT

Independent completion of treatment under supervision of Restorative Consultant

ABSTRACT

Introduction

Root fractures are uncommon injuries accounting for 1.2-7.0% of traumas in permanent teeth. The prognosis of a tooth that has sustained root fracture is related to the patient's age, degree of displacement of the coronal segment and the location and orientation of the fracture line. Long-term prognosis is primarily determined by the relationship of the fracture line to the base of the gingival crevice.

Case presentation

A 20-year-old female presented to the restorative department following an unexplained seizure resulting in a fall with frontal impact. Dental injuries sustained included subluxation, extrusion and a transverse sub-crestal undisplaced cervical root fracture.

Management and outcome

This case report demonstrates the importance of follow-up in the detection of post-traumatic complications. Effective management is dependent on a thorough understanding of aetiology, healing responses, diagnosis and prognosis. Healing response of the tooth and its tissues following root fracture may include: healing with hard dental tissue, connective tissue, bone and connective tissue or granulation tissue.

Discussion

Monitoring of root fractures over time is essential to determining the healing response and assess pulpal status. Pulp necrosis and infection typically occur in the initial 3-4months of trauma. Root fractures should be managed conservatively.

INTRODUCTION

Root fractures are defined as a fracture of the tooth involving dentine, cementum and pulp (Abbott, 2019). They can be classified according to direction (vertical or transverse), the number of fracture lines (simple or multiple) or specifically where the fracture is located (apical third, middle third, sub-crestal coronal third or supra-crestal coronal third) (Welbury et al., 2002).

Root fractures are commonly the result of direct trauma where there is frontal impact with a hard object. Where force strikes the crown of the tooth, the increased area of resistance transmits the force to the tooth root, which is most likely to fracture in the cervical third (Andreasen et al., 1989). The most common concurrent injuries are likely to be concussion or subluxation (Abbott, 2019). Complex healing patterns involving the hard tissues (i.e. dentin, cementum) and soft tissues (i.e. dental pulp) ensue, which are dependent on the coronal displacement of the fracture. If there has been no displacement of the coronal fragment the pulp may remain undamaged excluding a localised inflammatory response at the fracture site (Andreasen et al., 2004). Displacement of the coronal fragment can cause stretching or laceration of the pulp, a reduced or severed blood supply and pulp necrosis (Abbott, 2019).

Andreasen et al., (2019) describes four short-term possible healing responses of the tooth and its associated tissues following root fracture: healing with hard dental tissue, healing with connective tissue, healing with bone and connective tissue and no healing. Late pulp necrosis and infection of the coronal fragment may occur long-term, emphasising the importance of appropriate follow-up.

This case report demonstrates the conservative management of a transverse sub-crestal cervical root fracture, where implementation of evidence-based guidelines and appropriate treatment of all diagnoses resulted in a successful healing with dental hard tissue.

CASE DETAILS

History

A 20-year old female was referred by GDP within 5-days of injury to the Adult Dental Trauma Service, Glasgow Dental Hospital and School. Injury was sustained to teeth 12-22. Cause of injury was an unexplained seizure, resulting in a fall onto hard flooring at work. The patient presented to A&E where she was cleared of head injury. She was arranged a follow-up MRI by neurology, due to experiencing 2 similarly unexplained seizures over the 4 weeks prior to the date of injury. There was no loss of consciousness, no non-dental injuries sustained, no indication for tetanus booster vaccination and all fragments of teeth were accounted for. No other relevant medical history reported. During the course of follow-up the patient was formally diagnosed with epilepsy and subsequently medicated with Lamotrigine 20mg.

The patient had no previous history of dental trauma and was dentally anxious. The presenting complaint was pain and sensitivity to cold across the anterior maxillary and mandibular dentition. The patient was particularly concerned regarding the mobility of tooth 11 and felt 11, 21 looked uneven in length.

