Research Article

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Evaluation of Efficacy of Antioxidant Medicament in Primary Molars Pulpotomy: Two Year Follow - up Study

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ABSTRACT

Background: The aim of this study is to evaluate the efficacy along with clinical and radiographic success rate of antioxidant mix as a new pulpotomy medicament for primary teeth.

Materials and Methods: This study was done on 30 primary molar teeth in children, with age that ranged from 6 to 9 years. Pulpotomy procedure was performed followed by placement of antioxidant (mixed with saline) over the radicular orifice was carried out and permanent restoration with GIC was placed. Recall was scheduled for 3, 6, 9, 12 and 24 months respectively, after treatment.

Results: 3rd & 6th months follow-up revealed 100% successful, 9th and 12th month follow-up showed 96.2% clinical & 92.5% radiographic successful respectively. After 2 year, follow up revealed 92.3% clinical & 89% radiographically success rate.

Conclusion: The Clinical and radiographic success rate of antioxidant mix shows that it's an ideal pulpotomy agent.

Keywords: Antioxidants, Free Radicals, Free Radical Scavengers, ROS (reactive oxygen species), RNS (reactive nitrogen species), Pulpotomy.

INTRODUCTION

If a tooth with a carious lesion remains untreated or, is inadequately treated, a bacterial invasion of the coronal pulp will occur originating an inflammatory response at that level. In this stage the inflammation is confined to this space, if the affected tissue is removed and the entrance to the root canals is covered with an appropriate agent, the remaining tissue is capable of recovering. One such pulp therapy technique used for preserving decayed primary molars from extraction is pulpotomy. In this technique, the coronal pulp is removed, and the remaining radicular pulp is opined to be vital and free of any pathological alterations. The primary objective of pulp therapy is to maintain the integrity and health of the teeth and their supporting tissues[1, 2].

Don M. Ranly classified pulpotomy based on treatment objectives into devitalization, (Mummification, Cauterization), preservation (minimal devitalization, noninductive) and regeneration (inductive, reparative). Non chemical

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methods of pulpotomy include use of electro surgery and lasers. Medicaments used in devitalizing pulpotomy includes formocresol, Gysi Triopaste, Easlick's Paraformaldehyde paste and Paraform devitalizing paste. Preservative pulpotomy technique produce minimal insult to orifice tissue, thereby maintaining vitality and normal histological appearance of radicular pulp. The materials included in this category are ZOE, glutaraldehyde, ferric sulfate. Regenerate pulpotomy medicaments include calcium hydroxide, mineral trioxide aggregate,bone morphogenic proteins. Newer materials include Lyophilized freeze dried platelet, Enamel Matrix Derivative, propolis, sodium hypochloride, bioactive glass, Ankaferd Blood Stopper, Nano Hydroxy Apatite, Platelet Rich Plasma and Calciumphosphate cement[3]. Major of this pulpotomy materials are toxic and potential carcinogenic. Search for an alternative ideal pulpotomy agent is on till date. Very few studies have focused on wound healing agents in pulpotomy. Appropriate method, of wound healing, is essential for the restoration of anatomical continuity of damaged tissue and disturbed functional status of the radicular tissue[4].

Nowadays, antioxidants are getting more and more attention in wound healing, act as "free radical scavengers" by preventing tissue injury and inflammation and helps in repairing damages caused by ROS (reactive oxygen species) and RNS (reactive nitrogen species), and therefore can enhance the immune defense . Antioxidants return to the surface of cell to stabilize membrane and prevent damage to other cellular components. An increased interest in the role of free radical oxidative damage in human diseases along with an upsurge in research antioxidants are being widely used in routine general clinical practice, dental manufacturers have incorporated antioxidant formulations into toothpastes, mouth rinses/mouthwashes, lozenges, fluoride gels, dentifrices, oral sprays, and other dental products for the control of gingival and periodontal diseases. Recent studies also suggest that, topical use of antioxidants in the skin is very much effective so it does efficiently in oral cavity too[5, 6, 7, 8].

