

Review on Pulp Therapy in Primary Dentition

Dr.Subashree R,BDS

Abstract: Maintaining deciduous teeth in function until their exfoliation is absolutely necessary. Basic aim in doing endodontic treatment in children is as same as in adults i.e. for the removal of infection and inflammation and thus the relief of associated pain. Pulp therapy is one of the ways in saving the primary dentition. Pulp therapy is carried out in two ways either by vital or non-vital treatment. The article discusses about the aid in diagnosis, objectives and different modalities of treatment procedures of pulp therapy in primary dentition.

Keywords: Direct and Indirect pulp capping, Non-vital pulp therapy, pulpotomy, pulpectomy, vital pulp therapy.

I. Introduction

The foremost objective of doing pulp therapy in primary dentition is to retain every single primary tooth as fully functional component in the dental arch. This will allow proper mastication, swallowing, phonation, preservation of space required for the eruption of its permanent tooth and also in preventing the psychological effects due to early tooth loss.[1]. As the spread of caries and inflammation is rapid in deciduous teeth when compared to permanent teeth, early diagnosis and treatment is more necessary in children. Unlike permanent teeth, dental caries and trauma are considered as main aetiology for pulpal therapy in deciduous teeth. Even though there is distinct difference between reversible and irreversible pulpitis applied to permanent teeth, these differences are not much relevant to primary teeth, so any signs and symptoms of pulpitis indicates the need of pulp therapy in children.[2]. Pulp vitality test like electric pulp tester and thermal test are not reliable in primary teeth, instead other aids like pre-operative radiographs, visual and tactile examination mobility, percussion and Doppler flowmetry can be used for more reliable results. And, the formation of secondary dentine can be enhanced by using biocompatible and dentin-friendly restorations.[3]. Any infection or trauma caused in primary roots might affect the permanent teeth which may vary from enamel hypomineralisation to hypoplasia and rarely arrest or delayed eruption of the permanent teeth.[1]. Before commencement of pulpal treatment in endodontic patients, medical history is to be recorded to avoid any later complication and behavioural assessment along with co-operation ability of both children and parents can also help in increasing the success level of the treatment.[1].

II. Vital Pulp Therapy

Vital pulp therapy in primary teeth is carried out by direct pulp capping, indirect pulp capping or pulpotomy

2.1. Indirect Pulp Capping

The basic definition of indirect pulp capping is the treatment involving to protect and to maintain the vitality of the affected teeth, that if completely excavated would result in pulp exposure. Indirect pulp capping is done in the tooth which shows no sign and symptom.[4]. As there is no precise method to estimate the amount of dentin that has to be removed, it is advised to remove dentin which is infectious, necrotic and amorphous part and to leave remaining dentin that is firmer and still has chance of being intact.[5]. In order to increase the success rate, caries located in dentino-enamel junction is removed completely.[6]. The superficial layer of the carious dentin is called as infected dentin, this layer contains more of microorganisms and toxic agents which in case are left out can cause insult to the pulp. This layer is removed in order to increase the healing of pulp faster. The deep layer of the calcified dentin is called affected dentin, this layer also consists of microorganisms which in case left behind does not provide adverse effect. This is treated by placing biocompatible material over it. The aim of doing indirect pulp capping is to reduce the growth of bacteria, arrest the caries development and to enhance the growth of secondary dentin. It is based on the theory that, a zone of affected demineralization dentin exists between the outer layer of infected dentin and the pulp.[7]. Indirect pulp capping is indicated in tooth with no mobility, no discoloration, no radiolucency at the apex and with intact lamina-dura with periodontal ligament.[8]. The amount of reparative dentin formation is approximately 1.4µm/day after the cavity preparation which is achieved by placing the bioactive material over it.[7]. A radiopaque material such as dentin bonding agent, resin modified glass ionomer cement, calcium hydroxide, zinc oxide eugenol or glass ionomer cement are used, the main purpose for the use of these cements is to increase reparative dentin formation.[9-15]. If calcium hydroxide is placed immediately over dentin, then a thin mix layer of Glass ionomer cement or Zinc oxide eugenol is placed above it as calcium hydroxide has increased solubility and increased

micro-leakage properties.[16-19]. Interim therapeutic restoration with GIC is also used as it helps in decreasing caries growth by fluoride discharge within the cavity and exhibit the signs of reversible pulpitis.[20].