Examination

On extra-oral examination the lower and upper body of lip was oedematous and tender to palpate. Intra-oral examination noted a 2mm torn labial frenum, contusion to the labial gingivae apical to teeth 12-21 and abrasion to the labial mucosa adjacent to teeth 34-23. 21 appeared extruded 1mm. 12, 21, 22 were Grade I mobile. 11 was Grade III mobile but undisplaced. There was bleeding from the gingival crevice around teeth 12-22. Teeth 12-22 and 32-42 were tender to touch. An occlusal interference was evident between teeth 21 and 31 on protrusive guidance due to extrusive luxation.

Special Investigations

Clinical photographs were taken to aid monitoring of soft tissue healing and assessment of tooth discoloration (Andreasen et al., 2006) (Figure 1). Baseline radiographs included periapicals of all anterior maxillary and mandibular dentition alongside a maxillary occlusal radiograph as per Bourguignon et al., (2020) (Figure 2). Sensibility testing was not conducted at initial presentation due to patient discomfort, and likely unreliable responses (Bastos et al., 2014).

Figure 1. Pre-operative clinical photographs

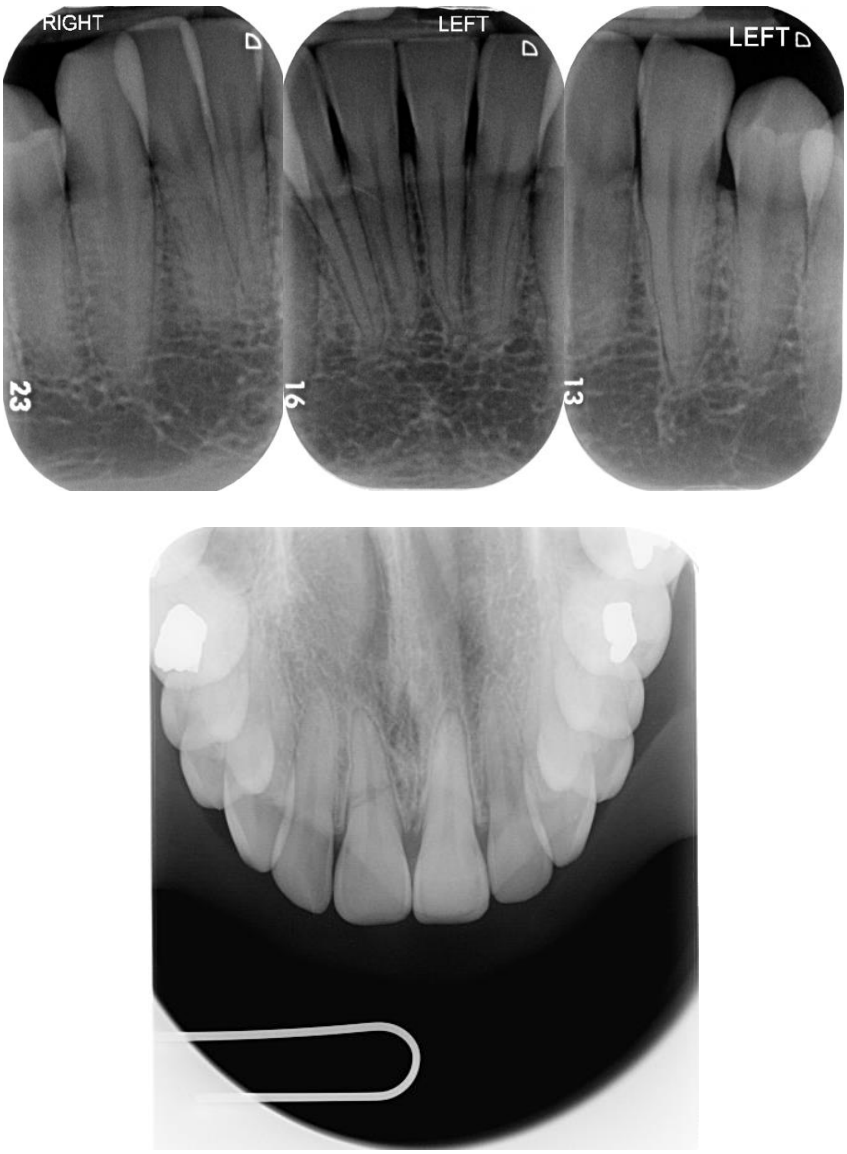


Figure 2. Baseline radiographic imaging

Radiographic report(s) Grade I findings demonstrated a transverse root fracture at the sub-crestal coronal third of tooth 11. A diastasis of 1mm is evident with an oblique fracture. There is increased periodontal ligament space apically and laterally around tooth 21, which appears extruded by 1mm.

Diagnoses

12 subluxation
