

Effect of antioxidant mix as a pulpotomy medicament in deciduous molars: Two year follow-up study

Brij Kumar^{1*}, Nitesh Sharma², Shilpi Karpathak³, Anil Pandey⁴, Saurav Kumar Prabhat⁵, Dhani Kapur⁶

^{1,2}Senior Lecturer, ³Reader, ⁴⁻⁶Post Graduate Student, ^{1,4-6}Dept. of Pedodontics and Preventive Dentistry, ^{2,3}Dept. of Prosthodontics Crown and Bridge, Rungta College of Dental Sciences and Research, Bhilai, Chhattisgarh, India

***Corresponding Author: Brij Kumar**

Email: brij220787@gmail.com

Abstract

Aim: The purpose of this study is to evaluate the clinical and radiological success of using the antioxidant mixture as a new medicament for the pulpotomy of milk teeth.

Materials and Methods: This study was performed on 30 molars in children aged 6 to 9 years. A pulpotomy procedure was performed, followed by the placement of an antioxidant (mixed with saline) on the canal orifice, and then permanent filling with GIC was performed. The review was assigned at 3, 6, 9, 12 and 24 months, respectively, after treatment.

Results: Follow-up at 3 and 6 months was 100% successful, follow-up at 9 and 12 months showed respectively 96.2% clinical success and 92.5% radiographic success. After 2 years of observation, clinical success was 92.3 and radiological success was 89%.

Conclusion: The clinical and radiological success of the antioxidant mixture shows that it is an ideal agent for pulpotomy.

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

Introduction

If a tooth with a carious lesion remains untreated or improperly treated, bacterial invasion in the coronary pulp occurs, causing an inflammatory response at this level. At this stage, the inflammation is limited to this space. If the affected tissue is removed and the root canal orifice is covered with a suitable agent, the remaining tissue is able to recover. One of the pulp therapy techniques used to preserve the decayed primary molars from extraction is pulpotomy. In this method, the coronal pulp is removed and the rest of the root pulp is considered vital and free of any pathological changes. The main goal of pulp therapy is to maintain the integrity and health of the teeth and their supporting tissues.^{1,2}

Don M. Ranley classified treatment-based pulpotomy in the following areas: devitalization (mummification, cauterization), preservation (minimal devitalization, non-inductance), and regeneration (inductive, restorative). Non-chemical pulpotomy methods include the use of lasers and electrosurgery. Materials used to devitalizing pulpotomy include formocresol, Gysi triopaste, Easlick paraformaldehyde paste and Paraform devitalizing paste. The conservative pulpotomy technique provides minimal damage to the tissue of the orifice, thus maintaining the vitality and normal histological appearance of the root pulp. Materials included in this category include ZOE, glutaraldehyde, iron sulphate. Medicaments for the regeneration of pulpotomy include mineral trioxide aggregate, calcium hydroxide and morphogenic bone

proteins. The newest materials include enamel matrix derivative, lyophilized freeze-dried platelets, propolis, bioactive glass, sodium hypochlorite, Ankaferd blood stopper, nano-hydroxyapatite, calcium phosphate, platelet rich plasma. Most of these pulpotomy materials are toxic and potentially carcinogenic. The search for an ideal remedy for pulpotomy continues today. Very few studies have focused on wound healing during pulpotomy. An appropriate method of wound healing is necessary to restore the anatomical continuity of the damaged tissue and the alteration of the functional state of the root tissue.⁴

The Antioxidants are getting more and more attention when healing wounds, they act as "free radical scavengers" to prevent tissue damage and inflammation, and help repair the damage caused by ROS (reactive oxygen species) and RNS (reactive nitrogen species), and therefore may enhance immune defense. Antioxidants come back to the surface of cells to stabilize the membrane and prevent damage to other cellular components. Increased interest in the role of oxidative damage by free radicals in human disease, as well as increased research on antioxidants, is widely used in routine clinical practice. Now a days antioxidants are used as a toothpastes, mouth rinses/mouthwashes, lozenges, fluoride gels, dentifrices, Oral sprays and other dental products in a large scale to control gum and periodontal diseases. Recent studies also show that topical application of antioxidants to the skin is very effective; it is therefore equally effective in the oral cavity.⁵⁻⁸

