

Review Article

Propolis: A Boon of Nature– An Overview

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Abstract: Propolis is one of the ancient natural product used in traditional medicine. Although its advantages were certain, it came in to light recently since 30 years in dentistry. It showed many antimicrobial, anti inflammatory and antioxidant properties with multiple uses in various areas of dentistry. It is effective even on the most resistant micro organisms like *Enterococcus faecalis* and *Candida albicans*. It has a very good healing capacity as well as the ability to maintain the viability of cells. Its complete potential is still being discovered. To uncover the hidden secrets of propolis, its detailed knowledge is mandatory. This article aims to provide a complete overview about propolis and its potential uses in general and in dentistry.

Keywords: Propolis, *Enterococcus faecalis*, *Candida albicans*

INTRODUCTION

Recently, focus has shifted towards herbal products which were known for their antimicrobial effect since ages in traditional medicines. Honey bee products like honey and propolis were used recently as antimicrobials [1]. Amongst them, Propolis is renowned for its antimicrobial activity and being used for various purposes in dentistry.

Propolis is derived from the Greek word “pro” before, polis “city” or defender of the city. It is proved to be a less irritating solution [2] and very effective in eliminating *E. faecalis* [3, 4]. It is used to treat different diseases and inflammatory conditions and can be applied both locally and systemically.

ORIGIN

Propolis is a natural flavinoid rich resinous product of honey bees, known for its antimicrobial, antioxidant and anti inflammatory action [5]. It is a sticky and gummy product derived from a honey bee, *Apis mellifera* that gets accumulated in the hives and used for building and insulating material. It is used to reinforce combs and acts as an aseptic material. Bees collect propolis from buds and cracks from various trees

in northern hemisphere. The trees which produce propolis are: Populus spp., Betula spp., Ulmus spp., Quercus spp., Salix spp., Aesculus hippocastanum L., Picea spp., Fraxinus spp., etc. The varied composition and properties of propolis are due to these trees [6].

Propolis is available in different parts of the world in different forms as capsules, lozenges, tincture and cream in Europe and America. It is also available as toothpaste and further research is being carried out at Oxford University to unveil the miracles of Propolis.

Propolis was used even at the ancient days of Egyptian and Greek civilizations. The Greeks were the first to recognize its healing powers. Hippocrates, the founder of modern medicine, used it for healing sores and ulcers. The Roman historian Pliny was quoted that “current physicians use propolis as a medicine because it extracts stings and all substances embedded in flesh, reduces swelling, softens indurations, soothes pain of sinews and heals sores when it appears hopeless for them to mend.” [7].

COMPOSITION

Propolis is a very complex mixture and, in general, it is composed of 50% balsams and resins, 30% wax, 10% essential oils, 5% pollen and 5% of other substances like sugars, vitamins etc., 5% organic compound and minerals. The main chemical elements present in propolis are amino acids and flavanoids including flavones, flavonols and flavanones; terpenes; vanillin; tetrochrysin; isalpinin pinocembrin chrysin galangin; ferulic acid; caffeic acid; caffeic acid phenethyl ester; cinnamic acid and cinnamyl alcohol, phenolics, and various aromatic compounds [8]. The composition again varies on the different geographic and the environmental conditions. Among all the varieties, Brazilian propolis is well known for its high biologic activity [6].

PROPERTIES

Propolis is available naturally in the form of a wax-like resin. Its melting point is usually 60° - 70°C and sometimes as high as 100°C [6].

It is known for its biological properties, including antibacterial, antifungal and healing properties. It consists of highly active bioflavonoid which has antimicrobial, antioxidant and anti-inflammatory properties.

Antibacterial Property

Propolis was found to be effective against both gram positive bacteria [9] especially against *Staphylococcus aureus* [10] and against gram negative bacteria against Salmonella [11]. The effect of propolis on growth and glucosyltransferase activity of *Streptococcus sorbinus*, *Streptococcus mutans* and *Streptococcus circuitus* was observed in vitro and in vivo [12] and found that the insoluble glycan synthesis and glucosyltransferase activity were inhibited by multiple actions of Propolis. Koru *et al.*, 2007 studied the antibacterial action against certain anaerobic oral pathogens and found to be very effective against *Peptostreptococcus anaerobius*, *Lactobacillus acidophilus*, *Actinomyces naeslundii*, *Prevotella oralis*, *Prevotella melaninogenica*, *Porphyromonas gingivalis*, *Fusobacterium nucleatum* and *Veillonella parvula*. They finally concluded that the antibacterial property of Propolis was due to the presence of Flavanoids and aromatic compounds such as caffeic acid [5, 13].

