



PROPOLIS IN PERIODONTICS- A REVIEW

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ABSTRACT

Propolis is a resinous yellow brown to dark brown substance that honey bees (*Apis mellifera*) collect from tree buds, sap flows, shrubs or other botanical sources to seal unwanted open spaces in the hive, protecting it from outside contaminants. Its healing qualities were recognized during the Egyptian and Greek civilizations. It has been used for treating different diseases and inflammatory conditions in the form of local as well as systemic applications. It has also been used in dentistry for various purposes. Therefore, it may be a valuable compound of non-synthetic, natural origin for patients seeking complementary agents and alternatives for synthetic chemicals.

KEYWORDS : Periodontics, Propolis, Honey, Ayurveda

INTRODUCTION:

Propolis (also called bee glue) is a natural resinous substance collected by honey bees (*Apis mellifera*) from parts of plants, buds and exudates (Ghisalberti, 1979). Bees use it as a sealer for their hives (García-Viguera et al, 1992)¹

The word propolis is derived from the Greek words "pro" meaning before, polis meaning "city" or defender of the city. (Wander, 1995) In nature, at room temperature, it is a sticky substance, but becomes hard and brittle at low temperature. (Park et al., 2002; Almas et al., 2001).²

The color of propolis varies from yellowish green to dark brown, depending on location - savannah, tropical forests, desert, coastal and mountainous regions - where it is produced.^{3,4,5}

This non-toxic resinous substance was classified into 12 types according to physicochemical properties and related to geographic locations; however, the botanical origin of only three types were identified (Wander, 1995)². Propolis has been used for treating different diseases and inflammatory conditions as both local and systemic applications.² Propolis is dispensed in various forms, such as tooth pastes, mouthwashes, lozenges, wine, cake, powder, jelly, tablets, soap and others.

HISTORY:

Its healing qualities were recognized during the Egyptian and Greek civilizations. Hippocrates, the founder of modern medicine, used it for healing sores and ulcers internally and externally. (Wander, 1995).²

The drug was used as an antiseptic for healing in the treatment of wounds and as a mouthwash and its use in the Middle Ages perpetuated among Arab doctors.⁶ Also, it was widely used in the form of ointment and cream in the treatment of wounds in the battle field, because of its healing effect. This healing property of propolis known as "Balm of Gilead," is also mentioned in the Holy Bible.⁷

COMPOSITION:

Propolis is mainly composed of plant resins and exudates that are gathered by bees. Some wax, bee secretions and pollen are added

later by the bees to give the final complex product, viz propolis.⁸

The compounds identified in propolis resin originate from 3 sources: plant exudate collected by bees; secreted substances from bee metabolism; and materials which are introduced

during propolis elaboration (Ghisalberti, 1979; Marcucci et al, 1994b).¹

Over 300 chemical compounds are described in various propolis origins.⁹ Propolis is composed of resin and balsams (50 - 70%), essential oils and wax (30 - 50%), pollen (5 - 10%) and other constituents which are amino acids, minerals, vitamins A, B complex, E and the highly active bio-chemical substance known as bioflavonoid (Vitamin P), phenols and aromatic compounds (Park et al., 2002; Almas et al., 2001).²

These constituents appear in various concentrations depending on geographical location, botanical origin⁸ and period of collection.¹

There are various substances known in propolis with distinct chemical structures from following classes: alcohols, aldehydes, aliphatic acids, aliphatic esters, amino acids, aromatic acids, aromatic esters, flavonoids, hydrocarbohydrates esters, ethers, fatty acids, ketones, terpenoids, steroids and sugars.¹⁰

Flavonoids are well known plant compounds which have antibacterial, antifungal, antiviral, antioxidant and anti-inflammatory properties.² Koru et al., 2007. Flavonoids (can be considered the main compound) and caffeic acid phenethyl ester (CAPE) are phenolic compounds.

They have antibacterial property, ability to inhibit the growth and cell division and to increase membrane permeability, thus, interfering with microbial cell motility.¹¹

The anti-oxidant property of propolis which is the protection against gamma radiation could be attributed to its radical scavenging ability (Krol et al., 1990).²

The anti-inflammatory property of propolis is due to the presence of caffeic acid phenethyl ester (CAPE) in propolis (Borrelli et al., 2002).²

PROCESSING OF PROPOLIS

Propolis samples can be obtained from colonies of Africanized honeybees (*Apis mellifera*) and collected over a period of one year using plastic nets. The nets are removed and frozen at the end of each month to facilitate propolis removal.

