



## A REVIEW: DOES HONEY HAVE ROLE IN DENTISTRY?

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### ABSTRACT

Honey rapidly clears infection from wounds when applied topically, which may make it suitable for treatment of periodontal disease as well as for clearing infection in oral ulcers and wounds following surgery. The anti-inflammatory activity of honey along with its antioxidant content has been used as a medicine throughout the ages, and in more recent times, it has been rediscovered that it is effective in treatment of burns, infected wounds and skin ulcers. It possesses potent antibacterial may be beneficial in preventing erosion of periodontal tissues that occur as collateral damage from free radicals released as an inflammatory response to infection.

### INTRODUCTION

In ancient times, honey was considered the food of gods and the symbol of wealth and happiness. It is a sweet syrupy substance produced by honeybee from the nectar of flowers and used by humans as a sweetener. Although very well known as food, it is one of the oldest medicines and has continued to be used as such throughout the ages. Honey was used to treat the infected wounds as long ago as 2000 years before the bacteria were discovered to be the cause of infection. In 50 AD, Dioscorides described honey as being "good for all rotten and hollow ulcers". According to Dr. Stefan Stangaciu, Apitherapy is defined as the art and science of treatment and holistic healing through the honey bee and her products for the benefit of mankind and all the animal kingdom [1].

Honey is the substance made when the nectar and sweet deposits from plants are gathered, modified and stored in the honeycomb by honey bees. The definition of honey stipulates a pure product that does not allow for the addition of any other substance. This includes, but is not limited to, water or other sweeteners. Fructose and glucose are the main carbohydrate constituents of honey. Honey is composed primarily of the sugar glucose and fructose; its

third greatest component is water. Honey also contains numerous other types of sugars, as well as acids, vitamins, proteins and minerals. The pure honey contains alkaloids, quinone glycosides, cardiac glycosides, flavonoids & reducing compounds [2]. Propolis is resinous material/sap that is collected after it oozes out from tree bark and bud. After bees have collected propolis they mix it with wax flakes and their saliva in the hive. This mixture is what they use to cover the interior of the hive. The bees not only use propolis as a building material and structural defence mechanism but their health is maintained as a result of its immune system enhancing properties. Propolis forms the bees external immune defence system, making the beehive one of the most sterile environments known to nature [3].

### Antibacterial Potential

The antibacterial property of honey was first recognized in 1892 by van Ketel [4]. Important factors influencing the antibacterial effectiveness of honey are as following:

### Osmotic Effect

Honey because of its high osmotic properties can extract water from bacterial cells thus leading to cell death. It has an osmolarity sufficient to inhibit microbial growth. Honey, like other saturated sugar syrups and sugar pastes, has an osmolarity sufficient to inhibit microbial growth. However, it has been shown that wounds infected with

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Staphylococcus aureus are quickly rendered sterile by honey [5].

### Acidic pH

Honey is quite acidic, its pH being between 3.2 and 4.5, which is low enough to be inhibitory to many animal pathogens. However, if honey is diluted, especially by body fluids, the pH will not be low enough to effectively inhibit bacteria [6].

### Hydrogen Peroxide

The third factor is the presence of hydrogen peroxide in honey. Hydrogen peroxide is produced enzymatically in honey by glucose oxidase enzyme secreted by bees into the nectar. Although, hydrogen peroxide has been used as an antiseptic, it is not now as popular because it causes inflammation and damage to tissues [7]. In honey, the enzyme found is activated by dilution and the peroxide produced is too mild to cause tissue injury, and yet has antimicrobial activity [8].

### Phytochemical Factors

It has enzymes and tissue nutrition minerals and vitamins that help repair tissue directly. Several chemicals with antibacterial activity have been identified in honey by various researchers: pinocembrin, terpenes, benzyl alcohol, 3,5-dimethoxy-4-hydroxybenzoic acid (syringic acid), methyl 3,5-dimethoxy-4-hydroxybenzoate (methyl syringate), 3,4,5-trimethoxybenzoic acid, 2-hydroxy-3-phenylpropionic acid, 2-hydroxybenzoic acid and 1,4-dihydroxybenzene [9].

### Increased Lymphocyte and Phagocytic Activity

Recent research shows that the proliferation of peripheral blood B-lymphocytes and T-lymphocytes in cell culture is stimulated by honey at concentrations as low as 0.1%; and phagocytes are activated by honey at concentrations as low as 0.1%. Honey (at a concentration of 1%) also stimulates monocytes in cell culture to release cytokines, tumour necrosis factor (TNF)-alpha, interleukin (IL)-1 and IL-6, which activate the immune response to infection [10].

