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CASE REPORT/CASO CLINICO

Regenerative endodontic procedures: A review of the literature and a case report of an immature central incisor

Procedura di rigenerazione endodontica: revisione della letteratura e caso clinico di un incisivo centrale immaturo

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KEYWORDS
Biodentine;
Necrotic immature permanent teeth;
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Abstract
Background: Trauma of developing teeth may lead to pulpal necrosis with subsequent arrestment of root development, making them more susceptible to fracture. Regenerative endodontic procedures induce maturogenesis in necrotic immature permanent teeth in order to promote continuation of root growth. Mineral trioxide aggregate (MTA) is widely used as a blood clot protecting material, although it presents a potential drawback of discoloration. Biodentine is a tricalcium silicate cement with adequate bioactive properties that solve the problem of discoloration.
Case report: The current case report demonstrates a maturogenesis of an upper central incisor with chronic apical abscess. Calcium hydroxide was used as intracanal medicament for a week. After a blood clot was formed, Biodentine was placed over it. Periapical healing and root growth were evident at 6 months follow-up. Cone Beam Computed Tomography (CBCT) confirmed apical closure and complete healing at 1 year.
Key-learning points: Apical closure of necrotic immature permanent teeth is possible by means of regenerative endodontic procedure.Regenerative endodontic procedure with Biodentine has

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some advantages over that performed with MTA: No tooth discoloration, hort setting time, asy manipulation. CBCT is the best technique to evaluate root canal growth (length and wide).

PAROLE CHIAVE
Biodentine;
Denti permanenti immaturi necrotici;
Trattamento di rigenerazione endodontica.

Riassunto
Background: Il trauma di elementi dentari in via di sviluppo può in alcuni casi esitare in necrosi pulpare con successivo arresto della crescita radicolare e maggiore suscettibilità alle fratture. Tale procedura di rigenerazione endodontica induce la maturazione degli elementi al fine di promuovere il proseguimento della crescita radicolare (maturogenesis). Nonostante la presenza di potenziali svantaggi in termini di discolorazione, il mineral trioxide aggregate (MTA) viene comunemente utilizzato come materiale a protezione del coagulo ematico. Biodentine è un cemento a base di tricalcio silicato con adeguate proprietà bio-attive capace di ovviare le problematiche di discolorazione.
Caso clinico: Il seguente caso studio dimostra lo sviluppo radicolare (maturogenesis) di un incisivo centrale superiore affetto da ascesso apicale cronico. Come medicazione intracanalare è stato usato l'idrossido di calcio per una settimana. A seguito della formazione del coagulo ematico, è stato successivamente posizionato al di sopra Biodentine. Si è riscontrata evidente guarigione e crescita radicolare a 6 mesi di osservazione. La tomografia computerizzata cone beam (CBCT) ha confermato la chiusura apicale e completa guarigione ad 1 anno.
punti chiave: La chiusura apicale di elementi dentari permanenti immaturi e necrotici è possibile tramite la procedura di rigenerazione endodontica. La procedura di rigenerazione endodontica attraverso l'utilizzo di Biodentine ha mostrato alcuni vantaggi quando confrontata con l'MTA: assenza di discolorazione dentale, tempo di indurimento ridotto, facilità di utilizzo. La CBCT rappresenta la miglior tecnica per valutare la crescita del canale radicolare (in lunghezza e larghezza).

Introduction

The majority of traumatic injuries to young permanent teeth occur before root formation is complete.[1] The most frequently affected teeth are the central and lateral maxillary incisors, located in a highly aesthetic zone, with a 20—30% prevalence in young patients.[2] Up to half of these traumatized teeth may result in pulpal necrosis, but only 8.5% will exhibit signs and symptoms of disease.[3] If total destruction of Hertwig's epithelial root sheath occurs, arrestment of normal root development leads to divergent dentinal walls and absence of the apical stop, which poses clinical challenges for conventional root canal treatment.

The apexification technique with calcium hydroxide, and more recently with MTA-like materials, has traditionally been the clinician's first choice. Although this technique has a high success rate regarding periapical healing, it does not allow the root to growth nor in both length and or width or thickness, leaving the tooth with short roots, and with thin walls that are prone to fracture.[4]

Regenerative endodontic procedures (REP) were proposed to overcome the drawbacks related to the clinical management of necrotic immature permanent teeth (NIPT)[5] and are gaining prominence over traditional apexification among researchers and clinicians.

REP are described as 'biologically based procedures designed to replace damaged structures, including dentine and root structures, as well as cells of the pulp—dentine complex'.[6]

Different terminologies have been used for REP. At present, the term *revascularization* is broadly widely used in the current literature, but many authors challenge its use. Initially, Trope choose this term because the nature of the tissue that formed after the treatment within into the root canals was unpredictable, and the only certainty was the presence of a blood supply.[7]

Wigler et al., in contrast, claimed that 'procedures designed to promote continued root development in NIPT should be described as *maturogenesis*, rather than *revascularization*', because it describes clinically and radiographically the apical maturation in NIPT.[8] In a letter to the editor of the Journal of Endodontics, Huang and Lin agreed that revascularization was more applicable to events following dental trauma than to endodontic procedures. Moreover, the term revascularization is imprecise because it only considers one aspect of the newly formed tissues.[9]

Iwaya et al. (2001)[5] and Banks and Trope (2004)[10] were the first to publish a REP case report (called *revascularization*) on a necrotic mandibular central incisor and on a necrotic immature permanent mandibular second premolar respectively. According to their reports, after provoking intracanal bleeding, the blood clots were covered with calcium hydroxide and MTA respectively. The findings of both studies showed a thickening of the root canal walls and continued root development.[5,10]

All regenerative endodontic procedures are based on the research published by Nygaard Ostby (1961), which demonstrated that vasculature could be established to support new

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