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Post-Traumatic Apexogenesis of Immature Non-Vital Permanent Incisors

Robia Ghafoor

ABSTRACT

Injury to an immature permanent tooth may result in cessation of dentin deposition and root maturation leaving an open root apex and thin dentinal walls that are prone to fracture. Endodontic treatment is often complicated and protracted with an uncertain prognosis frequently resulting in pre-mature tooth loss. There are several advantages of promoting apexogenesis in immature teeth with open apices. It encourages a longer and thicker root to develop thus decreasing the propensity of long term root fracture. This case report highlights the role of Hertwig root sheath and dental papilla in continued root formation of immature permanent tooth, even diagnosed with necrotic pulp.

Key words: *Apexogenesis. Dental trauma. Apexification.*

INTRODUCTION

Irreversible injury to the dental pulp of an immature permanent tooth from either infection or dental trauma before complete root development poses a clinical challenge. Dentin formation and tooth maturation ceases, creating difficulties in providing endodontic treatment. Non-vital teeth receiving apexification normally gain only an apical hard tissue bridge, not dentin, because of the loss of vital pulp tissues, odontoblasts, and Hertwig epithelial root sheath needed for the complete root development and susceptible to fracture on function.¹

Apexification classically tried with calcium hydroxide, which creates a desirable environment because of its anti-microbial and mineralization properties, aid formation of hard tissue comprising osteocementum at the end of root. Later on, mineral trioxide aggregate (MTA) was used successfully at the end of tooth roots to create an artificial barrier in order to compress the process of treatment into one or two visits.²

Root growth subsequent to trauma is linked to the importance of the dental papilla and root sheath of Hertwig in continued root formation. It is thought to provide a source of undifferentiated cells that could give rise to further hard tissue formation. In addition, it may protect against the growth of periodontal ligament cells to the root canal which could result in intra-canal bone formation and arrest of root development.^{3,4}

The following case report highlights the role of dental papilla and Hertwig root sheath in continued root

formation of immature permanent tooth diagnosed with necrotic pulp. Still, further case reports and research is needed to clarify this concept.

CASE REPORT

A healthy 8 years old female child presented to dental clinic, complaining of increasing pain and swelling around right upper tooth since one day. She had a history of fall one month back during skating as a result of that her upper 2 teeth were chipped off. She was first seen by her family dentist for initial management, where root canal treatment of right upper tooth was started and composite build ups of both upper teeth were done.

When she presented to us after one month of trauma, she was having acute facial swelling of upper lip extraorally and marked fluctuant swelling of buccal mucosa associated with tooth 11 and discoloured composite build ups in tooth 11 and 21 (Figure 1). Tooth 11 was tender to percussion and responded negatively to sensitivity testing while teeth 21, 12 and 22 responded normally to percussion and sensibility tests. Periapical radiograph of upper anterior teeth revealed immature developing roots of both teeth 11 and 21 with blunderbuss appearance (Figure 2).

Treatment consisted of abscess drainage and apexification of non-vital traumatized tooth. On initial visit abscess was drained through pulp chamber followed by complete pulpectomy of tooth 11. Working length was determined roughly on periapical radiograph. After chemo-mechanical cleaning, canal space was filled with non-setting calcium hydroxide. Tooth was made out of occlusion. Antibiotics and anti-inflammatory medications were prescribed to patient. Home care instructions were also given. On the follow-up visit after one week, she was asymptomatic and doing well. Patient was advised for follow-up visit after 3 months.

After one month, she again presented to dental clinic in emergency with swelling and pain associated with

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tooth 21. Abscess drained through pulp chamber and after canal preparation tooth was filled with non-setting calcium hydroxide to disinfect the root canal system. Patient was advised follow-up visit at one month interval,



Figure 1: Discoloured upper anterior teeth at the time of initial presentation.



Figure 2: Pre-operative radiograph of upper incisors at initial presentation.



Figure 3a: Final obturation radiograph with gutta percha.



Figure 3b: Direct composite build-up of fractured anterior teeth.

but patient did not show-up on her follow-up visit even not responded on phone calls. After 6 months of initial trauma she again visited to dental clinic and remained symptoms-free throughout this time period. Follow-up radiograph of tooth 11 and 21 was taken, which revealed apexogenesis continued root formation of tooth 11 and 21, so it was decided not to replace calcium hydroxide and let the apexogenesis process to complete naturally. Next, follow-up radiographs were made at 10 months and 14 months, which revealed almost completion of roots of both teeth 11 and 21 and completion of root development for both teeth 11 and 21 respectively. Final obturations of both teeth were done with gutta percha with good apical seal. After obturation of teeth 11 and 21 (Figure 3a) final build-ups were done with direct composite restorative material (Figure 3b) and she was advised full coverage extra coronal restoration for both teeth. Regular follow-ups were made at 18, 24 and 32 months to see any complications.

DISCUSSION

The treatment of choice for necrotic immature tooth is apexification, which is induction of apical closure to produce more favourable conditions for conventional root canal filling. Calcium hydroxide is the most commonly used material, to induce the formation of a calcified barrier at the open apex-apexification with higher success rates.⁵

Gupta *et al.* in their case report emphasizes the single use of calcium hydroxide with minimal mechanical intervention to maintain the integrity and vascularity of apical region and the treated tooth was examined only radiographically till the desired apical closure was achieved.⁶ Same technique was adopted in the current case report with successful clinical outcome. Apexification in one step using an apical plug of MTA can be considered a predictable treatment option, and may be an alternative to the use of calcium hydroxide.⁷

Thibodeau reported the case of a patient wherein revascularization of the necrotic infected pulp space of an immature permanent maxillary central incisor tooth was induced *in vivo* by stimulation of a blood clot from the periapical tissues into the canal space.⁸ This treatment approach can help rescue infected immature

teeth by physiologically strengthening the root walls and avoid the need for traditional apexification with calcium hydroxide or MTA.

Rule and Winter stated that root growth is only possible where the dental papilla and epithelial root sheath of Hertwig has retained its specialized function. In their reported cases inspite of having different types of trauma, the root sheath of Hertwig retained viable and continued to map out the apical fragment of teeth at position displaced from their coronal portions.⁹ Indeed Andreasen *et al.* also described continued root formation following dental trauma and they emphasize considerable powers of recovery of the dental papilla, probably due to its large number of undifferentiated mesenchymal cells.¹⁰

Chueh and Huang reported four clinical cases of immature teeth diagnosed with periradicular periodontitis or abscess treated with conservative approach, i.e. without canal instrumentation.¹ Instead, only copious 2.5% NaOCl irrigation was performed. All cases developed mature apices after 7 months to 5 years after the initial treatment without complications, although narrowing canal space was observed. In the current case report both upper teeth diagnosed with apical abscess and after chemo-mechanical cleaning single calcium hydroxide dressing was used throughout the treatment. Both the teeth developed mature apices without any complication.

Immature teeth should be treated as conservatively as practical to allow any possible apexogenesis to occur. Shifting apexification to apexogenesis even for non-vital

pulps with periradicular periodontitis or abscess is a clinically beneficial approach for patients if we gathered more clinical experience to help predict the treatment outcome.

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