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Regenerative Endodontics - A Case Report

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ABSTRACT:

The usual treatment modalities for an immature permanent tooth that has undergone pulpal necrosis is Apexification using Calcium Hydroxide or MTA. But both these approaches doesnot cause dentinal wall thickening, lengthening and apex maturation and closure. Regenerative Endodontic Procedures ensures that there is regeneration of the pulpal-dentin complex by migration of stem cells into the canal space , and there is thickening and lengthening of canal walls and apex maturation and closure. However the histological evidence of the tissues formed in the pulp canal space shows that there is repair instead of true regeneration. It is expected that with the further research works in this field there will be more modifications in the current procedure.

Key Words: Regenerative; Endodontics; Stem cells

Introduction :

An 11 years old male patient reported to the Department of Pedodontics and Preventive Dentistry, Sharavathi Dental College and Hospital, Shivamogga with the chief complaint of discolored and broken tooth in the upper front teeth region since 3 years. Patient gave history of trauma due to fall 3.5 years back while riding a bicycle following which the tooth broke. There was no loss of consciousness or bleeding.

The patient also gives history of taking, over-the-counter analgesics to relieve pain 3 years back after the trauma . Parents noticed the discoloration almost 1.5-2 years back but did not seek any treatment back then.

Clinical examination revealed, Ellis Class III fracture i.r.t. 21. The tooth was non-tender to percussion and palpation and was discolored in appearance. Cold test elicited no response confirming the non-vitality of the tooth. Patient's medical history was non-contributory.

Intra-oral periapical radiograph i.r.t. 21 revealed the presence of thin radicular dentin, open apex and peri-apical radiolucency. A diagnosis of pulpal necrosis was made secondary to Ellis class III fracture.

All the possible treatment modalities were explained to the parents. Risks and benefits associated with regenerative endodontic procedure was also explained to the parents and consent was taken.

On the first appointment, access cavity was prepared and the canal was debrided with minimal filling to avoid further weakening of root . Working length was determined. Copious saline and 1.5% sodium hypochlorite irrigation was done with the side-vented needle 1-1.5mm short of the apex to prevent extrusion of the irrigating solution into the periapical area that can harm the stem cells needed for regeneration. The canal was dried with paper points and triple antibiotic paste (1:1:1) (ciprofloxacin:metronidazole:minocycline) was applied inside the canal with the help of lentulospirals. This was followed by a temporary restoration to form a proper coronal seal.

On the second appointment after 2-6 weeks, the tooth was evaluated for any adverse signs and symptoms and anesthetized with lidocaine without vaso-constrictor. Since the tooth was found to be asymptomatic, the temporary restoration was removed and the triple antibiotic paste was removed with copious saline irrigation. Following this the canal was irrigated with 17% EDTA , (with the needle short of the apex) to help in release of growth factors from the radicular dentin. After this, an endodontic file was inserted beyond the working length to induce bleeding from the periapical area that will also carry the stem cells into the root canal space for regeneration to occur .

After clotting of blood, PRF which was prepared from patient's blood by Choukroun's Method was cut into smaller pieces and condensed into the canal leaving about 3mm of space from CEJ. After placement of PRF, MTA was placed upto CEJ and a coronal seal was given with Composite Resin.

Patient was recalled after 2 months for follow-up and evaluated both clinically and radiographically. The tooth was asymptomatic and the intra-oral periapical radiograph revealed the resolution of periapical radiolucency and continued root development. Patient has been scheduled for follow–up at 3 ,6 , 12, 24, 36 months follow up for evaluating the success of the procedure.

Discussion:

Regenerative endodontics has started establishing itself as a possible treatment option of non-vital immature permanent tooth. The other treatment option includes apexification using long term Calcium Hydroxide or one time MTA apical plug. But the root still remains thin and brittle and there is no complete development of root which makes it prone to fractures.

However, the regenerative procedures allow continued root development and apex maturation with the help of stem cells. The procedure of regenerative endodontics has three main elements: a. Stem Cells b. Scaffolds c. Growth Factors and the induction of bleeding is the primary component of regeneration.

In 2001, Iwaya *et al*. was the first one to use the term revascularization to describe this procedure , after this in 2008, the term revitalization was used by Huang and Lin, to describe the same procedure as regeneration and growth of soft and hard tissues was also reported and not

just the blood vessels. Whereas, the term regenerative endodontics was given by Murray *et al* in 2007 which was accepted by AAE.[5]

The pioneer experimental work in this field was done by Nygaard-Ostby in 1961 and Nygaard-Ostby and Hjortdal in 1971.[5]

Regenerative Endodontics is defined as, "biologically based procedures designed to replace damaged tooth structures, including dentine and root structures, as well as cells of the pulp–dentine complex".[6]

Dentin conditioning with 17% EDTA, results in an increase of 35% in stem cells from apical papilla. Whereas, there is an inverse relation of the concentration of Sodium Hypochlorite and the viability of the stem cells. Concentrations of 0.5%,1.5% and 3% Sodium Hypochlorite has similar effect on reducing the number of stem cells from apical papilla by 37% and using 6% concentration of Sodium Hypochlorite greatly reduces the survival of stem cells from apical papilla.[7]

In regenerative endodontic procedures, the main challenge is debriding the large canal with thin and fragile walls, that limits the amount of mechanical debridement possible.Hence, the disinfection is mainly dependent on chemical means.17% EDTA, can completely reverse the negative effect of lower concentrations of Sodium Hypochlorite.[7]

Dentine conditioned with EDTA, results in migration, adhesion and differentiation of stem cells onto the dentin thus, a pre-treatment of dentine with EDTA as final irrigation step results in better outcome of regenerative procedures.[8]