Table 1

| Classification of Antioxidants ⁹ | | | | |
|--|---|---|---|--|
| Endogenous Antioxidants | Dietary Antioxidants | Metal Binding Proteins | . Enzymatic Antioxidants | Nonenzymatic Antioxidants |
| a. Bilirubin b. NADPH and NADH c. Uric acid d. Melatonin hormone e. Thyols f. Ubiquinone g. Enzymes like iron-dependent catalase, glutathione peroxidase and Cu/Zn & Mn dependent superoxide dismutase | a. Vitamin C & E b. Polyphenols eg. Flavonoids, flavones, flavonols & proanthocyanidins c. β-Carotene, Other carotenoids & oxy carotenoids like lycopene & lutein d. Transferrin(iron) | a. Albumin (Copper) b. Metallothionein (copper) c. Myoglobin (iron) d. Ceruloplasmin (Copper) e. Ferritin (iron) | a. Glutathione peroxidase b. Glutathione reductase c. Superoxide dismutase d. Glutathione transferase e. Catalase | I. Nutrient a. Alpha-tocopherol b. Beta-Carotene c. Glutathione d. Ascorbate e. Selenium II. Non-nutrient a. Ceruloplasmin b. Uric acid c. Peptides Carmoisine d. Transferrin |

Health benefits of antioxidants:

1. Antioxidants support kidney function and reproductive function.
2. Supports a healthy vision.
3. Maintain good dental health.
4. Protects the liver and has an anti-aging effect.
5. Supports the immune system and improves the body's defenses.
6. Prevents myocardial infarction and atherosclerosis.
7. Helps in inhibit hyaluronidase by preserving the main substance around the tumor and preventing metastasis.
8. Improves nervous system function, improves sleep quality and reduces obesity.
9. Neutralization of carcinogenic toxins.
10. Provides protection against digestive disorders and supports the respiratory system.
11. Destruction of oncogenic viruses by increasing phagocytic activity.¹⁰

In this study, we used an antioxidant with properties such as, it stimulates the formation of collagen, helps wound healing, blocks the progression of the disease, avoids cell damage to free radicals, strengthens the immune system by increasing lymphocyte production, helps with angiogenesis, acts The first line of defense by stimulating the production of antibodies and protects the tissues.^{11,12}

Materials and Methods

30 primary molars requiring pulpotomy, meeting the following clinical and radiographic criteria, were selected and evaluated them 24 months.

1. Absence of spontaneous pain or history of night pain
2. Absence of purulent sinus or soft tissue edema
3. No signs or clinical symptoms.
4. Bleeding should stop within 5 minutes after the amputated pulp stumps.
5. A deep carious lesion radiologically approaches the pulp
6. It is restored after completion of the procedure
7. The absence of lesion by furcation involvement, periapical pathology, internal resorption and radiological calcification in the canal.

Procedure

The "one visit" methodology was conducted according to this clinical protocol. Pulpotomy was performed after dental anesthesia with 2% lidocaine and 1: 80,000 adrenaline. The isolation of the teeth was carried out using a rubber dam (Fig. 1), then access with the carbide bur 330 was obtained in the pulp chamber, followed by the removal and amputation of the coronal pulp using with a sharp spoon excavator (Fig. 2). Stasis in the opening of the root pulp was obtained with a wet cotton ball placed in the openings under pressure for 3 minutes. After stagnation, the antioxidant tablet was crushed and mixed with saline and placed on the orifice (Fig. 3), after which an improved eugenol zinc oxide layer (MRI DENTSPLY) was applied and permanent restoration was done (Fig. 4). Postoperative radiographs of the treated teeth were taken as a baseline (Fig. 5).

