

# Success of Revascularization of Pulp in Necrotic Maxillary Anterior Immature Permanent Teeth

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## ABSTRACT

**Objectives:** The purpose of the study was to examine efficacy of this procedure in necrotic immature permanent teeth.

**Methods:** Forty patients were enrolled for pulp revascularization procedure by disinfecting the root canal with triple antibiotics paste for one to two weeks, followed by creating the blood clot, sealing the canal orifice with mineral trioxide aggregate as sealing material. Patients were recalled periodically for up to twenty four months.

**Results:** Clinical evaluations demonstrated no adverse effects, during follow up 35 patients were asymptomatic, five cases of periapical periodontitis showed disappearance of sinus tract, on radiographic assessment there was progressive resolution of periapical radiolucency within first three-six months, the electric pulp test on sixth week demonstrated positive response, on radiographic evaluation there was progressive root length and thickness and continued root growth on six –twelfth months.

**Conclusion:** Revascularization is a safe and efficacious method of dental pulp regeneration in this study.

**Keywords:** Necrosis, Immature Permanent Teeth, Revascularization.

## INTRODUCTION

Most dental trauma occurs in the 7-12 years old age group and is mainly due to falls and accidents near home or school<sup>1</sup>. It occurs primarily in the anterior region of the mouth, affecting the maxillary teeth more than mandibular and lead to necrosis of dental pulp that arrest root development and have incomplete root formation<sup>2-6</sup>. The maintenance of dental pulp vitality is an underlying goal of most restorative procedures, but this becomes challenging and not possible even in few circumstances<sup>7</sup>. One of these situations is dental trauma commonly found among young children, especially to anterior teeth.

Treatment of an immature open-apex tooth with pulp necrosis and apical pathosis is a big challenge for endodontists<sup>8</sup>. The mechanical cleaning and shaping of a tooth with blunderbuss canal are difficult even not possible.<sup>9</sup> The thin, fragile root walls can fracture during mechanical filling and large volume of necrotic debris contained in wide root canal is difficult to completely disinfect.<sup>10</sup> Blunderbuss canal cannot be obturated and sealed by orthograde methods and require apical surgery and retrograde sealing of canal.<sup>11-15</sup>

Traditionally the endodontic management for non vital, immature, anterior teeth with open apices included surgery, retrograde sealing, calcium hydroxide-induced artificial apical closure (apexification) and mineral trioxide aggregates apical plug formation and guttapercha obturation surgical endodontic procedure seal the wide-open, often blunderbuss apical opening<sup>12</sup>. Although success can occur by using a surgical approach with retrograde seal, there are disadvantages. It is an invasive procedure with its accompanying shortcomings, including possibility of surgical complications as well as increased cost of treatment and possible psychological distress, especially in children.

Recently new treatment modality has emerged which consists of regenerative endodontics offering a high level of

success, in regenerative endodontics regeneration of tissue takes place rather than replacement of artificial substitutes, its an emerging and exciting field<sup>12</sup>. Revascularization is regenerative endodontic technique referring to create new tissue(blood clot) in previously necrotic tooth which leads to continued physiologic growth of immature roots, revascularization is the procedure to reestablish the vitality in a non vital tooth to allow repair and regeneration of tissues. The objective of this study was to evaluate the success of the revascularization approach in treatment of necrotic immature permanent anterior teeth because the conventional endodontic procedures may lead to premature loss of teeth, malocclusion, and compromise aesthetics and affect the long term prognosis of teeth. Successful pulp revascularization will prevent such complications and the affected teeth could reach its full physiological growth with a better long term prognosis.

## METHODS AND MATERIALS

The study was carried out on patients visiting the Operative Outdoor Department of de'Montmorency College of Dentistry/Punjab Dental Hospital, Lahore. The sample size of 40 cases is calculated with 95% confidence level, 5% margin of error and taking expected percentage of pulp revascularization i.e. 66.67% in patients presenting with necrotic maxillary anterior immature permanent teeth.

