

Plant based obturating materials in pediatric dentistry: A review

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Abstract

Primary teeth should be preserved until their normal exfoliation time so as to maintain arch length and function in order to provide proper guidance for the eruption of permanent teeth, enhance esthetics and mastication, prevent aberrant tongue habits, aid in speech and prevent the psychological effects associated with tooth loss. Pulpectomy consists of removing the pulp tissue associated with microorganisms and debris from the canal and obturating with resorbable filling material. Success rate of endodontic therapy depends on many factors like familiarity with the complexity of primary tooth canal systems, their formation and resorption pattern, obturating material as well as obturation technique used that is capable of densely filling the entire root canal system and providing a fluid tight seal from the apical segment of the canal in order to prevent reinfection. One of the major areas of research in pulpectomy is to discover new materials for obturation so to have the specific properties similar to teeth. This article will render the role of many important plants based obturating materials that can be used in dentistry with their properties, advantages and disadvantages.

Keywords: obturating materials, pediatric dentistry, primary teeth, pulp therapy

Introduction

Pulp therapy's major objective is to keep teeth and the tissues that support them healthy and intact. Pulpectomy is essential to maintain the tooth in its arch, to act as a natural space maintainer till the normal exfoliation happens and for aesthetic and speech purposes, mastication purposes^[1]. The objective of pulpectomy is complete removal of necrotic and irreversibly infected pulp of a tooth affected by caries, traumatic injuries or other causes, so that the tooth remains asymptomatic and functional in the oral cavity till it exfoliates normally. In spite of making up only a small portion of the flora in an untreated canal, *E. faecalis*, a very resilient and persistent bacterium, plays a significant role in the aetiology of recurrent peri radicular lesions after endodontic treatment^[2]. It is recommended that materials with antibacterial properties to be used as obturating materials in deciduous teeth for the best endodontic treatment outcome. Current materials for obturating deciduous teeth include calcium hydroxide, iodoform-based pastes, triple antibiotic paste, and zinc oxide eugenol (ZOE) through different vehicles. ZOE has been traditionally used as an obturating material in the deciduous teeth and was the first obturating material to be recommended for primary teeth. Zinc oxide eugenol is said to have anti-inflammatory and analgesic properties. However, many studies concluded that rate of material resorption is slower than the normal physiologic resorption of the tooth. Moreover, it can irritate the periapical tissues, can cause necrosis of bone and cementum and may alter the path of eruption of succedaneous tooth

The optimal requirements of a root-filling material for primary teeth were,

- It should not irritate the periapical tissues, nor coagulate any organic remnants in the canal.
- It should have a stable disinfecting power.
- Excess pressed beyond the apex should be resorbed easily.
- It should be inserted easily into the root canal and removed easily if necessary.
- It should adhere to the walls of the canal and should not shrink.
- It should not be soluble in water.
- It should not discolour the tooth.
- It should be radiopaque.
- It should induce vital periapical tissue to seal the canal with calcified or connective tissue.
- It should be harmless to the adjacent tooth germ.
- It should not set to a hard mass, which could deflect an erupting succedaneous tooth.

So, to overcome these, many obturating materials such as, calcium hydroxide and iodoform combinations (Metapex, Vitapex), endoflas and herbal derivatives have been introduced with promising results that can be used as alternatives to traditional ZOE. Hence, the aim of this review is to discuss various plant based obturating materials that are available and can be used in clinical practice.

Plant based materials

Aloevera

Aloe vera (*Aloe barbadensis*) belongs to Liliaceae family. It contains a clear gel and green part of the leaf which surrounds the gel is used to produce dried powder. The main chemical constituents of aloe vera are aloins and

barbadoins. It was found to have inhibitory effects on *S. pyogenes* and *E. faecalis*. aloe vera has anti-inflammatory, antibacterial, antifungal, antiviral, moisturizing, wound healing and pain relief properties [3]. Senapathi *et al* [4] concluded that ZOE with aloe vera extract found to have maximum antibacterial activity against *S. aureus* followed by *S. mutans*, *E. coli* and *E. faecalis*. Compared to plain ZOE, more antibacterial activity was noticed when ZOE was mixed with herbal extracts.

Triphala

Triphala [tri- three; phala- fruits, Amalaki (*Phyllanthus emblica*), Bibhitaki (*Terminalia bellirica*), and Haritaki (*Terminalia chebula*)] has potent antibacterial and anti-inflammatory properties. Tannic acid present in triphala has bacteriostatic and bactericidal properties. It was found to have significant antimicrobial activity against *E. faecalis* biofilm formed on tooth substrate. Senapathi *et al* found that, triphala had maximum antibacterial activity against *S. mutans* followed by *E. faecalis*, *S. aureus* and *E. coli* [4].

Tulsi

Tulsi (*Ocimum sanctum*) is used as a medicinal plant in day-to-day practice in Indian homes for various disorders. The principal constituent present in *Ocimum sanctum* leaves is Eugenol (1-hydroxy-2-methoxy-4-allylbenzene), which is mainly responsible for its therapeutic potential. It also acts as a strong COX-2 inhibitor and the analgesic property of Tulsi made it utilized for treatment of dental and mucosal pain. Methanolic extract of Tulsi has significant antimicrobial activity against *S. mutans*, *E. faecalis* and *S. aureus*. Tulsi formulation exhibited a superior zone of inhibition against *E. faecalis* [4].