Preparation of 20% propolis hydroalcoholic solution - Extracts of the propolis samples can be prepared by freezing the samples at -20°C and grinding the frozen material in a precooled mortar and pestle. The ground material is mixed with 99.8% (v/v) ethanol in hermetically-sealed glass vessels at a ratio of 1 g of propolis powder to 3 ml of ethanol. Vessels are then incubated for 1 week at room temperature in darkness, with constant agitation. The resulting ethanol solutions are clarified by centrifugation at 7000 g for 60 s and the supernatants were collected and filtered through Whatman #4 filter paper. Ethanol-soluble components were then collected by evaporation to dryness under vacuum. The extracts are re-dissolved in pure ethanol to obtain 20% (w/v) solutions. The final solutions are stored in hermetically sealed brown-glass bottles at room temperature. Propolis extract is stable for 6 months, maintaining its antimicrobial activity over this period.¹²

Extraction Procedures to Obtain Propolis Extracts:

- 1- Aqueous Extract: 1000 ml of distilled water is added to 100 grams of propolis in a dark glass which is left at room temperature for one to two weeks with shaking two to three times daily with shaker, then filtration is done first using gauze to get rid of the large particles, then the resultant liquid is filtered using a sterile Whatman filter paper No1. The filtered extract is then concentrated under vacuum 45°C (using a rota evaporator for five hours). The extract is then put in a clean and dark container in warm place until use.
- 2- Alcoholic Extract: The preparation was done by the same procedure of aqueous extract except we use 96% ethanol alcohol instead of distilled water.¹³

POTENTIAL USES OF PROPOLIS IN DENTISTRY

Propolis has been widely used in dentistry; the earliest reference of its use was probably a medical book named 'The Carbadini' published in the 13th century, where its beneficial role had been suggested in tooth decay. Since then, possibly due to its wide antimicrobial activity (including antibacterial, antifungal and antiviral activity), propolis has been used for the treatment and prevention of dental caries and periodontal diseases.⁸

USES OF PROPOLIS IN PERIODONTICS

Anti-plaque and Anti-calculus agent

A large number of mouth rinses have been used for their ability to disrupt the formation of plaque. In a double-blind cross-over study, propolis was found to be significantly more efficacious than placebo in reducing the plaque index and the concentration of insoluble polysaccharide.¹⁴ Reduction of insoluble polysaccharide by propolis may not only reduce the bulk of plaque but also affect the cariogenic potential of plaque.¹⁵

Murray *et al.* (1997) investigated the effectiveness of a propolis-containing mouth rinse in the inhibition of de novo plaque formation. The chlorhexidine mouth rinse was significantly better than the others in plaque inhibition. The propolis-containing rinse was marginally better than the negative control, but this difference was not significant.

Propolis has also been studied for its effectiveness in reducing malodour production and found to be ineffective, but it still may find a future role in toothpastes and mouth rinses as an anti-calculus agent (due to its inhibitory effect on both the rate of amorphous calcium phosphate transformation to hydroxyapatite and the induction time) and anti-plaque agent.¹⁶

Hidaka *et al.* (2008) studied the effects of honeybee products on the in vitro formation of calcium phosphate precipitates and inhibitory

effect on the rate of amorphous calcium phosphate transformation to hydroxyapatite and on the induction time. The results suggested that propolis may have a potential as anticalculus agents in toothpastes and mouthwashes.

In treatment of Gingivitis and Periodontitis

Sub-gingival irrigation with propolis extract as an adjuvant to periodontal treatment was found to be more effective than conventional treatment according to both microbiological and clinical parameters^{12,17} and, hence, propolis may be recommended in cases of gingivitis and periodontitis.

Ozan *et al.* (2007) performed a study to compare the effects of four different mouth rinse containing propolis solutions and mouth rinse containing 0.2% chlorhexidine (CHX) on oral microorganisms and human gingival fibroblasts. Effectiveness of mouth rinse containing propolis samples on oral microorganisms were not found as effective as CHX. On the contrary, samples found less cytotoxic on human gingival fibroblasts than CHX.

