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PROSPECT OF USING PROPOLIS IN CONSERVATIVE DENTISTRY AND ENDODONTIC TREATMENT (BASIC RESEARCH VS CLINICAL APPLICATION)

(PROSPEK PENGGUNAAN PROPOLIS DALAM BIDANG *OPERATIVE DENTISTRY* DAN PERAWATAN ENDODONTI (PENELITIAN DASAR VS APLIKASI KLINIS))

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Abstract

Propolis is a resinous hive product, collected by bees from tree buds and mixed with secreted bee wax in order to avoid bacterial contamination in the hive, and also to seal it. It is acknowledged that propolis has antimicrobial activity as well as anti-inflammatory, antioxidant, antitumor, immuno-regulatory, and regenerative tissue properties. Chemically, propolis is exceedingly complex and contains a rich variety of potent terpene, benzoic, caffeic, cinnamic, aromatic aldehyde, phenolic acid, and also high in flavonoid. Recently, propolis has been the subject of several studies, both *in vitro* and *in vivo* or even at animal or human with the aim to elucidate its biological and pharmacological properties. The use of propolis in dentistry has been done in few years ago for various purposes such as in treatment of periodontitis and dental caries, to accelerate the healing of post-extraction wounds, to treat aphthous stomatitis, as a storage media following teeth avulsion. The result of basic research of propolis apparently was useful to support its clinical application in dentistry. However, standardization the composition of propolis due to its chemical diversity is still a problem. Therefore the purposes of this review article were (1) to explain the prospect of propolis in conservative dentistry and endodontic treatment, and (2) to stimulate the interest of clinicians to make further research about this natural compound in dentistry. In conclusion, propolis is a natural medication with a promising future but further studies should be conducted to investigate its merit and demerits in clinical dentistry.

Key words: propolis, conservative dentistry, endodontic treatment

Abstrak

Propolis adalah suatu produk sarang lebah yang dikumpulkan oleh lebah dari pucuk tumbuhan dan mencampurnya dengan lilin yang disekresikan oleh lebah dengan tujuan mencegah kontaminasi bakteri pada sarang lebah, dan juga melapisinya. Telah diketahui bahwa propolis memiliki aktivitas antimikroba, anti-inflamasi, antioksidan, antitumor, meregulasi sistem imun dan regenerasi jaringan. Kandungan senyawa kimia propolis sangat kompleks dan mengandung senyawa terpen, benzoat, kafeat, sinamik, aldehida aromatik, asam fenolik dan flavonoid. Akhir-akhir ini, propolis telah menjadi subyek beberapa penelitian, baik *in vitro* maupun *in vivo* bahkan pada hewan coba atau manusia dengan tujuan untuk mengungkap sifat biologis dan farmakologisnya. Penggunaan propolis di bidang kedokteran gigi telah dilakukan beberapa tahun terakhir untuk berbagai tujuan seperti mengobati periodontitis dan karies gigi, mempercepat proses penyembuhan setelah pencabutan gigi, mengobati stomatitis aphosa, dan sebagai media penyimpanan gigi yang mengalami avulsi. Hasil penelitian dasar mengenai propolis tampaknya bermanfaat untuk mendukung aplikasi klinis dari propolis dibidang kedokteran gigi. Namun demikian, standarisasi komposisi propolis masih menjadi masalah oleh karena keanekaragaman senyawa kimianya. Oleh karena itu tujuan artikel ini adalah (1) menjelaskan prospek propolis dibidang konservasi gigi dan perawatan endodontik, dan (2) menstimulasi keinginan klinisi untuk melakukan penelitian lebih lanjut mengenai bahan alam ini dibidang kedokteran gigi. Sebagai kesimpulan, propolis adalah obat alami yang menjanjikan di masa depan namun penelitian lebih lanjut harus dilakukan untuk mengetahui manfaatnya secara klinis di bidang kedokteran gigi.

Kata kunci: propolis, konservasi gigi, perawatan endodontik

INTRODUCTION

Bee products, such as honey, royal jelly, pollen, and propolis are the oldest medicines traditionally used by Indonesian society. The word propolis (bee glue) is derived from the Greek word "pro" before, polis "city" or defender of the city. Propolis is a natural resinous hive product collected by honey bee from leaves and buds of different plant sources. Bees use propolis as a general sealer, draught excluder, antibiotic, and as an embalming substance to cover carcasses from hive invaders.[1,2] In nature, or when in room temperature, it is a sticky substance, but becomes hard and brittle at low temperature.[3]

The composition of propolis primarily consists of 50% (w/v) resinous compounds and vegetable balsam, 30% (w/v) beeswax, 10% (v/v) essential and aromatic oils, 5% (w/v) bee pollen and 5% various other substances, including organic debris.[4] The chemical composition of propolis is very complex, depends on the collecting location, time, and plant source.[3] Those include alcohols, aldehydes, aliphatic acids and esters, ketons, alcohols, amino acids, glucose, ferulic acids, cinnamic acids, terpenoids, and a large number of flavonoids. Other constituents which are amino acids, minerals, vitamins A, B complex, E and the highly active bio-chemical substances known as bioflavonoids (Vitamin P), phenols and aromatic compounds.[4]