CLASSIFICATION OF ANTIOXIDANTS [9]

1. **Endogenous Antioxidants**
a. Bilirubin
b. Thyols
c. NADPH and NADH
d. Ubiquinone
e. Uric acid
f. Enzymes like iron dependent catalase, glutathione perioxide and Cu/Zn & Mn dependent superioxide dismutase
g. Melatonin hormone

2. Dietary Antioxidants
a. Vitamin C & E
b. β-Carotene , Other carotenoids & oxy carotenoids like lycopene & lutein
c. Polyphenols eg. Flavonoids , flavones, flavonols & proanthocyanidins
d. Transferrin(iron)

3. **Metal Binding Proteins**
a. Albumin (Copper)
b. Ceruloplasmin (Copper)
c.Metallothionin (copper)
d. Ferritin (iron)
e. Myoglobin (iron)

4. Enzymatic Antioxidants
a.Superoxide dismutase
b. Glutathione peroxide
c. Catalase
d. Glutathione reductase
e. Glutathione transferase

5. Non enzymatic Antioxidants
I. Nutrient
a. Alpha tocopherol
b. Beta-Carotene
c. Ascorbate
d. Glutathione
e. Selenium
II. Non nutrient
a.Ceruloplasmin
b.Transferrin
c.Uric acid
d.Peptides Camosine

Health benefits of anitoxidants:

- Antioxidants support kidney and reproductive function.
- It supports immune system & improve defence power of the body.
- Maintains healthy vision.
- Improves nervous system functioning, quality of sleep and reduce obesity.
- Maintain good dental health.
- Protects liver and have anti-aging effect.
- Prevents myocardial infraction and atherosclerosis.

- It helps in inhibition of hyaluronidase, keeping the ground substance around the tumor intact and preventing metastasis.
- Killing oncogenic viruses through its enhancement of phagocytic activities
- Neutralization of carcinogenic toxins.
- Offers protection against digestive disorders and support respiratory system[10].

In this study we used antioxidant having properties like, it stimulates collagen formation which helps in wound healing, it stops disease progression, salvaging cellular free radical damage, fortifying the immune system by increased lymphocytes production, helps in angiogenesis, it acts first line of defense by stimulating the production of antibodies and protects the tissues.[11]

MATERIALS AND METHODS

30 deciduous molar teeth requiring pulpotomy treatment which met the fallowing clinical and radiographic criteria were selected and evaluated for 24 months[12].

- Absence of spontaneous pain or history of nocturnal pain
- Absence of clinical signs or symptoms
- Absence of suppurating sinus or soft tissue swelling
- Hemorrhage should stop with in 5 min from the amputated pulp stumps
- Restorable after completion of the procedure
- Deep carious lesion radiographically approximating to the pulp
- Absence of furcation involvement, periapical pathology, internal resorption and calcification in canal radiographically.

Procedure:

The methodology is “one visit” and was performed following this clinical protocol. The pulpotomy procedure was carried out after anaesthetizing the tooth with 2% lidocaine and 1: 80,000 adrenaline. Teeth isolation was done with rubber dam and then access to the pulp chamber was obtained with 330 carbide bur followed by extirpation and amputation of the coronal pulp with sharp spoon excavator. Stasis at the orifice of the radicular pulp was achieved with a moist cotton pellet placed on orifices under pressure for 3 min. After stasis, antioxidant tablet was crushed into powder and was mixed with saline and placed over the orifice followed by a layer of reinforced Zinc Oxide Eugenol (IRM DENTSPLY) and permanent restoration placed over it. Postoperative periapical radiographs of the treated teeth were taken and considered as baseline.

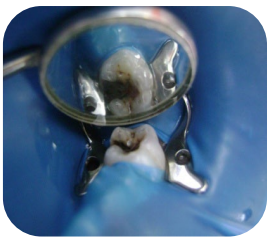
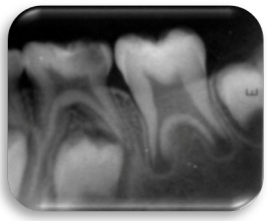