Anti inflammatory Property

Anti-inflammatory property of propolis is due to the presence of caffeic acid phenethyl ester (CAPE) in propolis [5, 14].

Anti Oxidant Property

The anti oxidant property of propolis is attributed to its radical scavenging ability which was better than that of vitamin C. They also demonstrated the ability of increasing amounts of Ethanolic Extract of Propolis to inhibit luminol H₂O₂ chemiluminescence in

vitro, and suggested that its anti-oxidative capacity was partly due to its high content of flavenoids [5, 15].

Anti fungal Property

Propolis and nine anti-fungal drugs were tested over four different infection causing fungi. It was concluded that propolis was equal or more effective than other preparations against three of the fungi, and in some tests, its activity was enhanced in the presence of propylene glycol. Propolis and propylene glycol together gave better results against *Scopulariopsis brevicaulis* than any of the drugs tested [16].

Antiviral Property

One of the constituent fraction of Propolis, isopentyl ferulate, inhibited the infectious activity of influenza virus A/HongKong in vitro and the production of hemalutinins in vivo significantly [7].

Anti cancer Property

The anti-tumoral property of Ethanolic Extract of Propolis was found to be significant and lasting but some part gets less effective in the presence of cytochrome - c - reductase inhibitors [7].

POTENTIAL USES OF PROPOLIS

In General Dentistry

Wound Healing

Magro-Filho and Carvalho in 1994 used propolis mouthrinse as well as topical application during a sulculoplasty technique and stated that hydroalcoholic mixture of Propolis helped in epithelial repair but had no effect on the wound healing when examined histologically [38].

As a Mouth Rinse

Propolis is effective against *Streptococcus mutans*, which is a well known contributor for tooth decay. Propolis showed considerable activity against bacteria and yeast associated with dental cavities, gingival and periodontal disease in test tube [17, 18], but one human study showed that propolis was no better than a placebo in inhibiting dental plaque formation [19]. Koo *et al.* evaluated the efficacy of Propolis mouth rinse on plaque accumulation for 3 days and concluded that supra gingival plaque was effectively reduced due to this mouth rinse [20].

Propolis can also be used to treat canker sores. It is often called as a “natural antibiotic” and can be often used as an alternative to other chemical mouth rinses [21].

Storage Media

Ozan *et al.* in 2007 determined that 10% Propolis solution can be effectively used as a storage media for avulsed tooth by maintaining the viability of the periodontal ligament cells [22]. A study conducted by Mori GG *et al.* in 2010 concluded that propolis can be

used as a storage media with duration of 6 hour period rather than 60 min. [23].

Propolis was found to be a promising storage media due to greater viability of periodontal ligament cells [24, 25].

In the treatment of Periodontitis

Propolis was known to significantly reduce the periodontitis-related bone loss. A study conducted by Toker *et al.* in 2008 provided both morphologic and histologic evidence that propolis, when administered systemically, prevented alveolar bone loss in the rat model [26].

Hidaka *et al.* 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. Propolis reduced the transformation of amorphous calcium phosphate to hydroxyapatite by 12 - 35% and with a 2.5 - to 4.4-fold increase in the induction time. These results suggested that propolis may have potential as anticalculus agents in toothpastes and mouthwashes [27].

Against *Candida albicans*

Its effect against *C. albicans* can be attributed to rapid (between 30 seconds and 15 minutes), dose-dependent cytotoxic activity and an inhibitory effect on Yeast-Mycelial conversion. The hyphal length was reduced even at lower propolis concentration. Dose and time-dependent inhibition of phospholipase activity was also an additional feature. Although, no clear effect was shown on adherence to buccal epithelial cells and surface structure hydrophobicity, but damage to the plasma membrane structure was confirmed [28]. Patients having full dentures who used hydroalcoholic propolis extract showed a decrease in the number of *Candida* [29].