Morinda citrifolia

M. citrifolia has high nutritional value and may induce therapeutic effects, including antimicrobial and antioxidant properties. *Morinda citrifolia* fruit contains a number of phytochemicals, including lignans, oligo- and polysaccharides, flavonoids, iridoids, fatty acids, scopoletin, catechin, beta-sitosterol, damnacanthol, and alkaloids. *M. citrifolia* fruit extract shows antifungal effects on *C. albicans* which is similar to the study where zinc oxide powder mixed with *M. citrifolia* showed weak zones of inhibition against *C. albicans* [5].

Neem

Neem (*Azadirachta Indica*) it has various medical uses such as immunomodulatory, antifungal, antihyperglycemic, antiulcer, antimalarial, anti-inflammatory, antibacterial, antiviral, and antioxidant properties. Quercetin and β -sitosterol were first polyphenolic flavonoids purified from fresh leaves of neem and were known to have antifungal and antibacterial activities. ZOE with Neem extract found to have good antimicrobial activity against the microorganisms tested, i.e., *S. aureus*, *P. aeruginosa*, and *C. albicans* [5]. It can be used as a potential root canal filling material in primary teeth because of its properties.

Curcumin

Curcumin exhibit to have antibacterial, antiviral, antifungal, antimicrobial, anti-inflammatory, antioxidant, antidiabetic, anticancer, antiallergic, anticoagulant, hepatoprotective, antiulcer, hypotensive, and hypocholesterolemic effects. In

dentistry, curcumin had explored for its use in mouthwashes and intracanal medicaments. Charishma *et al* [6], curcumin group showed the least overall success rate of 61.5% and curcumin with calcium hydroxide group showed overall success rate of 81.3%. Upadhyay *et al* [7], in 2015 showed highest amount of zone of inhibition against *E. faecalis* was noticed with by turmeric with calcium hydroxide. Owing to the anti-inflammatory properties of curcumin, its use as obturation needs further evaluation with longer follow-up and larger sample size.

Eucalyptus oil

Eucalyptus oil contains a valuable medicinally and pharmacologically influential chemicals, that is already been used in many aspects of medicine as an anti-inflammatory, antimicrobial, antioxidative, antihistaminic, antiseptic agent. The eucalyptus oil showed good inhibitory effect on both tested Microbes. zinc oxide eucalyptus showed almost similar antimicrobial effect Zinc oxide eugenol, while Metapex revealed lowest antimicrobial effect against tested microorganism [8].

Hesperidin

Hesperidin (herbal extract) is natural plant flavonoids from the Citrus species. It has high antimicrobial, anti-inflammatory, antioxidant (due to the presence of wide variety of active phytochemicals, including flavonoids, terpenoids, lignans, sulphides, polyphenolics, carotenoids, coumarins, saponins, plant sterols, curcumins) and biocompatible properties making their use in dentistry more extensive. Selwan *et al*, reported that hesperidin has low antimicrobial effect against *E. faecalis* and low clinical and radiographic success result [9]. Further studies are needed for assessment of the antimicrobial effect of Hesperidin.

Propolis

Propolis is a natural beehive product with potent antimicrobial and anti-inflammatory properties. The main chemical constituents present in propolis are flavonoids, phenolics, and other aromatic compounds. In dentistry, propolis has been used for root canal irrigation, direct and indirect pulp capping, reduction of dentin hypersensitivity, caries prevention against *Streptococcus mutans*, and as a storage media for avulsed teeth. Kakarla Sri *et al* reported that, Zinc oxide-propolis mixture has demonstrated a success rate of 95% [10], and also Al Ostwani *et al* [11] observed clinical success rate of 93.8% at 12-month follow-up. Propolis also has anti-inflammatory effect which suppresses the synthesis of prostaglandin, leukotriene, histamine, and transforming growth factor beta. Zinc oxide-propolis mixture can be considered as better alternative to conventional ZOE.

Allium sativum

Allium sativum is commonly known as garlic and is used to treat many infectious diseases due to its potent antimicrobial property because of the presence of allicin produced by enzyme alliinase which is active against a wide spectrum of bacteria. Abdelmoaty *et al* 2020 [12], reported that ZOE *Allium sativum* paste had shown 85% clinical and radiographic success rate than conventional ZOE mix.

Gingerol

Gingerol is the major pharmacologically-active component of ginger. Gingerols are the major powerful phenolic compounds that are used in some medical conditions as an antioxidant, anti-bacterial agent, anti-vomiting compound, anti-asthma, anti-nausea compound, and anti-cancer agent. It is rich in various chemical constituents, including phenolic compounds, terpenes, polysaccharides, lipids, organic acids, and raw Fibers. Due to its properties Fathi *et al* ^[13] conducted a study and concluded that Ginge-Cal (gingerol with calcium hydroxide) can be considered a promising material as pulpectomy paste or temporary inter-canal medicament for primary teeth with infected pulp due to antimicrobial action.

Tea tree oil, coconut oil, peppermint oil, cinnamon oil

Faizal C *et al* ^[14], stated that zinc oxide with tea tree oil had shown maximum antimicrobial activity against *Enterococcus faecalis* followed by zinc oxide with coconut oil, zinc oxide with peppermint oil, zinc oxide with cinnamon oil and zinc oxide with eugenol.

Conclusion

ZOE with various plant extracted oil or paste can be used for obturating materials in primary teeth. Aloe vera, Tulsi, Curcumin, Propolis, Gingerol had more antimicrobial efficacy against *S. mutans*, *E. faecalis*, *S. aureus* and *E. coli*. Due to their better antibacterial and antimicrobial efficacy they can be used as an ideal obturating material for primary teeth. However, further controlled studies and research is required to find the ideal obturating material for primary teeth.

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