### Clinical Significance in Dentistry

**1. Anti-caries:** Few microorganisms found in the oral cavity are able to adhere to the teeth and, among these, a limited group is cariogenic. The specific cariogenic microbiota consists of Streptococcus mutans, Lactobacillus and some Actinomyces species. However, during the initial phase of cavity formation, S. mutans is the most frequently associated microorganism. In addition to its ability to adhere to teeth and survive in acid environment, S. mutans is transmissible, as first demonstrated by Keyes. Based on literature reports showing that honey is a product with anti-inflammatory and bactericidal activity, several in

vitro and some in vivo studies have demonstrated its potential use in the treatment of bacterial diseases. It was concluded in one study that the propolis extract or honey used as mouthrinse possesses antimicrobial activity against S. mutans present in the oral cavity [11].

### 2. Anti-plaque

Koo H et al studied the effect of a mouthrinse containing selected propolis on three day dental plaque accumulation and polysaccharide formation. Six volunteers took part in a double-blind crossover study performed in two phases of 3 days. During each phase the volunteers refrained from all oral hygiene and rinsed with 20% sucrose solution 5 times a day to enhance dental plaque formation and with mouthrinse (placebo or experimental) twice a day. On the 4th day, the plaque index (PI) of the volunteers was scored and the supragingival dental plaque was analyzed for insoluble polysaccharide. The PI for the experimental group was significantly less than for the placebo group [12].

### 3. Periodontal Diseases

Honey having an anti-inflammatory activity raises the possibility of it being useful as a therapeutic agent for periodontitis; the anti-inflammatory activity would block the direct cause of the erosion of the connective tissues and bone. Furthermore, its activating effects on leukocytes could be beneficial, as some periodontitis is due to immune cell hypofunction allowing pathogens to grow unchecked and cause direct tissue damage. Yet immune cell hyperfunction can cause collateral damage to tissues through the release of reactive oxygen species (free radicals), by products of inflammation. The initial inflammatory response is elicited by bacterial cell wall components, but reactive oxygen species released from the activated phagocytes feedback as signals to elicit further inflammatory response. The erosive damage caused by the persisting state of inflammation in periodontal disease can be stopped by removing the bacteria causing the continuous stimulation of an inflammatory response or by blocking excessive inflammatory response. It has also been proposed that antioxidants be used to protect the periodontal tissues from the damaging free radicals formed in the inflammatory response [12]. Honey contains a substantial level of antioxidants [13] and has an anti-inflammatory action that has been clearly demonstrated to be direct and not secondary to the clearance of infection [14]. Another beneficial feature of using honey to treat periodontal disease would be its well established stimulation of the growth of granulation tissue and epithelial cells, which would aid in repair of the damage done by infecting bacteria and by the free radicals from the inflammatory response to them [15].

In a study, eight honeys and three types of propolis were tested and the result proved them effective as



an anticalculus agent in toothpastes and mouthwashes. Researchers in Brazil have found that periodontal diseases are amendable to treatment by green propolis. A study was conducted on four patients at a periodontics clinic in south eastern Brazil who had varying degrees of dental problems: calculus, gingivitis, bleeding, fluid accumulation, gingival recession, tooth mobility, pus formation, and bone loss. Treatment consisted of daily tooth brushing with propolis and washing the mouth with a propolis solution. The propolis was applied in certain periodontal pockets once a week for five weeks. All the periodontal pockets irrigated with propolis showed a 95% decline in gingivitis and pus. Because propolis is cheap and accessible to the population, its effectiveness in treating periodontal disease is extremely relevant to public health. The authors therefore recommend that 10% Brazilian green propolis be used in conjunction with treatment of chronic periodontitis [16].

#### 4. Oral Candidiasis

According to Brazilian researchers, green propolis is effective against oral candidiasis. Green propolis is collected from honeybees in south eastern Brazil. In one study, twelve patients were treated with propolis. After cleaning their prosthesis and their oral cavity, they dried the infected area and applied the propolis extract topically in candidiasis oral mucosa lesions with a swab, four times daily for a week. A control group of six patients performed the same treatment with Nystatin, a standard antifungal product. All 18 patients—whether treated with propolis extract or Nystatin—showed a remission of the candidiasis lesion in less than three weeks: 11 patients after 7 days, and 6 patients after 15 days [17].