Fig 1: Preoperative photograph, Fig 2: pre –op radiograph

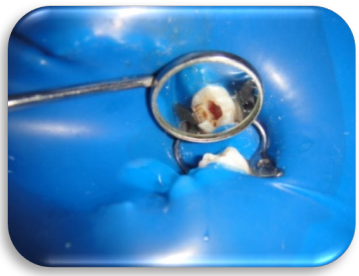

Fig 3: After access opening and coronal pulp amputation

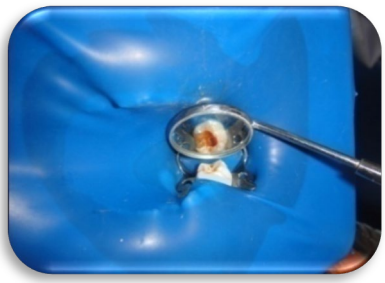

Fig 4: After placement of antioxidant

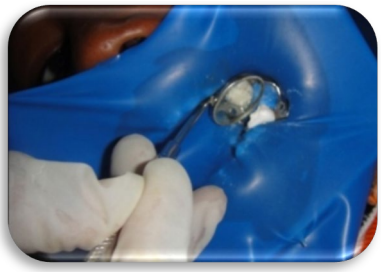

Fig 5: After placement of final restoration

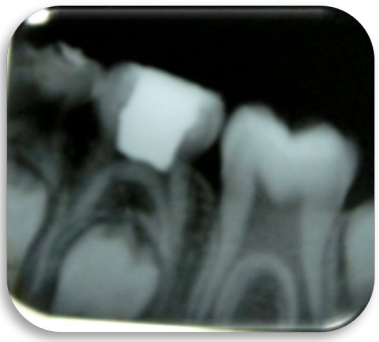

Fig 6: Immediate postoperative radiograph

The patients were recalled after 3rd, 6th, 9th, 12th and 24th month interval respectively and evaluated clinically and radiographically. Clinical criteria for successful pulp therapy are: 1. No pain 2. No percussion sensitivity 3. No swelling and/or fistula 4. No pathologic tooth mobility. Radiographic criteria for successful pulp therapy are: 1. No translucency in furcation area 2. No internal or external root resorption 3. No widening of periodontal space

As unsuccessful was referred treatment with one of the clinical or radiographic criteria described above. The data were recorded in patient's documentation and serve as a basis for evaluation at re-call visits.

RESULTS

- Thirty teeth observed after 3 months showed 100% success rate with no clinical and radiographic failure .
- After 6 months follow-up 30 teeth shows no clinical and radiographic failure means 100% successful.
- After 9 months 27 teeth observed in that 1 tooth showed pain means clinically 96.2% successful and 2 teeth showed radiolucency in furcational area means 92.5% successful radiographically. The same result was found after 12 month follow up.