In recent years propolis has been the subject of several studies, with the aim of elucidating its biological and pharmacological properties. It is acknowledged that propolis has antimicrobial activity as well as anti-inflammatory, antioxidant, antitumoral, and regenerative tissue properties.[5] Propolis has been found to be very effective against Gram positive bacteria [6]; especially against *Staphylococcus aureus* [7]; and Gram negative bacteria against *Salmonella* [8]. The effect of propolis on the growth and glucosyltransferase activity of Streptococcus mutans (*S mutans*) was observed and the results showed that the insoluble glycan synthesis and glucosyltransferase activity were inhibited by propolis.[9] Koru et al.[10] studied the antibacterial action against certain anaerobic oral pathogens and found to be very effective against Lactobacillus acidophilus, Actinomyces naeslundii, Prevotella oralis, Porphyromonas gingivalis, Fusobacterium nucleatum and Veillonella parvula. The results showed that the antibacterial property of propolis was due to the presence of flavanoids and aromatic compounds such as cafeic acid. Anti-inflammatory property of propolis was due to the presence of caffeic acid phenethyl ester (CAPE) in propolis.[11]

Current research involving propolis in dentistry spans many fields and highlights its antimicrobial and anti-inflammatory activities, particularly in Periodontics, Oral Surgery, Oral Medicine, Oral Pathology, Pedodontics, Conservative Dentistry and Endodontic to treat many different oral diseases and improve oral hygiene.[12] Conservative dentistry is the art and science of the diagnosis, treatment, and prognosis of defects of teeth that do not require full coverage restorations for correction. Such treatment should produce the restoration of proper tooth form, function, and esthetics while maintaining the physiologic integrity of the teeth in harmonious relationship with the adjacent hard and soft tissues, all of them should enhance the general health and welfare of patient.[13] Meanwhile, American Association of Endodontists defined Endodontics as a branch of dentistry that is concerned with the morphology, physiology and pathology of the human dental pulp and periradicular tissues. Its study and practice encompass the basic clinical sciences including biology of the normal pulp; the etiology, diagnosis, prevention, and treatment of diseases and injuries of the pulp; and associated periradicular conditions.[14]

The purpose of this paper is (1) to review many applications of propolis in Conservative Dentistry and Endodontic treatment based on basic research and clinical study so we will know its prospect in dentistry, and (2) to stimulate the interest of clinicians to make further research about this natural compound in dentistry.

PROPOLIS AS A DIRECT PULP CAPPING AGENT

Study conducted by Ahangari et al.[15] prove clearly higher effectiveness of direct pulp capping with propolis than with calcium hyroxide-based products. It not only stops inflammatory reaction, infection with bacterial and pulp necrosis but also induces formation of high quality tubular dentin through stimulation of stem cells. Recent study by Parolia et al.[16] found that wound healing was occurred in human dental pulp after having been capped by propolis and it has similar effectiveness in induction to create reparative dentin with calcium hydroxide and Mineral Trioxide Aggregate (MTA). Meanwhile, Sabir et al.[17] compared zinc oxide based filler, flavonoids propolis and non-flavonoid propolis as direct pulp capping agents in rats. The results showed that direct pulp capping with propolis flavonoids in rats might delay dental pulp inflammation and stimulate reparative dentin.

Hard tissue bridge formation after having been

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capped with propolis might be attributed to the property of propolis which has been shown could stimulate various enzyme systems, cell metabolism, circulation, and collagen formation.[18] These effects have been shown to be the result of the presence of arginine, vitamin C, provitamin A, B complex, and trace minerals such as copper, iron, zinc as well as bioflavonoids. All these factors of propolis help in good wound healing. In addition to wound healing ability, propolis is a good antimicrobial agent. It prevents bacterial cell division, breaks down bacterial cell wall and cytoplasm.[19] The other possible explanation was that dentin formation following pulp capping is known to involve differentiation of odontoblast-like cells that form reparative dentin and biosynthetic activity by surrounding primary odontoblasts. Both phenomenns require interacttion between extracellular matrix molecules and growth factors such as transforming growth factor (TGF)-β1 and bone morpho protein (BMP)-2 and BMP-4, growth factors known to be important for odontoblast-like cell differentiation.[20] Indeed, propolis is also capable of stimulating the production of TGF-β1.[21]

PROPOLIS AS A CARIOSTATIC AGENT

Study by Hayacibara et al.[9] evaluated the influence of propolis on S mutans viability, glucosyltransferases (GTFs) activity, and caries development in rats. They found that propolis could decreased both S mutans viability and GTFs activity and also inhibit caries development in rats. Meanwhile, more recent study done by Libério et al.[22] and Sabir [23] showed that propolis have potential as a cariostatic agent since it could reduced the number and inhibited the in vitro growth of S mutans by multiple actions of propolis. All of this data suggested that propolis is a novel anti-caries agent.