There are certain complications associated with revasularization procedure in immature teeth like: discoloration of the coronal structure, failure to induce bleeding,collapse of MTA into the canal space and thus certain modifications can be done in our regenerative endodontic procedure to overcome these short comings such as use of an alternative antibiotic,use of lidocaine without epinephrine and using collagen matrix above the blood clot for stability.[3]

Age and apical diameter of the root are also important factors to be considered for the success of regenerative endodontic procedure. It can be done in the age group of 9-18 years but the younger age groups are more successful and it is found to be effective even with the apical diameter as small as 0.5mm but teeth with wider apical diameters >/= 1mm shows better increase in root thickness, length and apex narrowing.[4]

The success of regenerative endodontic procedure can be ascertained by evaluating the following outcomes: Primary Goal which is the elimination of clinical signs and symptoms and also the evidence of bony healing. Secondary goal is the continued maturation of root in terms of its length and thickness. Tertiary Goal is the re-establishment of neurogenesis and a positive vitality test response.[9]

There are five types of radiographic outcomes according to Chen *et al.* first is the increase in the canal wall thickness and continued root development. Type two is blunt but closed root apex (no significant root development evident). Type three is continued maturation of root but the apex of the root remains open. Type four is presence of severe calcifications /obliteration of the canal space. Type five is formation of a hard tissue barrier between the coronally placed MTA and the apex of the root.[10]

There are certain limitations of Regenerative Endodontic Procedure such as: Multiple appointments and increased duration of the treatment, Coronal discoloration due to Minocycline and Grey MTA,

Histologically there is evidence of Repair rather than true Regeneration, Evidence of Root Fracture in some cases. In-growth of PDL, Cementum and Bone leading to Ankylosis, Chances of Intra-canal Calcifications and more success rate in only Younger age group.[9]

CONCLUSION:

Management of an immature non-vital tooth is always challenging to the clinician as there is limited possibility to mechanically debride the thin canal walls and the apex is also open. Performing apexification has its own limitations as there is no re-establishment of a pulpal-dentin complex and only formation of an apical barrier is attempted. Whereas, regenerative Endodontic Procedures opens up a new horizon to allow for angiogenesis and neurogenesis to occur that helps in canal lengthening, thickening and apical closure as well. The field of regenerative endodontics is ever evolving , and further researches in this field are bound to occur and modify the management protocols for management of an immature permanent tooth with an open apex.

Fig:1 Access opening done

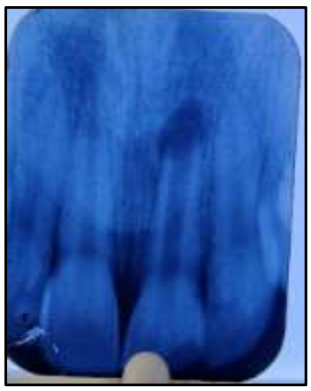

Fig:2 Pre-Operative Radiograph

Fig:3 Induction of bleeding

Fig:4 Placement of PRF

Fig:5 Placement of MTA

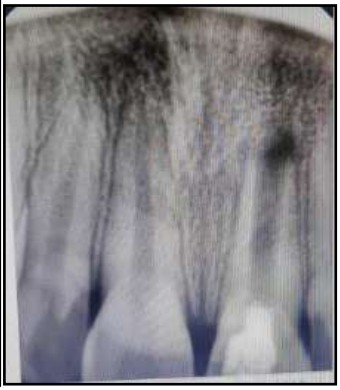

Fig:6 Immediate Post-Operative Radiograph

Fig:7 Follow-Up after 2 months

REFERENCES:

1. Dabbagh B, Alvaro E, Vu DD, Rizkallah J, Schwartz S. Clinical complications in the revascularization of immature necrotic permanent teeth. Pediatric dentistry. 2012 Aug 15;34(5):414-7.
2. Estefan BS, El Batouty KM, Nagy MM, Diogenes A. Influence of age and apical diameter on the success of endodontic regeneration procedures. Journal of endodontics. 2016 Nov 1;42(11):1620-5.
3. Kim SG, Malek M, Sigurdsson A, Lin LM, Kahler B. Regenerative endodontics: a comprehensive review. International endodontic journal. 2018 Dec;51(12):1367-88.
4. Murray PE, Garcia-Godoy F, Hargreaves KM Regenerative endodontics: a review of current status and a call for action. J Endod 2007;33:377-90.
5. Martin DE, De Almeida JF, Henry MA, Khaing ZZ, Schmidt CE, Teixeira FB, Diogenes A. Concentration-dependent effect of sodium hypochlorite on stem cells of apical papilla survival and differentiation. Journal of endodontics. 2014 Jan 1;40(1):51-5.
6. Galler KM, Widbiller M, Buchalla W, Eidt A, Hiller KA, Hoffer PC, Schmalz G. EDTA conditioning of dentine promotes adhesion, migration and differentiation of dental pulp stem cells. International endodontic journal. 2016 Jun;49(6):581-90.
7. Pulyodan MK, Mohan SP, Valsan D, Divakar N, Moyin S, Thayyil S. Regenerative endodontics: A paradigm shift in clinical endodontics. J Pharm Bioall Sci [serial online] 2020 [cited 2021 Aug 27];12:20-26.
8. Chen MH, Chen KL, Chen CA, Tayebaty F, Rosenberg PA, Lin LM. Responses of immature permanent teeth with infected necrotic pulp tissue and apical periodontitis/abscess to revascularization procedures. International endodontic journal. 2012 Mar;45(3):294-305.