Conservative Treatment of Non Vital Maxillary Central Incisor Having Resorbed Root Apex Using Regenerative Approach: A Case Report

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Abstract

Teeth with open apices have long been treated using $Ca(OH)_2$ apexification, surgical retrograde sealing or more recently by establishing an apical barrier of mineral trioxide aggregate. A case is presented in which a non vital maxillary central incisor having resorbed root apex and periapical pathology was treated using revascularization approach rather than the traditional methods. Results showed radiographic healing and a clinically asymptomatic patient over a recall period of eighteen months.

Keywords: Revascularization, Open apex, Apexification

Introduction

The general opinion for treatment of teeth affected by deep caries or trauma but having open root apices and vital pulps is to preserve remaining vital pulp tissue in their root canals to promote apexogenesis. Teeth having open apices and irreparable pulps mandate an endodontic therapy but root canal treatment (RCT) procedures like cleaning and shaping as well three dimensional filling of the root canal can become extremely difficult in roots that lack an apical barrier. Long term success of such teeth treated with conventional RCT may not be very predictable.

Clinical success can be improved in roots with open apices by inducing apical closure using apexification procedure prior to performing root canal treatment, but is a lengthy procedure. Moreover, prolonged use of $Ca(OH)_2$ in apexification has shown to significantly reduce the strength of root dentin.[1] Surgical intervention to acquire retrograde sealing of root canal is yet another method, but is an invasive procedure with associated surgical complications, increased treatment cost, demands dealing with psychological concerns of the patient and requires clinicians to have high clinical expertise. Establishing an apical plug with MTA offers a shorter treatment duration but is technique sensitive, expensive and poses problems during retreatment .

Treating such teeth by replacing the diseased or necrotic root canal contents with natural healthy tissue rather than with artificial materials and thereby revitalizing the tooth is an attractive option. It not only overcomes the above mentioned limitations but also contributes in root maturation/ apical closure and restores the nutritive, defensive and reparative functions of the living pulp. Recently introduced revascularization treatment has made pulp regeneration a possibility in nonvital, infected, immature permanent teeth.[2,3] Here in this report, revascularization was attempted in a non vital infected tooth having well formed root but resorbed apex. The apical opening was deemed wide enough to permit invasion of blood vessels and growth of new tissue. Kling *et al*.[4] have shown successful revascularization to occur in avulsed permanent teeth when the apical opening was greater than 1 mm mesio distally, compared to when the apical opening was smaller in size. Favourable clinical results reinforce the use of regenerative endodontics as a possible treatment modality in select cases.

Case Report

An 18 year old girl reported to the endodontic department of Krishna Dental College and hospital, Ghaziabad with the chief complaint of pain in left maxillary central incisor for evaluation and treatment. Her general medical history was non contributory. Dental history revealed that the patient suffered dental trauma 8 10 years back. Both maxillary central incisors showed Ellis class ll fractures. Maxillary right central incisor (11) showed no abnormal findings. Maxillary left central incisor (21) was slightly painful on palpation and tender on percussion. Pain associated with the tooth was mild, non continuous and spontaneous in character which aggravated on biting. No sinus tract was observed and periodontal probings were within normal limits. Periradicular radiographic examination revealed periapical radiolucency with root resorption resulting in an open apex in maxillary left central incisor (Fig. 1). Thermal testing and electronic pulp testing showed positive response in 11 and 22 but no response in 21. The clinical diagnosis of pulpal necrosis with symptomatic periodontitis was made in tooth no 21. It was planned to attempt revascularization in 21.

The tooth was isolated under a rubber dam and its crown disinfected with betadine(5 % povidone iodine, Bectodine, Ranbaxy laboratories Ltd, India). Access cavity was made without giving local anaesthesia and a necrotic pulp confirmed clinically. No haemorrhage was seen upon gaining access to the pulp space or during insertion of a small K file. Minimal instrumentation was done to preserve any tissue within the canal. The canal was copiously irrigated with 20ml of 2.5% NaOCl (Avarice Laboratories Pvt Ltd,G.B Nagar,India) and an antibiotic mix of ciprofloxacin (Cipla Ltd, India), metronidazole (J.B.Chemicals and pharmaceuticals Ltd, India) and minocyclin (Ranbaxy Laboratories Ltd, India) mixed with sterile water was placed in the canal and tamped down with a blunt end of a sterile paper point.[5] The access cavity was sealed with Cavit.

The patient was recalled after 4 weeks. She reported no further pain in the tooth. The patient was clinically asymptomatic and comfortable. Pain on palpation and percussion were also absent. The root canal was reopened under rubber dam isolation and the canal again flushed with 20ml of 2.5% NaOCl slowly. The canal was dried with sterile paper points. Revascularization process was initiated in the canal. This was done by inducing bleeding within the canal by gently pushing a sterile endodontic file beyond the apical canal opening into the periapical tissue and stroking the tissue 2-3 times. Once the bleeding was seen to extend until the cementoenamel junction, it was allowed to clot for a period of 10 minutes.

