International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Action of Ferric Sulphate on Pulpal Tissue – A Monograph

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Abstract: ***Pulpotomy is a procedure done when coronal pulp tissue is exposed by caries in primary teeth. Many techniques have been used for the treatment of pulpally involved primary teeth. One among those include ferric sulphate (FS) medicament which is used a hemostatic agent. Studies have shown that Ferric sulphate has good clinical and radiographic results with high tooth survival rates.***

Keywords: ferric sulphate, hemostatic agent, pulpotomy

1. Introduction

In pediatric dentistry, pulpotomy is a common therapy which is performed in a primary molar with extensive caries but without evidence of radicular pathology when caries removal results in a carious or mechanical pulp exposure. The pulpotomy is a procedure which involves covering the pulp stumps with a pulp-capping agent to promote healing or an agent to fix the underlying tissue [1].Various pulpotomy agents, formaldehyde-based materials, electro surgery, lasers, glutaral dehydehaemostatic medicaments, zinc oxide eugenol, bone morphogenic protein (BMP), collagen and calcium involving, dentin bridge inducing materials, have been usedfor the procedure.

Ferric sulfate or Fe_2SO_4 is one among that which is a dark brown chemical agent with acidic properties. Ferric sulfate exerts its haemostatic effect through a chemical reaction with blood proteins; this property makes ferric sulfate a very efficient haemostatic agent, without need for help from the haemostatic system to exert its effect. It adequately control bleeding even in the patients with abnormal haemostasis [2,3]. This property, with regard to the significant amount of proteins in the blood, makes ferric sulfate a very strong haemostatic agent.

2. Mechanism of Action

When ferric sulphate is applied, the blood proteins get agglutinated (4). Red blood cells which have sialated glycoproteins embedded give a negative charged surface. This negativity will create a repulsive electric zeta potential between cells (5). When agglutination force exceeds the force of repulsive force generated by the negative charge, blood gets agglutinated.

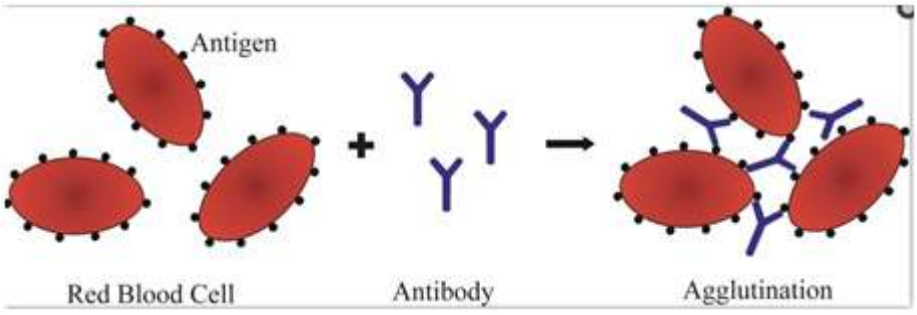

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Figure 1: Hemagglutination reaction; blood group antigens and antibodies forming clumping of erythrocytes.

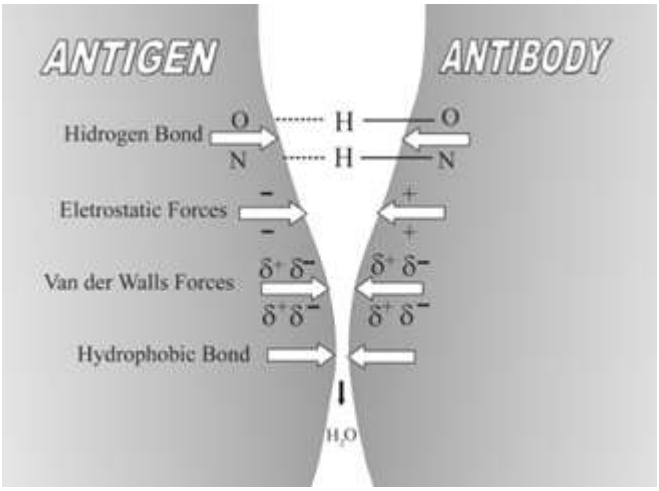

Figure 2: Forces involved in antigen antibody bonding

A reaction occurs when Ferric and sulphate ions reacts with the blood which forms agglutinated blood proteins. The agglutinated blood proteins form plugs which helps in sealing the damaged capillary orifices (6). The capillary which has 3-7um in diameter [7] occludes when the ferric ion protein complex seals the vessels which will prevent clot formation [8]. This could be due to a chance that metal proteins clot formed at the surface of pulp stumps can act as barrier and there is a passive function as proposed by Ranly[9].

Figure 3: Clinical application of ferric sulphate. Bleeding in the pulp chamber after amputation of the coronal pulp tissue followed by arrest of the blood after application of ferric sulphate

3. Adverse Effects

Ferric sulphate, produces local and reversible inflammatory response to oral soft tissues, but no toxic or harmful effects have been published in dental or medical literature [10].

The most common radiographic finding seen was internal resorption and calcific metamorphosis [11].

The findings of internalresorption could be as a result of the sub-base used in pulpotomy. Pulpotomy technique with ferric sulfate use zinc oxide and eugenol (ZOE) as the sub-base. Previous investigations of ZOE as a pulpotomy agent have also reported internal resorption to be a common finding. Zinc oxide eugenol, when used as a base in pulpotomy can come in contact with the highly perfused environment of pulp and undergo hydrolysis of the zinc eugenolate to yield free eugenol. Direct placement of eugenol over vital tissue causes a moderate to severe inflammatory response with resulting chronic inflammation and necrosis. Chronic inflammation of pulp may can cause internal resorption. Therefore, zinc oxide eugenol may not be an ideal base for ferric sulfate pulpotomies due to the inflammatory tissue response [12].

Although the exact cause of internal resorption is unknown, there is speculation that whatever the precipitating factor, it produces a vascular change in the pulp that involves an inflammation and the formation of granulation tissue. There is an accompanying metaplasia of normal connective tissue and macrophages to form osteoclast-like giant multinuclear odontoclasts.It can also be due to the variation in the pulpotomy technique used or due to lack of predentine[13].

Radiographic changes can be osseous and dental. Resorption in bone, interradicular destruction, external root resorption, periapical bone destruction are the osseous resorptive changes examined. Whereas, dental changes can be due to the kind of medicament used and its pulpal response [14].

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