PROPOLIS AS A DESENSITIZING AGENT

Purra et al.[24] conducted a clinical study to evaluated the effect of propolis and 5% potassium nitrate on dentinal hypersensitivity. Ten patients aged 20-40 years with total 156 hypersensitive teeth were selected for a 3 month study. Each patient was subjected to treatment with saturated ethanolic solution of propolis, 5% potassium nitrate and distilled water. The patients were recalled at 1st, 7th, 14th, 30th day and at 3 months recall for the application of the agent and re-evaluation. The final reevaluation of the patients was done after 3 months after the first applicatione study. Propolis was applied twice daily on teeth with hypersensitivity. The hypersensitivity was assessed by using a cold graded thermal test. The results showed no significant difference between the propolis group and the potassium nitrate group in the immediate post-treatment period; however, the results were significant at the end of first week and second week. At 4 weeks and 3 months period, a comparison between the both groups again showed no significant difference. It was concluded that propolis was more effective than 5% potassium nitrate in relieving dentinal hypersensitivity and had an immediate and sustained effect. Another in vitro study was done by Hongal et al.[25] by using scanning electron microscopic (SEM) found a thin, smooth layer over dentin surface of human molar was occured after having been immersed in 30% ethanolic extract of propolis (EEP) solution for 4 minutes. They were concluded that 30% EEP solution was able to occlude dentinal tubules, which suggests that use of propolis can provide a safe and noble option for the treatment of dentin hypersensitivity. Meanwhile, *in vitro* study was done by Sabir [26], who found that the microhardness of human enamel increased after having been immersed in 0.125% EEP solution for 21, 42, 63 and 84 minutes.

PROPOLIS AS AN INTRACANAL IRRIGANT MEDICAMENT

Bhardwaj et al.[27] conducted an in vitro study to evaluated the efficacy of Morinda citrifolia juice, Aloe Vera and Propolis in comparison to 1% sodium hypochlorite with passive ultrasonic irrigation for removal of the intraradicular Enterococcus faecalis (E. faecalis) boifilms in extracted single rooted human permanent teeth. Biofilms of E. faecalis were grown on the prepared root canal walls of 60 standardized root halves which were longitudinally sectioned and treated with passive ultrasonic irrigation along with test irrigants. The root halves were processed for SEM. The results of this study indicated that propolis was effective in removing E. faecalis biofilm.

Oncag et al.[28] compared the antibacterial efficacy of three commonly used intracanal medicaments with propolis against E. faecalis. They concluded that propolis had good in vitro antibacterial activity against E. faecalis in the root canals, suggesting that it could be used as an alternative intracanal medicament. Similar study was conducted by de Rezende et al.[29] and Awawdeh et al.[30] evaluated the effectiveness of propolis and calcium hydroxide as a short-term intracanal medicament against E. faecalis. They concluded that propolis is very effective as intracanal medicament in rapidly eliminating E. faecalis in vivo. Meanwhile Sabir[31] also evaluated

the effect of several concentrations of EEP solution toward the growth of E. faecalis in vitro, the result showed that 1% EEP solution was the most effective concentration to inhibit the growth of E. faecalis after 24 and 48 hours incubated at 37ºC.

DISCUSSION

Nowadays, there are trends to use natural materials as cure for many diseases. Alternative medicine has made a lot of contributions the modern medical practice. Propolis has been the subject of several recent studies. It is acknowledged that propolis has many activities including antimicrobial activity as well as anti-inflammatory, antioxidant, antitumoral, and regenerative tissue properties. Chemically, propolis is exceedingly complex and contains of a rich variety of potent substance. It's also high in flavornoids, it may account for many benefits attributed to propolis and some researchers refer to propolis as a type of flavonoid.[5] Recently, propolis has been used in dentistry for various purposes.[12] Flavonoids are known to be antibacterial and anti-inflammatory while the other phenolic compounds and caffeic acid esters have powerful antioxidant properties, other derivatives in propolis are known to stimulate the immune system.[32, 33] A very active ingredient is CAPE, with anti-inflammatory activity.[11] Flavonoids in propolis contain of very potent inhibitors of eicosanoid production, which strongly affect the immune and inflammatory response. However, it is believed that no single ingredient is predominantly active rather than all work together as a holistic product.[5]

There were basic research data of propolis effect on conservative dentistry and endodontic treatment, mostly come from Eastern Europe where propolis has been used as a natural medicine. Unfortunately, only a few reports were published about successful clinical use of propolis in that field, so there is a need further human trial of this natural remedy in treating oral diseases. That fact may be influenced by many factors such as standardization the composition of propolis due to its chemical diversity is still a problem because propolis was collected in different geographic region [34] and allergy/sensitivity to propolis particularly if patients are taking propolis systemically.[35] However, it seems that the result of basic research of propolis was useful to support its clinical application in dentistry.

As conclusion, propolis is a natural medication with a promising future but further studies should be conducted to investigate its merit and demerits in clinical dentistry.

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