Against Caries

Several investigations carried out with crude propolis extracts, its isolated fractions, and purified compounds showed *Streptococcus mutans* count reduction which was attributed to the interference with their adhesion capacity and glucosyltransferase activity, which are the main factors in carrying out the caries process. Propolis can be used as an effective cariostatic agent [30].

In Dentin Hypersensitivity

Propolis was found to be a promising desensitizing agent. Flavanoids present in propolis might be able to suppress the information of free radicals by binding heavy metals in ions which are known to catalyze many processes leading to the appearance of free radicals. Propolis is known to be an antioxidant, antimicrobial, anti-inflammatory, immunostimulatory, and heavy metal chelating agent. It also has an effect on tissue

regeneration [31]. It mainly acts by obliterating the dentinal tubules and also simulates reparative dentin formation thus, reducing the hypersensitivity [32].

A study evaluated the clinical efficiency of CPP-ACP F, sodium fluoride, propolis, and distilled water that was used as placebo in treating dentinal hypersensitivity and concluded that propolis was most efficient amongst all in treating dentinal hypersensitivity and CPP- ACPF showed to be the least efficient [33].

As a Pulp Capping Agent

It was suggested that flavonoids from propolis may stimulate reparative dentine formation and may delay pulp inflammation by stimulating production of transforming growth factor (TGF)- β 1 and synthesis of collagen by dental pulp cells [3]. It also induces the production of high quality tubular dentin [34].

In Endodontics

As a Root Canal Irrigant

Propolis was stated effective in dentinal tubule disinfection against *Enterococcus faecalis*. It produced 66% and 70% inhibition of *E. faecalis* at an intra canal dentinal tubular depth of 200 μ and 400 μ [35]. So, still more studies are required to substantiate its clinical efficacy as an irrigant.

The antibacterial property of Propolis is due to the presence of flavanoids and aromatic compounds such as caffeic acid [5].

As an Intracanal Medicaments

Propolis was found to be more effective than calcium hydroxide as an intracanal medicament against *E. faecalis* and its effectiveness is not weakened by dentine [3]. It can be used as a promising intracanal medicament but when compared with Chlorhexidine, it was found equally effective for *Enterococcus faecalis* and less effective on *Candida albicans* [36, 37].

Biocompatibility and Allergic reactions

Prior to clinical usage, complete knowledge of the biocompatibility should be present. Garcia *et al* conducted a study to confirm the biocompatibility of propolis by inducing it in subcutaneous tissue of rats and concluded that propolis with Copaiba oil vehicle showed beneficial biological properties.

However people allergic to propolis can develop rashes, itching, oedema and cracking of skin. It may also irritate the skin when applied and can cause eczema, lesions, psoriasis or mouth sores.

Asthmatic patients and Pregnant women should not be advised the usage of propolis. If the patient is allergic to black poplar (also *populus nigra*), pollen, bee stings, honey and balsam of Peru, he/she should avoid propolis as well. It can be evidenced as most of the

compounds in propolis and balsam of peru are common. [5]

CONCLUSION

Among the recent herbal products used in dentistry, Propolis is booming rapidly due to its antimicrobial, anti-inflammatory and biocompatible property. But, still more studies are required to confirm its advantages and success in human beings.

