

Application of Propolis in Pediatric Dentistry

Dhanashri Yerate^{1*}, Shashibhushan KK² and Shobha R³

¹Postgraduate student, Department of Pedodontics and Preventive Dentistry, Sharavathi Dental College and Hospital, India

²Professor and HOD, Department of Pedodontics and Preventive Dentistry, Sharavathi Dental College and Hospital, India

³Senior Lecturer, Department of Pedodontics and Preventive Dentistry, Sharavathi Dental College and Hospital, India

*Corresponding author: Dhanashri Yerate, Postgraduate student, Department of Pedodontics and Preventive Dentistry Sharavathi Dental College and Hospital, Shimoga, India

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Abstract

Background: Propolis is a resinous substance derived from bees. It has been used for various medicinal purpose due to its beneficial properties, including anti-fungal, antimicrobial, anti-inflammatory, and immune modulatory effects. In dentistry, propolis has wide applications for the prevention of dental caries and periodontal diseases, as a storage medium for avulsed tooth, and in endodontics, and periodontics.

Objective: To highlight the applications of propolis in pediatric dentistry.

Discussion: The applications of propolis is explored in various faculties of dentistry, including preventive dentistry, traumatology, periodontology, endodontics, and orthodontics.

Conclusion: Although most research published are vitro studies or animal studies, as we might face limitations while replicating these to human trials. Pediatric age group due to their developing immunity are more prone to diseases and are susceptible to adverse effects of commercially available drugs. Propolis being a natural alternative is easily accessible, safe with reduced adverse effects. In future, propolis may find a definitive role in dentistry; however, further clinical trials are necessary to study the beneficial effects of each component.

Introduction

Propolis is a resinous substance from buds and barks of trees collected by bees, specifically from conifer and poplar trees. It is basically a honeybee product. Propolis, is derived from the Greek pro - 'in defense of' and polis - 'the city', hence, propolis-defender of the city/hive' [1]. Propolis has broad spectrum of biological properties. Propolis is intentionally produced by the honeybees to smooth the walls, stabilize moisture and temperature, seal cracks and protection of hive [2]. Propolis is extensively utilized to treat and prevent ulcers, cold, sprains, heart diseases, rheumatic disease, and dental caries. It has varied biological properties such as anti-inflammatory, antimicrobial, antifungal, antioxidant, antitumor, antiulcer, and anti-HIV activities [2].

The therapeutic application of propolis in dentistry

- Antimicrobial agent- for the treatment of periodontal diseases and dental caries
- Treating pulpal infections
- Post-surgical tissue repair agent [2].

Botanical Sources of Propolis

Propolis is most accepted and demonstrated chemically in temperate zones especially in bud exudates from hybrids of genus *Populus* (poplars) as the main source, markedly species of the sector Aigeiros. The most common species of this sector is (black poplar) *Populus nigra* L, the supplementary two species are *Populus deltoides* L. and *Populus fremontii*. Poplars (notably *P. nigra*) being the main source for propolis ("poplar-type propolis") is true for China, North America, and Europe and few non tropical areas of Asia.

Chemical Composition

Propolis is composed of the basic compounds: plant exudates, products secreted during bee metabolism, propolis elaboration materials. The geographic location and variability of plant species leads to highly different chemical composition of propolis. The crude propolis is chemically composed of 50% resin and vegetable balsam, 35% waxes, 5%to10% aromatic oils, 5% pollen, and minor other substances including organic debris. Vitamins C, E, B1, B2,

B6, and mineral elements like iron, calcium, aluminum, manganese, silicon, vanadium, copper, have also been identified in propolis samples [3].

Application of propolis in pediatric dentistry

Dental caries being the most prevalent chronic infectious disease is amenable to prevention and treatment. Propolis possess antimicrobial activity against *Streptococcus mutans*, which is a significant contributor to dental caries. The Propolis extract might be used as an alternative in prevention of dental caries [1]. In pediatric dentistry, as almost all the oro-dental issues necessitate the direct contact of material/medicament to oral mucosa or hard tissues. Such as, mouth rinse, intra-canal irrigation, direct contact with pulp in direct pulp capping and pulpotomy. Hence, children are at constant risk toxins produced by medications either due direct contact or by systemic absorption [3].

