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Treatment Options from Our Winged Friends: A Review on Propolis and Its Potential Applications in Dentistry.

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ABSTRACT

There is a recent trend to employ naturally-derived substances as medicaments. Propolis is one such product that is derived from honeybees. Propolis is a resinous substance that has anti-bacterial, anti-viral, anti-cancer and anti-fungal effects. Propolis has also been utilised in dentistry for surgical wound healing, root canal treatment, pulp capping and tooth hypersensitivity and as a storage medium. It has a bright role in future dentistry.

Keywords: Propolis, Anti-Inflammatory Agents, Anti-Bacterial Agents, Cariostatic agents, Protective Agents, Dental Plaque, Root Canal Irrigants

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INTRODUCTION

The honeybee produces a number of nutritionally rich products like royal-jelly, beeswax, honey and propolis [1]. Propolis is a yellowish-brown substance that is sticky and glue-like at room temperature and hard and brittle at lower substances. It is collected by honeybees from buds and exudates of certain trees and plants and mixed with secreted bees-wax. Propolis in Greek means 'defender of the city/hive' (from the Greek pro – 'for or in defence of' and polis – 'the city') and it is used by bees as a building material in the construction, maintenance and protection of the beehives [2]. Because of its properties, it forms the bees external immune defence system, making the beehive one of the most sterile environments known to nature and as a result maintains the health of the honeybees [3].

Composition

Propolis is composed of resin and balsams (50-70%), essential oils and wax (30-50%), pollen (5-10%) and lesser constituents such as amino acids, minerals, vitamins such as vitamin-A, vitamin B-complex, vitamin-E and the highly active biochemical substances known as bio-flavenoids (such as Vitamin P and CAPE – Caffeic Acid Phenethyl Ester), phenols, aromatic compounds and elements such as iron and zinc [2,4].

Functions

Propolis has been shown to inhibit synthesis of prostaglandins, reduce the inflammatory response by inhibiting the lipoxygenase pathway of arachidonic acid [5]. Propolis breaks down bacterial cell wall, cytoplasm and prevents bacterial cell division thereby serving as an antibacterial agent [6]. Flavonoids and caffeic acid also aid the immune system by promoting phagocytic activities and stimulating cellular immunity. The presence of arginine, vitamin C, pro-vitamin A, vitamin B-complex, and trace minerals such as copper, iron, zinc as well as bioflavonoids cause stimulation of various enzyme systems, cell metabolism, circulation and collagen formation could contribute to the hard tissue bridge formation by Propolis [5].

Use of Propolis in Dentistry

Propolis has found application in cariology; as a storage medium for teeth after avulsion; for use in dentifrices; in the treatment of dentinal sensitivity; as irrigant and intra-canal medicament; prevention of microleakage and in the control of Plaque and Gingivitis.

Caries

Jae-Gyu Jeon [7] has reported that tt-farnesol – a bioactive sesquiterpene alcohol commonly found in Propolis significantly increased the membrane proton-permeability and reduced glycolytic activity of *S.mutans* in the biofilms. It reduced biomass accumulation and prevented ecological shifts towards *S.mutans* dominance within mixed-species biofilms. Studies [8,9] have concluded that the propolis-extract tested possesses antimicrobial activity

against *S.mutans* present in the oral cavity. It was found that Apigenin, a 4,5,7-trihydroxyflavone, was the most effective inhibitor of Glucosyltransferases on the surface of saliva-coated hydroxyapatite beads [10]. Hence, it could be a possible useful adjunct to the anti-biofilm/anti-carries chemotherapeutic strategies.

Control of Plaque and Gingivitis

In a clinical trial [11], a mouthwash containing propolis 5% demonstrated a statistically significant reduction in gingivitis of greater than 40%, at 45 and 90 days when compared to the baseline gingivitis scores. Also with respect to plaque scores there was a statistically significant reduction-of 26% and 24% at 45 and 90 days respectively. Studies [12, 13] have reported that silicate toothpaste with extract from propolis showed very good plaque-cleaning, plaque-inhibiting and anti-inflammatory effect. However, Ozan [14] stated that mouth-wash preparations of Propolis samples (concentration 10%, 5%, 2.5%, 1%) were not found to be as effective as Chlorhexidine on oral microorganisms. However, these samples were less cytotoxic on human gingival fibroblasts than Chlorhexidine. With regards to sub-gingival irrigation, propolis-extract as an adjuvant to periodontal treatment was more effective than irrigation with a placebo or no additional treatment, both by clinical and microbiological parameters [15].