11 transverse undisplaced sub-crestal cervical root fracture, subluxation
21 extrusion
22 subluxation
32-42 concussion

Treatment

Initial treatment included digital repositioning of tooth 21 under local anaesthetic. Passive and flexible stabilisation of teeth 12-22 was achieved with a wire-composite splint, extending from tooth 13 to 23 comprised of a 0.4mm diameter stainless steel wire. This achieved physiological stabilisation of the mobile coronal segment of tooth 11 with a proposed splinting time of up to 4-months (Bourguignon et al., 2020). Composite and bonding agents were kept away from the gingiva and proximal areas to avoid plaque retention. Antibiotic coverage was not prescribed in concurrence with the literature demonstrating no improvement in clinical outcomes for root-fractured teeth (Andreasen et al., 2004). Patient instructions were given to optimise tooth and tissue healing to avoid participation in contact sports, meticulous oral hygiene, rinsing with antibacterial mouthwash for 1-week and pain management.

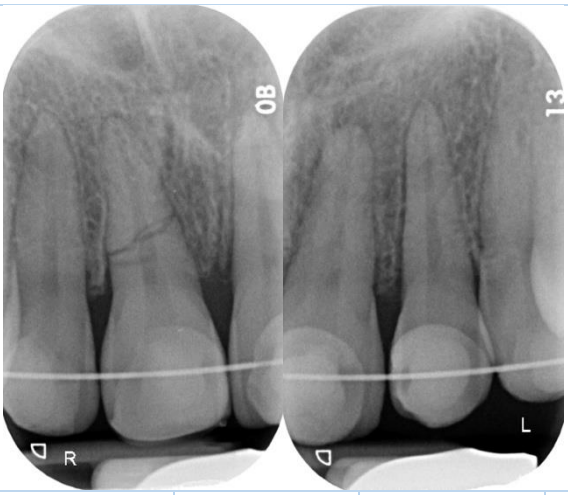
Figure 3. Repositioning of teeth confirmed radiographically following splint placement

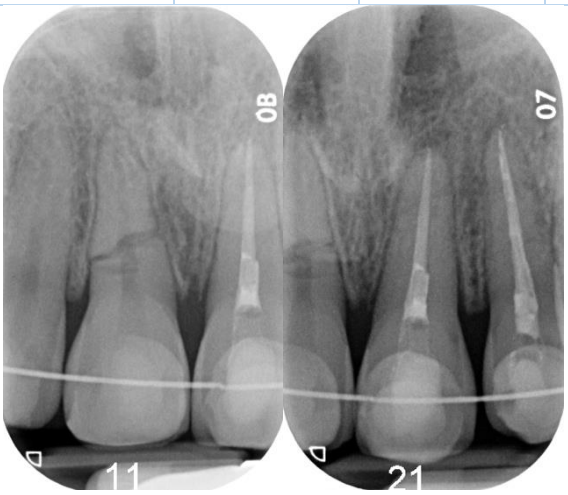
Follow-up

Subsequent follow up was arranged as per the International Association of Dental Traumatology guidelines (Bourgingnon et al., 2020). This involved clinical pulp status evaluation and radiographic examination at 2-weeks, 4-weeks, 8-weeks, 12-weeks, 6-months, 1-year. The patient was then discharged with arrangement for yearly follow-up in primary care for at least 5-years.