REFERENCES

1. Adewumi AA, Ogunjinmi AA; The healing potential of honey and propolis lotion on septic wounds. *Asian Pacific Journal of Tropical Biomedicine*, 2011; 1(1): S55-S57.
2. Bortoluci da Silva F, Milanezi de Almeida J, Galvão de Sousa SM; Natural medicaments in endodontics – a comparative study of the anti-inflammatory action. *Braz Oral Res.*, 2004; 18(2): 174-179.
3. Awawdeh L, AL-Beitawi M, Hammad M; Effectiveness of propolis and calcium hydroxide as a short-term intracanal medicament against *Enterococcus faecalis*: A laboratory study. *Aust Dent J.*, 2009; 35(2): 52–58.
4. Nara A, Dhanu, Chandra P, Anandakrishna L, Dhananjaya; Comparative Evaluation of Antimicrobial Efficacy of MTAD, 3% NaOCl and Propolis against *E Faecalis*. *Int Journal Clin Pediatr Dent.*, 2010; 3(1): 21-25.
5. Parolia A, Thomas MS, Kundabala M, Mohan M; Propolis and its potential uses in oral health. *International Journal of Medicine and Medical Sciences*, 2010; 2(7): 210-215.
6. Nabi Shah GH, Manzoor M, Mathivanan V, Mir GM; Comparison of Physical properties of different Propolis Samples from two different regions of India. *International Journal of Scientific Research*, 2013; 2(11): 17-19.
7. Almas K, Dahlan A, Mahmoud A. Propolis as a natural remedy: An update. *Saudi Dent J*, 2001;13(1): 45-49.
8. C Scully; Propolis: a background. *British Dent J.*, 2006; 200: 359 – 360.
9. Seidel V, Peyfoon E, Watson DG, Fearnley J; Comparative study of the antibacterial activity of propolis from different geographical and climatic zones. *Phytother Res.*, 2008; 22(9): 1256-1263.
10. Velazquez C, Navarro M, Acosta A, Angulo A, Dominguez Z, Robles R *et al.*; Antibacterial and free-radical scavenging activities of Sonoran propolis. *Appl. Microbiol.*, 2007; 103(5): 1747-1756.
11. Orsi RO, Sforcin JM, Rall VLM, Funari SRC, Luciano B, Fernandes JR A; Susceptibility profile of *Salmonella* against the antibacterial activity of propolis produced in two regions of Brazil. *J Venomous Anim Toxins including Trop Dis.*, 2005; 11(2): 109-116.
12. Ikeno K, Ikeno T, Miyazawa C; Effect of propolis on dental caries in rats. *Caries Res.*, 1991; 25(5): 347-351.
13. Koru O, Toksoy F, Acikel CH, Tunca YM, Baysallar M, Uskudar Guclu A *et al.*; In vitro antimicrobial activity of propolis samples from different geographical origins against certain oral pathogens. *Anaerobe*, 2007; 13(3-4): 140-145.
14. Borrelli F, Maffia P, Pinto L, Ianaro A, Russo A, Capasso F *et al.*; Phytochemical compounds involved in the anti-inflammatory effect of propolis extract. *Fitoterapia*, 2002; 73(Suppl 1): 53-63.
15. Krol W, Czuba Z, Scheller S, Gabrys J, Grabiec S, Shani J; Anti-oxidant property of ethanolic extract of Propolis (EEP) as evaluated by inhibiting the chemiluminescence oxidation of luminol. *Biochem Int.*, 1990; 21(4): 593-597.
16. Miller-Clere J, Michel D, Simeray J, Chaumon JP; Preliminary study of the anti-fungal properties of Propolis compared with some commercial products. *Fac Medicine & Pharmacy, Besancon Monograph Cedex, France*, 1987.
17. Steinberg D, Kaine G, Gedalia I; Antibacterial effect of propolis and honey on oral bacteria. *Am J Dent.*, 1996; 9(6): 236–238.
18. Park YK, Koo MH, Abreu JA, Ikegaki M, Cury JA, Rosalen PL; Antimicrobial activity of propolis on oral microorganisms. *Curr Microbiol.*, 1998; 36(1): 24–28.
19. Murray MC, Worthington HV, Blinkhorn AS; A study to investigate the effect of a propolis-containing mouthrinse on the inhibition of de novo plaque formation. *J Clin Periodontol.*, 1997; 24(11): 796–798.
20. Koo H, Cury JA, Rosalen PL, Ambrosano GM, Ikegaki M, Park YK; Effect of a mouthrinse containing selected propolis on 3-day dental plaque accumulation and polysaccharide formation. *Caries Res.*, 2002; 36(6): 445–448.
21. Vidya Dodwad and Bhavna Jha Kukreja; Propolis mouthwash: A new beginning. *J Indian Soc Periodontol.*, 2011; 15(2): 121–125.
22. Ozan F, Polat ZA, Er K, Ozan U, Deger O; Effect of propolis on survival of periodontal ligament cells: new storage media for avulsed teeth. *J Endod.*, 2007; 33(5): 570-573.
23. Mori GG, Nunes DC, Castilho LR, de Moraes IG, Poi WR; Propolis as storage media for avulsed teeth: microscopic and morphometric analysis in rats. *Dent Traumatol.*, 2010; 26(1): 80-85.
24. Casaroto AR, Hidalgo MM, Sell AM, Franco SL, Cuman RK, Moreschi E *et al.*; Study of the effectiveness of propolis extract as a storage medium for avulsed teeth. *Dent Traumatol.*, 2010; 26(4): 323-331.
25. Martin MP, Pileggi R; A quantitative analysis of Propolis: a promising new storage media following avulsion. *Dent Traumatol.*, 2004; 20(2): 85-89.
26. Toker H, Ozan F, Ozer H, Ozdemir H, Eren K, Yeler HJ; A morphometric and histopathologic