Therecent advance in indirect pulp capping are BIODENTIN, a new bioactive cement having dentine like mechanical properties it stimulate growth of secondary dentin formation which inturn increases the tissue regeneration and promotes remineralisation.[21].STEMCELLS, a group of undifferentiated cells with capable of self-removal and multiline-age themselves for long periods which is therapeutically used for indirect pulp capping.[22]. PROPOLIS, the natural derivative with biological andpharmaceuticalpropertiesincreases these secondary dentin formation.[23].THERACAL LC,aresin modified calcium silicate filled liner used as protective liner base which helps in reducing the dentin hypersensitivity and increase the calcium release.[24]. LASER, amore advanced material yet not used commonly, laser ND-YAG is used for reducing microleakagein deep restoration.[25].ENDO SEQUENTIAL ROOT REPAIR MATERIAL, a combination of calcium silicate, monobasic calcium phosphate, zirconium oxide, titanium oxide, which in combination used as antibacterial restorative material. [26].

2.2. Direct Pulp Capping

Direct pulp capping is carried out when a healthy pulp has been mechanically or accidentally exposed during operative procedures or by trauma. This treatment is done only when the exposure level is minimal and tooth should be vital with non-infected pulp, no mobility, no radiolucency seen at the apical end.[27].In case of inadvertently exposed pulp or free of oral contamination calcium hydroxide[28,29], zinc oxide eugenol[30], formocresol[28], enamel matrix cement[29] or simvastatin[31] cement are used. It has been suggested that the high cellular contact of the primary pulp may be the cause of failure in the treatment. The undifferentiated mesenchymal cells may differentiate into osteoclast cells in response to either the caries or direct pulp capping which in turn leads to internal root resorption. The exposure on the axial wall of the tooth gives very poor prognosis as the pulp in coronal portion lose its blood supply which would lead to necrosis of the tooth.[32]. Another adverse effect of doing direct pulp capping is acute dentoalveolar abscess.[33].

2.3. Pulpotomy

Pulpotomy is defined as the procedure of removing the infected portion of the coronal pulp. Pulpotomy is further of two types, vital and non-vital pulpotomy.

Vital Pulpotomy, a method where the deep caries is completely removed and coronal pulp chamber is opened. It is made sure that no overhanging dentinal tissues are left out in the cavity prepared. The coronal tissues are removed using excavator or rose head bur and saline irrigation simultaneously. Once the coronal portion is removed, sterile cotton is used to achieve haemostasis by placing directly on the radicular pulp with little pressure. A cotton pellet is dipped in Buckley's formocresol solution in the ratio of 1:5 and placed directly on the radicular portion of the pulp in order to fix the inflamed tissues, control the bacterial growth and to allow the healing process of the unaffected pulp. This is followed by restoration of the tooth with zinc oxide eugenol and glass ionomer cement where stainless steel crown is placed over it to reduce the fracture of the tooth.[34].

Non Vital Pulpotomy, a method which is implemented when there are irreversible changes seen in radicular pulp or when the pulp is completely non-vital. However, the ideal treatment of this is doing pulpectomy. In order to prevent the root canal treatment, it is suggested that necrotic pulp is removed using burs or excavators during the first visit. And, when there is an absence of signs and symptoms (usually after two or three weeks), permanent restoration and capping can be done. This is done by using Beachwood creosote solution with the cotton pellets direct placed on radicular and followed by zinc oxide eugenol restoration. This technique shows minimal success rate.[35].