A summary of the pulp status evaluation and radiographic outcomes proceeds. During the follow-up visits clinical and radiographic signs resulted in subsequent root canal treatment of teeth 21 and 22. Tooth 11 was monitored for evidence of healing prior to eventual removal of the buccal splint and placement of a bonded palatal retainer. At return to routine dentistry following covid-19 pandemic, the palatal retainer had de-bonded but no clinical mobility of 11 warranted retainer replacement. Composite additions to incisal edge of 21 were completed and clinical photographs taken.

Date	Tooth	12	11	21	22
14.11.19	TTP	-	+	+	-
	ECL	+	+	+	+
	EPT	+	+	-	-
	Mobility	-	+ Grade I	-	-
	Swelling/Sinus	-	-	-	-
	BOP	-	-	-	-
	PPD	-	-	-	-

	Radiographic				
02.12.19	TTP	-	+	+	-
	ECL	+	+	-	-
	EPT	29	42	-	-
	Mobility	-	+ Grade I	-	-
	Swelling/Sinus	-	-	Y	-
	BOP	-	-	-	-
	PPD	-	-	-	-
	Radiographic	 11 further displacement of fracture no evidence of periapical or fractured segment radiolucency 21 PDL widening with periapical radiolucency			
09.12.19	TTP	-	+	+	-
	ECL	+	+	-	-
	EPT	29	42	53	-
	Mobility	-	+ Grade I	-	-
	Swelling/Sinus	-	-	Y	-
	BOP	-	-	-	-
	PPD	-	-	-	-
Decision to initiate root canal treatment tooth 21 due to clinical presence of labial swelling tender to palpation apical, tenderness to percussion with negative vitality testing and radiographic periapical radiolucency. Decision to initiate root canal treatment tooth 22 due to persistent negative sensibility and vitality testing with radiographic periapical radiolucency.					
16.12.19	TTP	+	+		
	ECL	+	+		
	EPT	80	65		

	Mobility	-	-		
	Swelling/Sinus	-	-		
	BOP	-	-		
	PPD	-	-		
13.01.20	TTP	+	+		
	ECL	+	+		
	EPT	58	34		
	Mobility	-	-		
	Swelling/Sinus	-	-		
	BOP	-	-		
	PPD	-	-		
	Radiographic	 11 no increase in fragment displacement no periapical or radiolucency at fractured segment 21, 22 well condensed root canal filling within 2mm of radiographic apex			
17.02.20	TTP	-	+		
	ECL	+	+		
	EPT	32	22		
	Mobility	-	-		
	Swelling/Sinus	-	-		
	BOP	-	-		
	PPD	-	-		
	Radiographic	 11 reduced fragment displacement with evidence of healing 21,22 no periapical radiolucency			