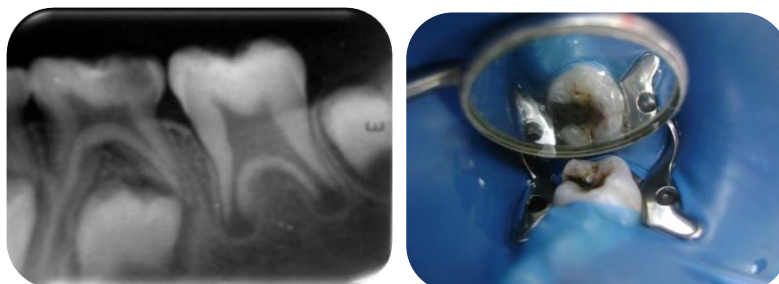


Fig. 1: Pre-op radiograph Isolation with rubber dam

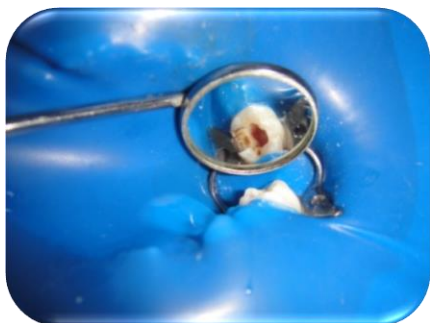


Fig. 2: Access opening and coronal pulp amputation

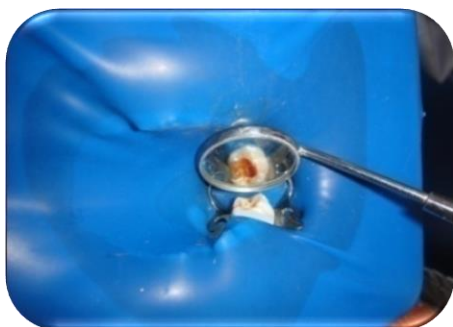


Fig. 3: Placement of antioxidant

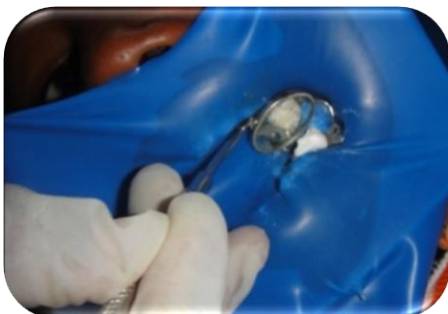


Fig. 4: Placement of final restoration

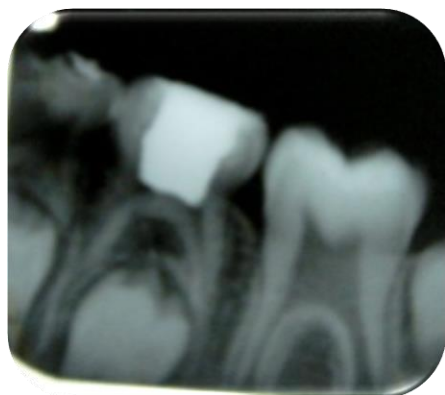


Fig. 5: Postoperative radiograph

Patients were recalled after the 3rd, 6th, 9th, 12th and 24th months, respectively, and were evaluated clinically and radiologically.

The clinical criteria for successful pulp treatment are: 1. No pain. 2. Lack of sensitivity to percussion. 3. Lack of edema and / or fistula. 4. Lack of pathological tooth mobility.

Radiological criteria for successful pulpal treatment: 1. Absence of transmission in the furcation area. 2. The lack of internal or external resorption of the root. 3. Lack of periodontal expansion.

In the event of failure, the treatment was indicated according to one of the clinical or radiographic criteria described above. The data has been recorded in the patient's documentation and serves as a basis for evaluation during follow-up visits.

Results

Thirty teeth observed after 3 months showed 100% success without clinical and radiological abnormalities (Fig. 6).

After 6 months of observation of 30 teeth, there is no clinical and radiological abnormality, which means a 100% success (Fig. 7).

After 9 months, the 27 teeth observed, on this 1 tooth showed that the pain meant a clinical success of 96.2% and 2 teeth showed radiolucency in the area of furcation, which corresponds to a success of 92.5% radiographically. The same result was found after 12 months of observation (Fig. 8).