Patients were selected of both genders having age of 7-11yrs with the history of trauma along with Necrotic pulp in maxillary anterior teeth with open apex radiographically. An informed consent was involved for the patient. No ethical issue or risk was involved to the patient. The demographic information like name, age, gender and address was obtained.

A detailed history was taken, followed by clinical examination of the patient. Preoperative radiographs for maxillary anterior teeth were taken of each patient.

Teeth were anesthetized using local anesthesia, isolated with a rubber dam and an access cavity was prepared. Canal was gently flush with 20ml of 5.25% sodium hypochlorite (NAOCL) solution. Canal was dried with paper points, and a mixture of ciprofloxacin (200mg), metronidazole (500mg), and minocycline (100mg) was placed in the canal with lentulo-spiral and left for 7 days. Access cavity was sealed with temporary filling material. After one week the antibiotic was removed by 5.25% NAOCL if the tooth found symptom free. The canal was dried with paper points and confirmed to have no exudates. A file was introduced into the canal until vital tissue felt, to create some bleeding into the root canal system. The bleeding was allowed to reach at 3 mm below the cemento enamel junction, and the tooth was left for 15 min so as a blood clot carefully. Then mineral trioxide aggregate (MTA) was placed over the clot carefully followed by a wet cotton pellet and temporarily restored with cavite. One week later, the tooth was restored with dentine-bonded resin composite restoration and the patient was scheduled for recall. Post operative radiograph was taken immediately after the procedure so as to make a base line radiograph to compare it with radiographs taken on follow up.

Effectiveness of revascularization was assessed on the basis of disappearance of sign and symptom clinically and absence of radiolucency on radiographs, pulp vitality response and elongation and thickening of roots radiographically on 6 to 12 months follow up.

## RESULTS

A total of 40 teeth evaluated in 40 patients with necrotic maxillary anterior immature permanent teeth. 21 were male (52.5%) and 19 were female (47.5%). Out of 40 patients 80% (n=32) showed success while 20% (n=8) were no success. In 80% 13 patients aged 7-8 years showed immediate absence of lesion, and 27 patients aged 9-11 years showed absence of lesion over time period.

Age and absence of lesion (success) showed significant relationship between radiographic evaluation. Patients were age of 7-8 years showed rapid increase in root length and thickness of root walls.

Table 1: Age Distribution of the Patients (N=40)

Age (in years)	No. of Patients	%age
7-8	13	32.5
9-11	27	67.5
Total	40	100
Mean and s.d.	9.15+1.42	

Table 2: Gender Distribution of the Patients (N=40)

Gender	No. of Patients	%age
Male	21	52.5
Female	19	47.5
Total	40	100

Table 3: Success Of Revascularization Of Pulp In Necrotic Maxillary Anterior Immature Permanent Teeth

Success	No. of Patients	%age
Yes	32	80
No	08	20
Total	40	100

Table 4: Stratification of Success of Revascularization of Pulp in Necrotic Maxillary Anterior Immature Permanent Teeth With Regards to Age (n=40)

Age (in years)	No. of Patients	SUCCESS (n=32)	
		No. of Patients	%age
7-8	13	12	92.31
9-11	27	20	74.07
Total	40	32	

## DISCUSSION

Revascularization is a new treatment modality that comes under the umbrella of pulp regenerative procedures.<sup>10-12</sup> Regenerative endodontic procedures can be defined as biologically based procedures designed to replace damaged structures, including dentin and root structures, as well as cells of the pulp-dentin complex. Regenerative dental procedures offer high levels of success for many conditions, an ideal form of this therapy consists in which diseased or necrotic pulp tissue is removed and replaced with healthy pulp tissue to revitalize teeth.<sup>14-16</sup> Regenerative endodontics has different approaches which include root canal revascularization via blood clot, stem cells therapy, pulp implantation, PRP, PRF scaffold implant and gene therapy.<sup>16-18</sup>