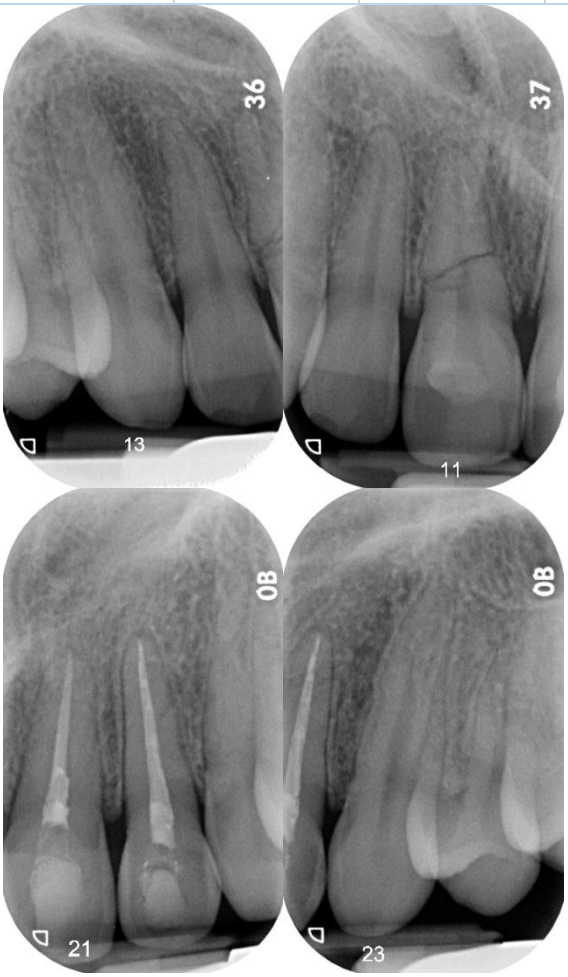
Impressions taken for bonded palatal retainer following removal of buccal splint (4-months in situ)					
11.03.20	Placement of bonded palatal retainer 12-22, removal of trauma splint from 13-23				
09.11.20*post-pandemic covid-19	TTP	-	+		
	ECL	+	+		
	EPT	49	48		
	Mobility	-	-		
	Swelling/Sinus	-	-		
	BOP	-	-		
	PPD	-	-		
	Radiographic	 11 evidence of interposition of hard tissue no periapical radiolucency 21,22 no periapical radiolucency			
21.12.20	Addition of flowable composite shade A2 to incisal edge 21. Clinical photographs. Discharge to GDP for continued monitoring.				

Figure 4. Post-operative clinical photographs

DISCUSSION

Bourguigon et al., (2020) describes the importance of two-dimensional imaging projections at two angulations in the detection of lateral luxation, root fractures and alveolar bone fractures. In this case baseline and follow-up radiographs were necessary to make a thorough diagnosis, particularly when distinguishing between the extrusion of 21 and possible displacement of the coronal fragment of 11. Cohenca et al., (2007) discussed the consideration of cone beam computerised tomography (CBCT) to provide enhanced visualisation of the location, extent and direction of the root fracture. However in this case additional imaging would not have changed management, hence exposing the patient to additional ionizing radiation would not have been justified.

Comprehensive diagnoses was aided by clinical findings and radiographic assessment. At presentation all teeth demonstrated bleeding from the gingival sulcus, tenderness to percussion and mobility indicative of luxation injury (Andreasen et al., 2019). Diagnosis of extrusive luxation tooth 21 was reached following clinical findings of elongation incisally when compared to the adjacent 11. This was aided via radiographic assessment which identified increased periodontal space apically and laterally, therefore confirming the incisal discrepancy was not due to displacement of the coronal segment of tooth 11. In accordance with the literature, endodontic treatment of teeth 21, 22 was initiated on the basis of clinical findings, pulp sensibility testing and radiographic findings (Andreasen et al., 2019). Teeth 21, 22 were subsequently obturated using a cold lateral condensation technique.

Treatment options for root fractures typically include reduction of the fracture if displaced and stabilisation by short-term, passive and flexible splint (Kahler and Heithersay, 2008). In this case a 0.4mm diameter wire-composite splint was selected to provide physiological stabilisation due to concomitant subluxation of the coronal fragment. This remained in situ for 4-months. In a study investigating the healing of root-fractured teeth, 30% demonstrated healing with hard tissue given prompt, optimal repositioning and <1mm displacement of the coronal segment (Andreasen et al., 2004).

CONCLUSION AND CLINICAL IMPLICATIONS

This case has exhibited a favourable healing outcome following root fracture and prolonged stabilisation. It demonstrates the importance of patient compliance with follow-up visits and home care (i.e. maintaining meticulous oral hygiene, avoiding participation in contact sports), which contribute to a better healing outcome. Root canal treatment completed on teeth 12,22 demonstrated a favourable healing outcome clinically and radiographically. In accordance with the IADT guidelines, this patient will require long term follow up: yearly, up to five years and beyond.

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