Pulpotomy also has developed along three lines namely devitalisation, preservation and regeneration.DEVITALISATION is the first approach to pulpotomy. This is a two stage technique where local anaesthesia cannot be obtained to permit the extirpation of pulp during uncontrolled bleeding or during the application of formocresol. This technique completely mummifies the coronal pulp leaving behind radicular pulp to maintain its vitality.[36]. If the tooth is not anaesthetised, cavity preparation is made till the exposed pulp is reached. Cotton dipped in paraformaldehyde devitalising paste is applied on exposed pulp to fix the tissues, with zinc oxide eugenol dressing given over it. After two to three weeks when there is absence of symptoms, the devitalised coronal pulp is removed, irrigated with saline, then hard setting mix of zinc oxide eugenol and formocresol is placed over radicular pulp.[37].Another form of doing devitalisation is by electrosurgical pulpotomy, where mummification eliminates the pulp infection and vitality with crosslinking and denaturation.This carbonizes the heat and denatures the pulp and bacterial contamination. This might as well stir up acute and chronic inflammation [38], root resorption and develop apical pathological changes.[39]. Despite

of its adverse effects this procedure is more technique sensitive and needs more diagnosis, MARK AND DEAN reported this procedure shows high success rate.[40].PRESERVATION is a method which causes minimal insult to the radicular tissues by using Gluteraldehyde and ferric sulphate. Zinc oxide eugenol is the first agent to be used for preservation. As eugenol has destructive properties and causes internal resorption, a layer of calcium hydroxide is used [41,42]. Gluteraldehyde has been proposed as an alternative for formocresol based on its fixative properties, self-limiting penetration, low-antigenicity, low-toxicity and ability to eliminate cresol.[43-47]. The histologic picture of gluteraldehyde shows superficial zone of fixation of the tissues and very minimal underlying inflammation.[48].A non-aldehyde chemical ferric sulphate has received some importance in pulpotomy. This haemostatic compound has encountered the problems with clot formation thereby reducing the inflammation and internal resorption.[49-50].REGENERATION, an ideal pulpotomy in which treatment should maintain healthy radicular pulp in vital stage and odontoblast lined dentin chamber. In this method, tissue is isolated from noxious restorative material in the chamber thereby diminishing internal resorption. Calcium hydroxide is the main restorative material that induce regeneration of dentin.[51]. Recent advances shows that bone morphogenic proteins can induce bone formation and act as true biological pulp capping and pulpotomy agent.[52].

III. Non-Vital Pulp Therapy

Non vital pulp therapy is carried out by pulpectomy procedures.

3.1. Pulpectomy

Pulpectomy is the ideal method of root canal treatment for the tooth which is irreversibly infected, traumatic or non-vital which can be due to caries or trauma. Generally, this technique is considered difficult because of the complexity of roots in primary teeth. The cavity preparation and removal of the necrotic coronal pulp is done initially. If radicular pulp is necrotic, a two-stage technique is required, but if it is found to be irreversibly inflamed a one-stage technique may be undertaken.[53]

In One Stage Technique, the affected tooth is isolated and instrumented to find working length that is estimated from a pre-operative radiograph. After drying the canals with paper-points, formocresol is applied for up to 5 minutes. The root canals are then filled with a thin mix of zinc oxide-eugenol, using rotary paste filler, and the restoration of tooth is completed.

In Two Stage Technique, non-vital tooth is again cleaned, shaped and irrigated to remove all necrotic debris and remaining caries thoroughly. A swab of cotton wool dipped in with either formocresol or beechwood creosote is sealed in the pulp chamber with a rigid zinc oxide eugenol dressing for one week. After three to four weeks, the tooth should be symptom-free, nil mobility, without a discharging sinus and absence of pathological changes at the apex. If not, a second application of beechwood creosote is required. If the tooth is found to be symptomless, a dressing of zinc oxide-eugenol, with or without the addition of formocresol, is packed into the base of the chamber and the tooth finally restored followed by permanent restoration.[54]

IV. Conclusion

A successful paediatric endodontic treatment is based on re-establishment of healthy periodontal tissues, free of pathologic root resorption and maintenance of primary teeth in an infection free state to hold space for its eruption of its successor. With adherence to sound principles, case selection and techniques followed in paediatric pulp therapy results in a major health benefit to the child.[46].

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