#### 5. Pulp Therapy in Primary and Permanent Teeth

According to Sabir et al, direct pulp capping with propolis in rats may delay dental pulp inflammation and stimulate reparative dentin. Partial dentinal bridge formation was seen in these animals after application of propolis in this study [18]. Another study in Manipal College of Dental Sciences, Manipal, conducted on premolars for direct pulp capping also showed that propolis is equally efficacious as calcium hydroxide. It has been concluded in a study that propolis can be used along with calcium hydroxide as an intracanal medicament [19]. According to Estrela et al.; oily vehicles become an issue if a calcium hydroxide paste is used as an intracanal medicament because oily substances have low solubility in water and do not allow immediate availability of the hydroxyl ions released from calcium hydroxide. Thereby, a less effective antimicrobial action is expected. Otherwise, oily vehicles could be an option when calcium hydroxide is used as an obturation agent. One could consider associating calcium hydroxide with propolis in order to add the jaw from traumatic injury that had been nonresponsive to any conventional treatment for more than six months. In

all beneficial biological properties of propolis, particularly its antiinflammatory, immunomodulating, antibacterial, antifungal and antiviral properties to those of calcium hydroxide. Moreover, as an oily substance, propolis may promote low-speed dissociation and diffusion when used as a component in an endodontic paste for primary teeth. It is also important for endodontic compounds to accompany the physiological resorption of primary teeth. The association of propolis with calcium hydroxide could aggregate the benefits of each material. However, propolis would not jeopardize the antimicrobial activity of calcium hydroxide. By testing a mixture of propolis and calcium hydroxide against a polymicrobial culture extracted from primary tooth root canals, better results were observed than those obtained with calcium hydroxide plus propylene glycol [20].

#### 6. Oral Ulcers

Honey adsorbs toxins from the mucous membrane and precipitate protein, so the pus and inflammatory exudates are adsorbed by the natural honey, thus protecting the underlying tissues and enhanced normal healing and the epithelialization. Sticky viscous properties of the natural honey, enables it adhere to the ulcer. This mechanism for coating the ulcer prevents it from secondary infection, and prevents ulcer surface from direct communication from different chemicals and microbes. No allergic mucosal reaction or toxic effects have been noted with honey usage [21].

#### 7. Wound Healing

The therapeutic features of honey seen in its usage in wound care elsewhere on the body indicate that it has the potential to be useful for prevention or treatment of infected wounds following tooth extraction or surgery, and for treating other oral infections. Elbagoury and Fayed in 1985 conducted a study describing a small clinical trial of placing honey in sockets before closure of wound, after surgical removal of impacted third molar and concluded that there was less pain, less incidence of postoperative complications and less swelling in honey treated group than in the untreated control group [22]. The effectiveness of honey in such an application is likely to be limited as it has a tendency to dissolve quickly in saliva and thus does not have a longer therapeutic effect. A novel wound dressing material consisting of gelled honey that has been developed (PCT patent application by the University of Waikato, December 2000) may be useful for this, and for the treatment of oral ulcers, as it adheres to the oral mucosa and is slow to dissolve in saliva. A similar rapid alleviation of pain was observed when the gelled honey was used in a case of erosion of the gum and jaw bone due to infection following surgery with bone grafting to repair damage to this case, the gelled honey was moulded into the infected area and held in place by wearing a mouth guard over



it[23].

### 8. Stomatitis Following Radiotherapy

The anti-inflammatory action and stimulating effect on tissue repair of honey could possibly be of benefit for the relief of oral conditions resulting from radiotherapy and chemotherapy of cancer. Publications on the use of honey on thermal burns to the skin report that honey reduces inflammation [24].

### 9. Anti-halitosis

Candy made with honey may also be useful for prevention of halitosis, as honey has been observed to give rapid removal of malodour from infected wounds. It would not be just the antibacterial action of honey involved, as bacteria would use the glucose in honey in preference to

amino acids, and thus would produce lactic acid instead of bad-smelling amines and sulphur compounds [25].

### CONCLUSION

Honey is a low-cost natural product that can be used for different purposes. Now, commercially honey is used in various industries for product formation and this trend is increasing day by day as industrialists are finding honey to be cheap source of sweetening agent without any side-effects as in case of synthetic sweeteners. The therapeutic properties of honey is evident in its usage in wound care which clearly give it potential for therapeutic use in field of dentistry, but there is need for the trials to be carried out before its usefulness is known. Risk of caries is reduced by selecting honey having a high level of antibacterial activity.

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