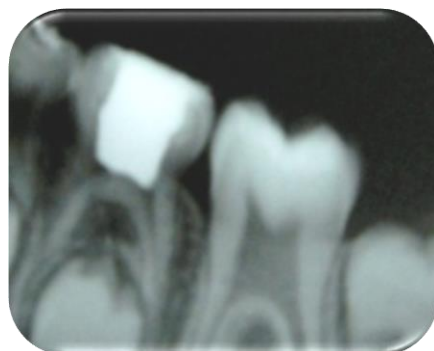


Fig. 6: 3rd month follow-up - the clinical picture and radiographic picture

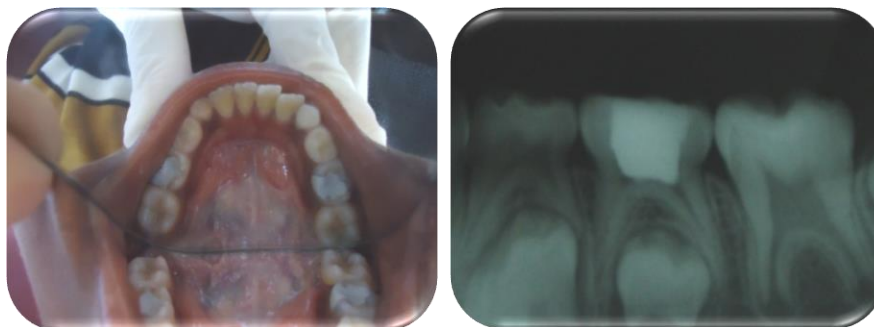


Fig. 7: 6th month follow-up clinical picture and radiographic picture



Fig. 8: 9th & 12th month follow-up-clinical and radiographic picture

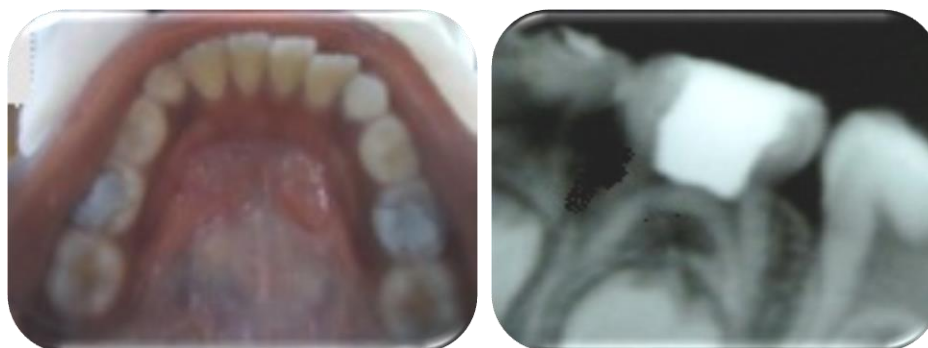


Fig. 9: 24th month follow up – clinical and radiographic picture

After 24 months of observation, only 26 teeth were available, of which 2 teeth indicated that pain was a clinical indicator of success of 92.3% and 3 teeth showed radiolucency in the furcation region, which means that 89% of them were radiologically success rate (Fig. 9).

Discussion

The goal of pulp treatment in children is to successfully treat a tooth affected by the pulp and restore its health.⁵ The viability of the pulp after injury depends on the state of the pulp at this time and the therapeutic approach used. An ideal agent for pulpotomy is to speed up the restoration of the remaining root pulp tissue to a healthy state, so that the tooth has a normal physiological state.⁴ Davis WL et al studied the antioxidant activity of copper and zinc superoxide dismutase in normal and inflamed tissues of the human dental pulp. In both, the normal and inflamed dental pulp, they analyzed the presence of this enzyme, but in

inflamed tissues, the activity of the enzyme was markedly and significantly increased in comparison to normal tissues, this indicates that the human dental pulp has an endogenous protective mechanism designed to protect tissue components from the toxic effects of reactive oxygen species.¹³ Most studies evaluating the effectiveness of antioxidants in wound healing have systemic uses. It has also been shown that topical application of a tissue-specific antioxidant would be more beneficial and have no adverse systemic effect. Antioxidants act by binding to free radicals, turning them into harmless compounds. Several researchers have attempted to reduce the activity of free radicals by using local free radical scavengers. According to Chapple, for the scavengers to succeed, they must be located on the radical site and must be active against the injurious species using a mechanism compatible with the local environment.¹⁴ Alacam et al. (1999) used the antioxidant catalase as a direct agent covering the pulp and improved tissue healing was

observed with the differentiation of pulp cells into functional odontoblasts and the subsequent formation of dentinal bridges.⁸ Rotstein I et al. conducted a study in which they used topical application of catalase antioxidant on the mucous membrane of the rat tongue, which prevents free radical damage caused by hydrogen peroxide.¹¹ Mizushima et al. showed that with topical application of antioxidants, local skin lesions and their symptoms decreased rapidly.¹⁵