Adverse effects of allopathic drugs in children

- a) Increased permeability of blood brain barrier
- b) Difference in body weight ratio
- c) Reduced levels of lipids
- d) Increased quantity of water
- e) Increased tendency of adverse allergic reactions
- f) Alterations in composition of serum proteins
- g) Developing immunity.

Such adverse effects have led to search of more natural and suitable alternative such as propolis [3].

Pulpotomy

The success of pulpotomy lies in formation of hard tissue barrier beneath the medicament and maintenance of pulp vitality. Aghazadeh et al. compared MTA and propolis as pulpotomy agent. A total of 25 healthy 4- to 8-year-old children were selected all the pulpotomies teeth were evaluated at 3, 6, and 9 month clinically and radiographically [4]. The teeth treated with MTA showed more suitable clinical and radiographic results as compared to propolis at 9 months follow-up [5]. Similarly, Madan et al. compared MTA and propolis on pulpotomized primary molars and stated that the Clinical outcome of Propolis is comparable to that of MTA at both 6 and 12 months follow up period. Hence, Propolis seems to be a promising and a reliable medicament for pulpotomy [6]. Whereas Reddy et al. assessed formocresol, propolis and growth factor as pulpotomy medicaments in deciduous teeth. The results obtained indicated greater clinical and radiographical success for PDGF group (96.3%, 88.89%) followed by PS group (96.3%, 88.4%) and FC group (76%, 72%). Histological examination showed thick and continuous dentin bridge formation with minimal inflammation in both PS and PDGF group. Conclusion: PDGF and PS showed greater

efficacy than FC clinically, radiographically and histologically with PDGF relatively having a lead in success rate. Thus, justifying their use as a novel and promising pulpotomy medicaments with regenerative property [7]. Neda et al. compared formocresol and propolis as pulpotomy agent in primary second molar and revealed no significant differences in the success rates of primary molar pulpotomy procedures between propolis and formocresol. Propolis can be used for pulpotomy procedures as a substitute for formocresol [8].

Direct Pulp Capping

Incidence of traumatic injuries spurge in children leading to increased risk of fracture. Hence maintenance of such teeth in functional state along with healthy pulp dentine complex is challenging. Direct pulp capping involves placement of biocompatible agent to pulp tissue to seal pulp against bacterial penetration, initiate dentine bridge, and maintenance of healthy pulp tissue [3]. Sabir et al. analyzed the expression COX-2 on inflamed rat dental pulp after capped with propolis. Eighty male Sprague Dawley rats were divided randomly into 5 groups Grp I- Negative control, Grp II- EEP propolis, Grp III- Flavonoids Propolis, Grp IV- Non-Flavonoids Propolis, Grp V- Calcium hydroxide and suggested that EEP and Ca(OH)₂ were stronger than other materials test to suppress COX-2 expression on inflamed rat dental pulp [9]. Bretz et al. stated no difference between propolis and calcium hydroxide in direct capping. As they offer similar efficacy in dentine bridge formation, reduction of pathologic microbes and promoting healing of pulpal inflammation [10]. Also study carried out by Ozorio et al. indicated that propolis and calcium hydroxide exhibit similar effectiveness in induction of reparative dentin [11].