The objectives of regenerative endodontic procedures are to regenerate pulp-like tissue, revascularization focuses on triggering bleeding into an empty root canal and form blood clot in the canal space space after getting sterilization with the hope that this will trigger a process similar to the role of the blood clot in triggering wound healing in surgical procedures.<sup>19,20</sup> Several studies have reported on revascularization using blood clot as a matrix; it consists of cross-linked fibrin that serves as a pathway for the migration of stem cells, macrophages, and fibroblasts from the periapical area. The cells in the blood clot contain growth factors important for the wound healing process. Moreover bleeding induced angiogenesis helps in recruiting stem cells/progenitor cells necessary for a successful outcome. In results revascularization promotes root development. In addition to the antibacterial role of antibiotics pastes, the demineralization effect of tripaste and bipaste suggested a significant role of in pulp regeneration by enhancing the attachment and growth of host stem cells on dentine through the exposure of embedded collagen fibers and various growth factors. MTA was introduced into the dental field in the mid-1990s. It was originally advocated to be used for perforation repair and as root-end filling material. MTA has been recognized as a bioactive material that has regenerative potential; it is hard tissue inductive and hard tissue conductive, and biocompatible.

There are several advantages to a revascularization approach such as this approach is technically simple, requires shorter treatment time, very cost effective and regeneration of tissue in root canal system by a patient's own blood avoids the possibility of immune rejection.<sup>15-19</sup> It requires no additional treatment and the most attractive things are continuing growth of roots, thickens the root dentinal walls, resolution of periapical radiolucency and sign and symptoms, closes open apex and continues development of roots in normal physiologic manner.

Rui Yu Ding et al presented a clinical study of pulp revascularization of immature teeth with apical periodontitis.<sup>12</sup> The purpose of that study was to examine the effect of a pulpal revascularization procedure for immature necrotic teeth with apical periodontitis. A tri antibiotic mix (ciprofloxacin, metronidazole and minocycline) was used to disinfect the pulp for 1 week. Then a blood clot was created in the canal, over which grey mineral trioxide aggregate was placed to seal the access cavity, they demonstrated success of revascularization and resolution of sign and symptoms, absence of pain, and all successful cases showed an increase root length narrowing of the canal space, closure of apex.

Raison bose, et al conducted a retrospective evaluation of radiographic outcomes in immature teeth with necrotic root canal system treated with regenerative endodontic procedures. The results showed that regenerative Endodontic treatment with triple antibiotic paste produced significantly greater Increase in root length and greater root wall thickness.<sup>15</sup>

Joseph A. et al presented a case series on challenges in regenerative endodontics Six immature teeth with apical periodontitis (in three patients) were treated via the revascularization protocol using irrigants, a triple antibiotic paste, and a coronal seal of mineral trioxide aggregate and composite.<sup>21</sup> For follow-up, all six teeth showed resolution of periapical radiolucencies, whereas three of six teeth showed continued root development. Two teeth displayed a positive response to vitality testing.

Naseem Shah et al presented a pilot clinical study to evaluate the efficacy of revascularization in 14 patients of infected immature teeth.<sup>13</sup> Endodontic treatment was initiated, and after infection control, revascularization was performed. The cases were followed up at regular intervals of 3 months; the outcome was as follows. Radiographic resolution of periradicular radiolucencies was judged to be good to excellent in 93% (13 of 14) of the cases. In the majority of cases, a narrowing of the wide apical opening was evident. In 3 cases, thickening of apical dentinal walls and increase root length were observed. The striking feature was complete resolution of clinical signs and symptoms and healing of periapical lesion in 78%. Thickening of lateral dentinal walls was evident in 57% (8/14) of cases, and increased root length was observed in 71%.

The result of present study are comparable with that study 40 cases have been treated 32 cases went successful that is 80%(32 of 40) and showed complete resolution of sign and symptoms and absence of periapical radiolucency, in majority of cases root length elongation and root walls thickness and apical closure was observed.

## CONCLUSION

Pulp revascularization is a promising alternative treatment for the immature permanent teeth ,it showed the continuation of root development with thickening of root walls and apical closure .this therapy promotes

investigation of stem cells from apical region in young patients with open apexes.

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