Irrigant and intracanal medicament

An *in-vitro* study [16] investigating the efficacy of Propolis as a root-canal irrigant determined that Propolis was effective to eliminate *E.coli* and reduce the amount of endotoxins. Propolis was significantly more effective than non-setting calcium hydroxide against *E.faecalis* after short-term application *ex-vivo* [17]. In an *in-vitro* study using *Streptococcus mutans*, *Staphylococcus aureus*, *Kocuria rhizophila*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Enterococcus hirae*, propolis-based toothpastes presented antibacterial activity against 83.3% of the analysed bacteria. For 66.7% of these bacteria, the propolis-based pastes exhibited greater antibacterial activity than calcium hydroxide [18]. Rezende *et al* [19] concluded that the association between propolis 11.0% extract and calcium hydroxide could aggregate all the benefits of each one, resulting in a better treatment choice for pulpal diseases in primary teeth. Propolis was more effective than tri-antibiotic mixture against *E.faecalis* at a 2-day time period, and both were equally effective at 7 days [20]. In a study [21] comparing the anti-microbial activity of propolis with that of sodium hypochlorite in a root-canal system propolis has antimicrobial activity equal to that of sodium hypochlorite. However, sodium hypochlorite possesses other significant attributes like dissolving pulp tissues that propolis is not known to possess. It was also seen that antimicrobial effectiveness of propolis did not exceed CHX [22, 23].

Oral Wound Healing

A study conducted by Magro-Filho and de Carvalho [24] analysed the effects of Propolis mouth-rinse at intervals of 7, 14, 30 and 45 days on the repair of surgical wounds after sulcoplasty by the modified Kazanjian technique. Cytological and clinical evaluation revealed that the mouth-rinse containing Propolis aided in repair of oral surgical wounds and exerted a minor analgesic and anti-inflammatory effect.

Dentin Sensitivity

Propolis could prove to be a good option in the treatment of patients with dentin-sensitivity. In an *in-vitro* study [25] the application of 10% and 30% propolis gels did not seem to reduce the hydraulic conductance of dentin but it showed capacity of partially obliterating the dentin tubules. In a clinical study [26] 85% of the subjects were found highly satisfied, while assessing the level of satisfaction after using propolis

Storage medium

In a study [27] it was shown that the efficacy of propolis in maintaining functional viability of PDL-cells was similar to that of milk. It was noted that combinations of propolis 10% + Dulbecco's modified Eagle's medium (DMEM), propolis 20% + DMEM, and DMEM alone, are equally good as storage media of choice to keep PDL-cells viable during extra-alveolar periods of up to 24hrs [28]. Gopikrishna has claimed that propolis kept significantly less PDL-cells viable compared with coconut water [29].

Oral Candidiasis

Propolis has proven anti-mycotic activity against fungi and has found application in treating oral mycoses. In a clinical study on twelve patients [30], Propolis-extract was applied topically on oral mucosal candidial-lesions, four times daily for a week, whereas a control group of six patients received an identical regime of topical Nystatin. All 18 patients – whether treated with Propolis-extract or Nystatin – showed a complete remission of the candidial-lesions in less than three weeks.

Prevention of Microleakage

Dental cavity-varnishes are employed to coat freshly cut dentine in an effort to reduce microleakage and post-operative hypersensitivity. Formulations of fluoridated propolis-containing cavity-varnish had a significant effect in reducing the microleakage under amalgam restorations [31].

Systemic Hypersensitivity

Although, allergy and sensitivity to Propolis is rare, nevertheless patients should be asked about any known reactions to bee stings, allergies to bee products, honey and sensitivity to pollen. Fernandez et al [32] reported two cases of allergic-stomatitis accompanied with labial oedema, dysphonia and dyspnoea after topical use of Propolis solution and lozenges. Brailo [33] reported a case of delayed contact sensitivity developing on the lips and on the oral mucosa as a result of 10 days of topical propolis use for the treatment of recurrent aphthous ulceration. Pasolini et al ³⁴ described a patient who developed contact cheilitis due to intake of Propolis-enriched honey. Hay and Greig ³⁵ reported a case of oral mucositis with ulceration in a patient who used Propolis lozenges every day after dinner.

CONCLUSION

Propolis has shown promise in dentistry in various aspects of treatment. Current and on-going research is likely to yield improved results in existing uses and a further multitude of dental applications. Notwithstanding its wide-ranging potential, its antigenic potential demands a cautious and selective usage in its applications to treat oral disease.

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