Propolis As Storage Media

Preserving the cellular viability is of prime importance while considering the restoration of health of periodontal ligament and to cease the root resorption process after tooth replantation of avulsed tooth [3]. Babaji et al. comparatively evaluated the efficacy of hank's balanced salt solution (HBSS), propolis, Aloe vera, and pomegranate juice (PJ) in preserving the vitality of periodontal ligament (PDL) cells of avulsed teeth. Fifty orthodontically extracted sound teeth with healthy PDL were selected for the present study. Selected teeth were randomly divided into study groups (10 in each) and 5 each as positive and negative control groups. All the teeth were immersed immediately after extraction into respective storage media. Propolis showed more viable PDL cells followed by HBSS, A. vera, and PJ [12]. Gopikrishna et al. (2008) the potential of a new storage medium, coconut water, in comparison with propolis, Hank's balanced salt solution (HBSS) and milk in maintaining viable periodontal ligament (PDL) cells on simulated avulsed teeth. Results showed that coconut water kept significantly more PDL cells viable compared with propolis, HBSS or milk. Coconut water can be used as a superior transport medium for avulsed teeth [13]. Shingare et al. evaluated behavior of propolis, milk and egg albumin as storage

media after orthodontic teeth extraction. No statistical difference was found in viability of pdl cell counts and it was concluded these can be used as good natural alternative to commercially available storage media [14]. Ahangari et al. compared 50% propolis, 10% HBSS, milk and egg white on periodontal cell survival at different time intervals and concluded that based on PDL cell viability propolis can be recommended as biologic storage media [15].

Mouth Rinse

Propolis may restrict bacterial-plaque development and periodontitis causing pathogens due to its inherent antibacterial properties. A systematic review of randomized clinical trials aimed to evaluate the available evidence regarding the efficacy of propolis-based mouthwash on dental plaque and gingival inflammation. Overall, propolis mouthwashes showed good efficacy on plaque and gingivitis in all of the included studies. Out of the eight studies that reported on plaque index, 5 studies found equal efficacy of propolis and CHX in reducing plaque, two studies found superior efficacy in favor of CHX, while one study found superior efficacy in favor of propolis. Six studies assessed gingival inflammation outcome, four of which reported better results with propolis, while two studies reported comparable results [16]. A study was carried out for a period of two years in patients undergoing fixed orthodontic treatment. A total of 100 subjects were randomly divided into 2 groups of 50 subjects each and were informed to swish and sopit 10 ml of mouth rinse. Plaque index and gingival index were assessed at baseline and at a three-day interval. It was concluded that Propolis mouthwash has a required effect on gingival health of patients. The propolis extract might be used as an alternate to CHX in the prevention of periodontal and gingival problems [17].

Endodontic Therapy

The aim of successful root canal treatment is to eliminate the bacterial contamination associated with minimal irritation of periapical tissue. Parolia et al. assessed the antibacterial effect of propolis nanoparticles (PNs) as an endodontic irrigant against *Enterococcus faecalis* biofilm of root canal system. Two-hundred-extracted human teeth were sectioned. The root canal was enlarged to an internal diameter of 0.9 mm. The specimens were inoculated with *E. faecalis* for 21 days. Following which were randomly divided into seven groups, with 30 dentinal blocks in each group including: group I-saline; group II-propolis 100 µg/mL; group III-propolis 300 µg/mL; group IV-propolis nanoparticle 100 µg/mL; group V-propolis nanoparticle 300µg/mL; group VI-6% sodium hypochlorite; group VII-2% chlorhexidine. Dentin shavings were collected at 200 and 400 µm depths, and total numbers of CFUs were determined at the end of one, five, and ten minutes. Results stated Propolis nanoparticles as endodontic irrigants were the most effective at ten minutes in reducing *E. faecalis* CFUs when compared at one minute and five minutes [18]. A study was conducted to determine the difference in antibacterial effectiveness between a combination of calcium hydroxide with 2% CHX digluconate or 25% propolis as an intracanal medicament against *E. faecalis* (in vitro)

bacteria. The combination of calcium hydroxide with propolis 25% more effective than the mixture of calcium hydroxide with 2% CHX digluconate as root canal medicament against *E. faecalis* bacteria.

Conclusion

Although there are studies with encouraging alternatives of various products of propolis compared to commercially available counterparts. Further research with large scale randomized control human trails would be necessary for propolis to be a natural substitute.

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