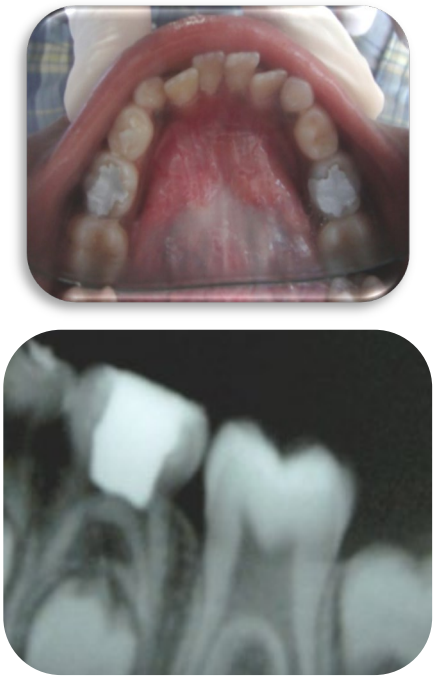

Fig 7: 3rd month follow-up - the clinical picture and radiographic picture

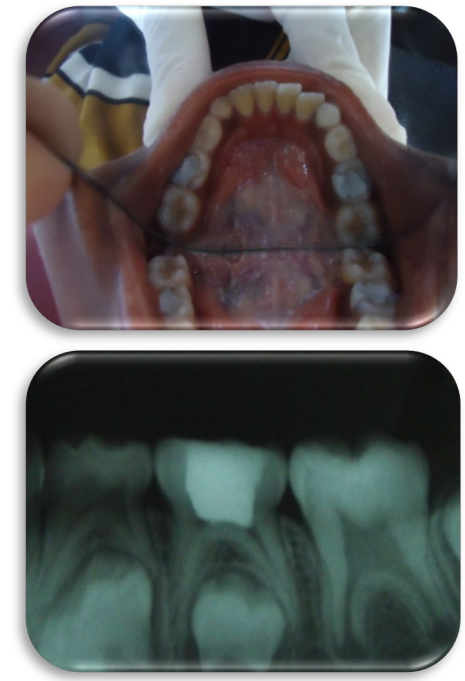

Fig 8: 6th month follow-up clinical picture and radiographic picture

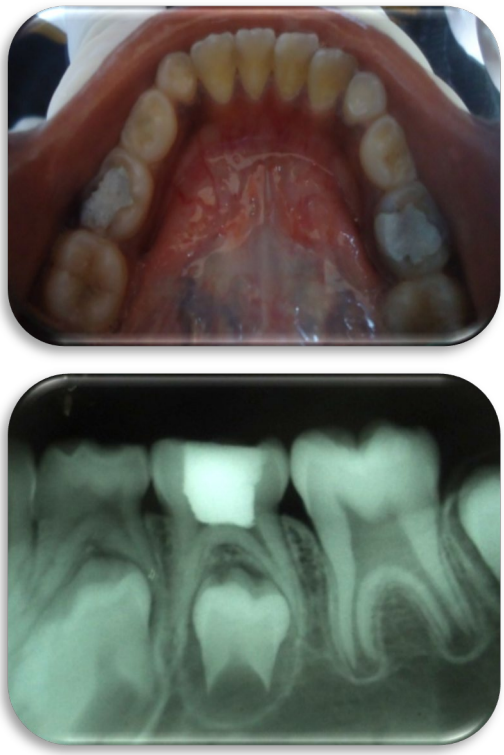

Fig 9: 9th & 12th month follow-up-clinical and radiographic picture

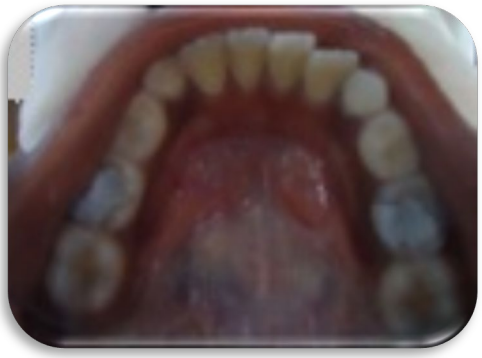

Fig 10: 24th month follow up – clinical and radiographic picture

- After 24 months follow up, only 26 teeth were available for observation in which 2 teeth showed pain means clinically success rate was 92.3% and 3 teeth showed radiolucency in furcational area means 89% successful radiographically were found.

DISCUSSION

The objective of pulp therapy in a child patient is the successful treatment of a pulpally involved tooth and to reatain the tooth in a healthy condition [5]. The vitality of the pulp after an injury depnds upon the condition of the pulp at the time and the therapeutic approach used. The ideal pulpotomy agent should accelerate the recovery of remaining radicular pulp tissue to a healthy state so that involved tooth attains normal physiological state[4]. Davis WL et.al studied Copper-zinc superoxide dismutase antioxidant activity in normal and inflamed human dental pulp tissue, both normal and inflamed dental pulps were assayed for the presence of this enzyme but in the inflamed pulpal tissues, enzyme activity was markedly and significantly increased in comparison to that in the normal tissues and it indicates that human dental pulp possesses an endogenous defense mechanism designed to protect the tissue components from the toxic effects of the reactive oxygen species[13]. Most of the studies evaluating the effectiveness of antioxidants at wound healing deal with systemic applications. It has also been shown that local application of a tissue specific antioxidant would be more beneficial and has no adverse systemic effect. Antioxidants work by binding to the free radicals transforming them into non-damaging compounds. Several investigators attempted to reduce free radical activity with the local use of free radical scavengers. According to Chapple in order for a scavenger to be successful, it must be located at the site of the radical and must be active against the injurious species by a mechanism that is compatible with the local environment[14]. Alacam et.al (1999) used catalase antioxidant as direct pulp capping agent and better tissue healing was observed with differentiation of pulpal cells into functional odontoblasts and subsequent dentine bridge formation[8]. Rotstein I et.al applied topically antioxidant catalase on rats tongue mucosa which prevent hydrogen peroxide induced free radical injury[11]. Mizushima et.al showed that when antioxidants applied topically skin lesions and symptoms were rapidly decreased[15].

Clinical & radiographic success of antioxidant in present study is due to its wound healing properties, it may preserve more amount of radicular pulp by preventing further damage to DNA and cellular proteins and arresting the disease progression by salvaging cellular free radical damage, while the conventional pulpotomy medicaments which tend to devitalize the remaining radicular tissue. Antioxidants enhances chemotaxis, stimulates the production of antibodies

helps in phagocytosis and having antinflammatory property by increased lymphocyte production[16].

CONCLUSION

In our present study Clinical and radiographic success rate of antioxidants is due to its property by preventing free radical damage, stimulates antibody production acts as first line of defence, helps in healing of remaining radicular pulp by collagen formation and angiogenesis. Future researches should continue with the aim of investigating the pharmacodynamic properties of topical antioxidants, biocompability, wound healing capacity and understanding their pathways in preserving and radicular pulp.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interest regarding this article.

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