- evaluation of the effects of propolis on alveolar bone loss in experimental periodontitis in rats. *Periodontol.*, 2008; 79(6): 1089-1094.
27. Hidaka S, Okamoto Y, Ishiyama K, Hashimoto K; Inhibition of the formation of oral calcium phosphate precipitates: the possible effects of certain honeybee products. *J. Periodontal Res.*, 2008; 43(4):450- 458.
28. D'Auria FD, Tecca M, Scazzocchio F, Renzini V, Strippoli V; Effect of propolis on virulence factors of *Candida albicans*. *J Chemother.*, 2003; 15(5): 454-460.
29. Ota C, Unterkircher C, Fantinato V, Shimizu MT; Antifungal activity of propolis on different species of *Candida*. *Mycoses*, 2001; 44 (9-10): 375-378.
30. Libério SA; The potential use of propolis as a cariostatic agent and its actions on mutans group streptococci. *J Ethnopharmacol.*, 2009; 125(1): 1-9.
31. Torwane NA, Hongal S, Goel P, Chandrashekar BR, Jain M, Saxena E *et al.*, Effect of two desensitizing agents in reducing dentin hypersensitivity. *J Clin Diagn Res.*, 2013; 7(9): 2042-2046.
32. Sales-Peres SH, Carvalho FN, Marsicano JA, Mattos MC, Pereira JC, Forim MR *et al.*; Effect of propolis gel on the in vitro reduction of dentin permeability. *Appl Oral Sci.*, 2011; 19(4): 318–323.
33. Madhavan S, Nayak M, Shenoy A, Shetty R, Prasad K; Dentinal hypersensitivity: A comparative clinical evaluation of CPP-ACP F, sodium fluoride, propolis, and placebo . *J Conserv Dent.*, 2012; 15(4): 315-318.
34. Ahangari Z, Eslami G, Koosedghi H, Ayatollahi A, Kousedghi H; Antibacterial activity of propolis and Ca(OH)₂ against *Lactobacillus*, *Enterococcus faecalis*, *Peptostreptococcus* and *Candida albicans*. *African Journal of Microbiology Research*, 2012; 6(14): 3510-3515.
35. Kandaswamy D, Venkatesh Babu N, Gokulnath D, Kindo AJ; Dentinal tubule disinfection with 2% chlorhexidine, propolis, morinda citrifolia juice, 2% povidone iodine, and calcium hydroxide. *Int Endod J.*, 2010; 43(5): 419-423.
36. Ramani N, Mathew S; Comparative evaluation of antimicrobial efficacy of chlorhexidine digluconate and propolis when used as an intracanal medicament: ex vivo study. *Journal of International Oral Health*, 2012; 4(2): 17-23.
37. Bolla N, Kavuri SR, Hema Iswarya T, Sayesh V, Shenoy A; Comparative evaluation of antimicrobial efficacy of odontopaste, chlorhexidine and propolis as root canal medicaments against *Enterococcus faecalis* and *Candida albicans*. *Journal of International Dental and Medical Research*, 2012; 5(1): 14-24.
38. Margo-Filho O, de Carvalho AC; Topical effect of propolis in the repair of sulcoplasties by the modified Kazanjian techniques. *Cytological and clinical evaluation. J Nihon Univ Sch Dent.*, 1994; 36(2):102-111.