The clinical and radiographic success of the antioxidant in this study is due to its healing properties, it can preserve a greater amount of root pulp, thus preventing further damage to DNA and cellular proteins and delaying the progression of the disease, thus preserving cell damage caused to free radicals, while conventional pulpotomy medicaments devitalize the remaining root tissue. Antioxidants improve chemotaxis, stimulate antibody production, help with phagocytosis and have anti-inflammatory properties by increasing lymphocyte production.¹⁶

Conclusion

In our current study, the frequency of the clinical and radiological success of antioxidants lies in its property: to prevent the damage caused by free radicals, to stimulate the production of antibodies, to act as a first line of defense, to help the healing of the Remaining root pulp due to collagen formation and angiogenesis. Further research is needed to study the pharmacodynamic properties of local antioxidants, biocompatibility, the ability to heal wounds, and to understand the means of preserving them and their root pulp.

Source of funding

None.

Conflict of interest

None.

References

- Goyal P, Pandit IK, Gugnani N, Gupta M, Singla N, Singla V. Clinical Efficacy Of Various Medicaments Used For Pulpotomy In Primary Molars – A Comparative Study. *Int J Res Dev Pharma Life Sci* 2016;5(3):2107-16.
- Niranjani K, Ghanshyam PM, Kumar AAV, Divya G, Thakur MS, Saujanya K. Clinical Evaluation of Success of Primary Teeth Pulpotomy Using Mineral Trioxide Aggregate, Laser and Biodentine- an In Vivo Study. *J Clin Diagn Res* 2015;9(4):35-7.
- Praveen NHK, Rashmi N, Vipin KB, Pujan PM. Pulpotomy Medicaments: Continued Search for New Alternatives- A Review. *OHDM* 2014;13(4):883-90.
- Stadelmann WK, Digenis AG, Tobin GR. Impediments to wound healing. *Am J Surg* 1998;176:39S-47.
- Sen CK, Khanna S, Gordillo G, Bagchi D, Bagchi M, Roy S. Oxygen, oxidants, and antioxidants in wound healing: An emerging paradigm. *Ann N Y Acad Sci* 2002;957:239-49.
- Hamid AA, Aiyelaagbe OO, Usman LA, Ameen OM, Lawal A. Antioxidants: Its medicinal and pharmacological applications. *Afr J Pure Appl Chem* 2010;4(8):142-51.
- Rosyy: Antioxidants. Available from: <http://staywow.com> [Accessed 11th September 2016].
- Guo S, DiPietro LA. Factors Affecting Wound Healing. *J Dent Res* 2010;89(3):219-29.
- Davis, WL, Jacoby BH, Craig KR., Wagner G, Harrison JW. Copper-zinc superoxide dismutase activity in normal and inflamed human dental pulp tissue. *J Endod* 1991;17:316-8.
- Alacam A, Tulunoglu O. Effects of topical Catalase application on dental pulp tissue: a histopathological evaluation. *J Dent* 2000;28(5):333-9.
- Rotstein I, Wesselink PR, Bab I. Catalase protection against hydrogen peroxide-induced injury in rat oral mucosa. *Oral Surg Oral Med Oral Pathol* 1993;75(6):744-50.
- Kunisawa J, Kiyono H. Vitamin-mediated regulation of intestinal immunity. *Frontiers Immunol* 2013;4:180-9.
- Prabhala RH, Garewal HS, Hicks MJ, Sampliner RE, Watson RR. The effects of 13-cis-retinoic acid and beta-carotene on cellular immunity in humans. *Cancer* 1991;67: 1556-60.
- Puertollano MA, Puertollano E, de Cienfuegos GA, de Pablo MA. Dietary antioxidants: Immunity and host defense. *Curr Top Med Chem* 2011;11:1752-66.
- Mizushima Y, Kobayashi M. Interaction of anti-inflammatory drugs with serum proteins, especially with some biologically active proteins. *J Pharma Pharmacol* 1968;20:169-73.
- Carr AC, Maggini S. Vitamin C and immune function. 2017; 9(11):1211-18.

How to cite this article: Kumar B, Sharma N, Karpathak S, Pandey A, Prabhat SK, Kapur D. Effect of antioxidant mix as a pulpotomy medicament in deciduous molars: Two year follow-up study. *Int J Oral Health Dent* 2019;5(3):131-5.