

Reawakening the Root Development: An Unusual Case of Dual Dental Trauma and Spontaneous Re-initiation of Root Formation

A Clinical Case Report

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ABSTRACT

This case report describes an unusual scenario of two distinct traumatic dental injuries in a young male patient, resulting in spontaneous re-initiation of root development in the maxillary left central incisor. The patient, initially experienced a lateral luxation injury of the incisor following an indoor fall, resulting in arrested root development of the UL1 at the age of 10. A subsequent concussion injury to the UL1, incurred during a rugby accident four years later, instigated an unexpected re-initiation of root formation. Despite initial plans for root canal treatment and root end closure, the procedure was halted due to evidence of active regenerative processes. Approximately 3mm of additional root growth was observed since the episode of the second traumatic injury. Following a 3-month review period, no further evidence of additional root development was observed, and the tooth was obturated with TotalFill BioCeramic Putty and Gutta Percha. This report highlights the complexity of root formation and regeneration, emphasizing the rare potential for spontaneous re-initiation of root development following trauma. Treatment options for necrotic teeth with immature root apices, including regenerative endodontic procedures are also discussed in this report.

INTRODUCTION

Traumatic injuries to teeth can result in pulpal inflammation or necrosis, disturbing the root development, which is primarily regulated by Hertwig's epithelial root sheath (HERS) and the dental papilla.¹ The damage or destruction of HERS can lead to necrotic teeth with incompletely formed open apices and thin root canal walls.² However, despite the presence of necrotic pulp, apical papilla can still act as a source of stem cells required for root development.³ While it's widely acknowledged that dental trauma can halt root development, the occurrence of trauma sparking a re-initiation of root formation is exceedingly uncommon. This case report discusses an unusual presentation of two distinct incidents of dental trauma with evidence of spontaneous re-initiation of root development after the second injury. The aim of this case report is to investigate the current literature of available treatments for necrotic immature teeth, explore the complex processes of root regeneration and highlight the importance of further research in this field.

History

A 14-year-old male patient presented at the paediatric department at Liverpool University Dental Hospital following history of two separate incidents of dental trauma to his UL1. The first injury occurred when the patient was 10 years old, resulting in lateral luxation of the UL1. The injury was a consequence of a fall indoors, which led to the arrest of root development of the UL1. Four years later, at the age of 14, the patient experienced a second traumatic event which caused a concussion injury to the UL1. The patient was assessed at the at Liverpool University Dental Hospital after this second injury.

The patient was medically fit and well and asymptomatic.

Examination

The extra oral examination was unremarkable. Intra oral examination revealed adult dentition with good oral hygiene. The UL1 was intact and non-mobile.

Special investigations

The findings from the trauma chart completed at the assessment appointment are summarised below.

Tooth number	UR1	UL1	UL2
Mobility	NIL	NIL	NIL
Colour	NORMAL	NORMAL	NORMAL
Percussion	NIL	NIL	NIL
Sensibility (Endofrost)	POSITIVE	NEGATIVE	POSITIVE
Sinus	NIL	NIL	NIL

Periapical Radiographs

A periapical radiograph taken on the day of the original assessment revealed UL1 with open apex and a visibly shorter root in comparison to the UR1 (Figure 1).



Figure 1. A periapical radiograph of UL1 taken following the second episode of trauma.

Diagnoses

UL1 lateral luxation injury in 2017

UL1 concussion injury in 2022

UL1 pulpal necrosis

Treatment

Following the discussion of the available treatment options, the patient and his parents opted for root canal treatment and root end closure of the UL1.

The endodontic treatment was started approximately 14 weeks following the assessment appointment, and the necrotic status of the pulp was confirmed on entry into the pulp chamber. Following placement of calcium hydroxide dressing, a periapical radiograph was taken at the end of the appointment which revealed continued root development with approximately 3mm of additional apical root present (Figure 2). Due to the evidence of active regenerative processes, the plan to perform root end closure was halted to enable monitoring for further development.



Figure 2. A periapical radiograph UL1 with open apex with evidence of root development and additional 3mm of root length in comparison to Figure 1. The calcium hydroxide dressing was placed up to 20.5mm (patency reading)

The patient was reviewed after 3 months with a new periapical radiograph showing no evidence of any further root development (Figure 3).



Figure 3. A periapical radiograph taken at the 3-month review appointment showing no evidence of further root development of UL1.

A new apex locator reading was taken which revealed additional 3.5mm root length. A working length radiograph was taken to confirm the new working length of the tooth (Figure 4). Following a 4-week review period the tooth was obturated using TotalFill Bioceramic Putty Plug and Gutta Percha (Figures 5 and 6).



Figure 4. A periapical working length radiograph with the file placed at 24mm



Figure 5. A periapical radiograph showing the TotalFill Bioceramic Putty Apical Plug

Figure 6. A periapical radiograph showing complete obturation of the UL1

Follow-up

The patient is due to attend a 3-month review appointment in September 2023.

DISCUSSION

Treatment options for traumatized immature necrotic teeth include pulpotomy, apexogenesis, pulpectomy, apexification, or revascularization procedures.⁴ Current treatment modalities include apical closure with Mineral Trioxide Aggregate (MTA) plug which enables the seal of the apical foramen.⁵ MTA based materials offer several benefits such as rapid treatment, superior biocompatibility, and osseous induction, however further root formation cannot be expected, and susceptibility to root fractures due to thin canal walls and poor root-crown ratio remains.⁶

Regenerative endodontic procedures (REP) have recently been introduced as an alternative treatment option aiming at the formation of pulp-like tissues inside the root canal after inducing an influx of stem cells from the apical papilla. Although short term studies show favourable outcomes of REP treatments, complications such as resorption or regenerative tissue necrosis frequently occur.⁷

The root formation and root regeneration are complex processes involving growth factors, morphogens and the migration and differentiation of stem cells.⁸ Early studies investigating teeth treated with REPs reported a variety of types of tissues forming in the canal space, including ingrowth of connective tissue and formation of "islands" of mineralised tissue.⁹ Although most studies focus on the outcomes of the treatment delivered to traumatised teeth, a recent publication presented a case report of "spontaneous apexification" following trauma to maxillary left central incisor with an immature apex.⁴ Histological examination of the tooth has shown the presence of irregular calcifications with evidence of deposition of cementum in the canal lumen. It appears that a traumatic injury to a tooth with an immature apex has a potential to stimulate HERS and cells in the apical papilla resulting in re-

initiation of root development and apexification. Further research is required in this field, to acquire a more comprehensive understanding of this process.

CONCLUSION AND CLINICAL IMPLICATIONS

This case report describes an extremely rare observation of spontaneous re-initiation of root development as a result of dental trauma.

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