Toker *et al.* (2008) analyzed the morphometric and histopathologic changes associated with experimental periodontitis in rats in response to the systemic administration of propolis. The findings of this study provided morphologic and histologic evidence that propolis, when administered systemically, prevented alveolar bone loss in the rat model.²

In dentinal hypersensitivity

Numerous materials have been used to reduce dentin hypersensitivity; propolis is one of them. The probable mechanism for the reduction in hypersensitivity may be the occlusion of dentinal tubules.¹⁷ When compared with casein phosphopeptide – amorphous calcium phosphate

(CPP-ACP) F and sodium fluoride, topical application of propolis was found to be most effective in reducing hypersensitivity over a period of 90 days.¹⁸

Mahmoud *et al.* conducted a pioneer study on the effect of propolis on dentinal hypersensitivity in vivo (Mahmoud *et al.*, 1999). It was concluded that propolis had a positive effect in the control of dentinal hypersensitivity. In another in vitro study using Scanning Electron Microscopic (SEM), it was found that propolis occluded the dentinal tubules in both 60 and 120 s application on human dentin (Almas *et al.*, 2001).²

Wound healing

A study conducted by Magro-Filho and Carvalho, 1994 analyzed the effects of propolis mouth rinse on the repair of surgical wounds after sulcoplasty by the modified Kazanjian technique and concluded that:

- (a). The mouth rinse containing propolis in aqueous alcohol solution aided repair of intra-buccal surgical wounds and exerted a small pain killing and anti-inflammatory effect.
- (b). The vehicle employed caused minor irritation on infra-buccal surgical wounds.
- (c). Exfoliative cytology showed epithelization of infra-buccal surgical wounds.

They also examined histologically the effects of propolis topical application to dental sockets and skin wounds. It was concluded that topical application of propolis hydro-alcoholic solution accelerated epithelial repair after tooth extraction but had no effect on socket wound healing (Magro Filho and Carvalho, 1990).²

Propolis: A promising new storage media following avulsion

Both length of extra-alveolar time and type of storage media are significant factors that can affect the long-term prognosis of replanted teeth. Numerous studies have examined various media in an attempt to determine the ideal material for storage of the avulsed tooth.²

Based on the data available for propolis as an interim transport

medium, it may be concluded that propolis is an acceptable long-term storage medium for avulsed teeth. However, long-term human trials are necessary to term it the 'best' storage medium for avulsed teeth.¹⁶

Martin and Pileggi (2004) conducted a study and compared various storage media and it appeared that propolis may be a better alternative to Hank's Balanced Salt Solution (HBSS), milk, or saline in terms of maintaining PDL cell viability after avulsion and storage.

Ozan et al. (2007) (showed that 10% propolis was a more effective storage medium than milk), Hank's Balanced Salt Solution, tap water as the negative control, and Dulbecco's Modified Eagles Medium (DMEM).²

Effect on *Candida albicans*

Propolis has been found to inhibit *Candida albicans* isolated from HIV-seropositive individuals when compared to nystatin in an in-vitro study,¹⁹ and also in denture wearers, thus supporting its antifungal activity.²⁰

Martins et al. (2002) suggested that commercial 20% ethanol propolis extract (EPE) could be an alternative medicine in the treatment of candidiasis in HIV-positive patients.²

Denture stomatitis

Santos et al. (2008) concluded this new Brazilian propolis gel formulation had efficacy comparable to Daktarin (Miconazole gel) and could be an alternative topical choice for the treatment of denture stomatitis.²

Recurrent aphthous stomatitis

Systemic intake of propolis (500 mg/day) was found to be effective in reducing the number of disease outbreaks and improving the quality of life of patients suffering from recurrent aphthous stomatitis.²¹

Samet et al. (2007) has shown propolis to be effective in decreasing the number of recurrences and improve the quality of life in patients who suffer from Recurrent Aphthous stomatitis (RAS).²

Antiviral agent

Propolis may have a future role in the prophylaxis or treatment of herpes simplex virus (HSV) infections of the oral cavity, owing to the prevention of virus absorption into the host cells and/or inhibition of an internal step(s) during the viral replication cycle, thus preventing the appearance and development of symptoms in vivo.²² In another study, Brazilian propolis showed not only direct anti-HSV-1 activity but also immunological activity against intradermal HSV-1 infection in mice.²³

SIDE EFFECTS:

Propolis is safe, non toxic substance and for most people, does not cause irritation. However, there are people who are allergic to it. Caffeic acids could be one of the causes of allergies to propolis.²

The symptoms of allergies include reddening of skin, rashes, swelling, itching and even cracking of skin. Apart from that, it may also irritate the skin area where it is applied on, causing eczema, psoriasis on skin and mouth sores in the oral cavity.²

As such, propolis should be avoided by asthmatic patients, patients allergic to bee stings and patients allergic to honey products. Patch testing should be done to rule out allergy to propolis before prescribing it to a patient.⁸

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