$Ca(OH)_2$ paste (Metapex,Meta Biomed Co.Ltd , Chungbuk, Korea) was placed over the blood clot and tamped with a moist cotton pellet. The access cavity was sealed with restorative GIC(GC, GC Corporation, Tokyo, Japan) having a thickness of at least 3 mm. The patient was asked to report after 1 week for evaluation and crown preparation.

On subsequent visit of the patient at 1 week, the patient was asymptomatic. The GIC restoration in the access cavity was reduced and a bonded resin restoration placed. Crown preparation was performed and a temporary crown restoration given (Fig. 2a). An intraoral radiograph was taken (Fig. 3a) to compare with the follow up radiographs to be taken at 3 months, 6 months, 12 months and 18 months.

On each recall appointment, both clinical and radiographic evaluation was done. At the 3 month recall, the patient was asympotamatic. There was no spontaneous pain. Pain on palpation and percussion were absent and periodontal probing depths were within normal limits. Vitality testing was however not responsive. Radiographic evaluation showed partial resolution of periapical radiolucency (Fig. 3b). Since the patient was asymptomatic, the temporary crown was replaced with a metal ceramic crown and the fractured mesio incisal edge of the adjacent central incisor restored with an acid etch composite resin (Fig. 2b).

Six month recall showed no abnormal clinical findings. Radiographic evaluation showed a complete resolution of periapical radiolucency (Fig. 3c). At the 12 month and 18 month follow up, patient continued to be asymptomatic. Closure of the root apex was seen on the radiograph (Fig. 3d, Fig 3e).

Discussion

With the availability of advanced instruments and systems and an enhanced knowledge following extensive research in the field of tissue engineering, it has now become possible to attempt endodontic regeneration.[6] Recent case reports have shown the ability to generate functional pulp dentin tissue using regenerative endodontic procedures like revascularization in immature teeth.[2,3] This case report showed the possibility of treating a necrotic infected mature root having open apex using revascularization approach.

Revascularization is based on attaining thorough disinfection of the root canal, which in this case was achieved using 2.5% NaOCl and a triantibiotic mix[5] placed within the canal for a period of 4 weeks. Minimal instrumentation was performed to preserve any tissue occupying the canal space so that after having rendered this tissue sterile, it could serve as a part of the matrix on which new tissue could grow. Bleeding was additionally induced in the canal space to create a blood clot- physical scaffold of fibrin rich in platelet derived growth factors -to serve as a major part of the matrix and promote growth of neo tissue, which otherwise may not have been possible in an empty canal space.

The biologic result so obtained was functionally remarkable as there was seen closure of the apex and regeneration of some vital tissue inside the canal. The radiograph taken at 3 months showed the loop of $Ca(OH)_2$ which was placed above the blood clot in the canal to have resorbed suggesting growth of vital tissue. Since the cellular origin of the vital tissue cannot be predicted, the tissue that grew into the canal could be either pulp-like or periodontal-like. The apical closure obtained could be attributed to the deposition of calcified material - dentin, cementum or bone which cannot be differentiated radiographically but confirmed only histologically. Whatever the nature of the tissue formed, the apical closure so obtained aids in improving the prognosis of root canal treatment, if at all needs to be performed in future.

Revascularization treatment is of a relatively shorter duration, requires much less armamentarium, is non expensive and can be carried out in a routine clinical setting without the need for any advanced dental systems. Favourable results render this treatment approach worth considering as a suitable adjunct to conventional endodontic treatment even in well formed roots.

References

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Legends

Fig. 1 : An intraoral periapical radiograph of maxillary central incisors showing periapical radiolucency and resorption of the root leading to an open apex in tooth # 21.

Fig. 2 : Clinical photographs showing (a)Ellis Class ll fracture in tooth # 11 and crown preparation in tooth # 21 (b) Teeth # 11 and # 21 restored with acid etch composite resin and PFM crown respectively.

Fig.3a Post operative radiograph taken after blood clot was induced. The blood clot was covered with $Ca(OH)_2$ paste and the access cavity sealed with glass ionomer restoration which was later replaced with composite resin restoration.

Fig.3b Follow up radiograph taken at 3 months showing partial healing of periapical lesion and resorption of the loop of $Ca(OH)_2$

Fig.3c At 6 months, there was seen complete resolution of radiolucency with closure of the open apex. There was further resorption of the $Ca(OH)_2$ paste.

Fig.3d At 12 months, a well formed apex is seen and the periapex continues to exhibit a normal architecture.

Fig.3e At 18 months, calcification is seen in the apical canal with a normal periapex.