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Role of Phytotherapy in Gingivitis: A Review

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Abstract: There is a long and venerable history of the use of plants to improve dental health and promote oral hygiene. Plants contain phytochemicals such as alkaloids, tannins, essential oils and flavonoids which have pronounced antimicrobial activity. Plants have also been incorporated into dentifrices and have been used to provide natural chewing gums for oral hygiene, to treat toothache, gingivitis and periodontal disease. There is a potentially valuable role for Phytotherapy in assisting with the management of gingival and periodontal diseases. The evidence and research which supports such a role for a few plants and plant products has been reviewed in this study.

Key words: Phytotherapy, phytonutrients, phytochemicals, gingivitis, periodontal disease

INTRODUCTION

Chronic gingival inflammatory conditions primary etiology is often investigated to be bacterial plaque and its byproducts (Botelho *et al*., 2007). The association between poor oral hygiene, dental plaque and the severity of periodontal diseases is also well established (Botelho *et al*., 2007). Numerous antimicrobial agents have been and are being tested throughout the world in order to determine which agents are efficacious and safe in preventing plaque formation and/or inhibiting the colonization of periodontopathogens within the plaque (Tsao *et al*., 1982).

Plants (herbs) and naturally derived products from plants (herbal supplements) have been used to enhance health and for medicinal purposes for thousands of years (Cohan and Jacobsen, 2000). Most herbal supplements have been utilized for centuries based on empirical and testimonial support for their efficacy (Cohan and Jacobsen, 2000). Development in alternative medicine research has led to many mouth rinses and toothpastes based on plant extracts (Ozaki *et al*., 2006). The scientific evidence-based literature also supports the efficacy and safety of numerous herbs today (Cohan and Jacobsen, 2000). Hence scientific evaluation for safety and efficacy is needed for the drugs of alternative medicine (Subash *et al*., 2011).

TERMINOLOGY

Therapy comes from the Latin word *therapia*, originally from Greek therapeia, from therapeuein which means to treat medically. The Latin prefix phyto stands for plant and is called photon in Greek. In other words "Phytotherapy" can be called herbal medicine (http://www.scienceinafrica.co.za/2004/june/phytotherapy.htm) It is the study of the use of extracts from natural origin as medicines or health-promoting agents (Zhao, 2007). The term phytonutrients refer to plant nutrients with particular biological activities in supporting human health. Phytonutrients emphasize more specifically natural bioactive compounds from plants with general benefits to human health.

RATIONALE FOR PHYTOTHERAPY

Phytotherapy has a long history and has been used worldwide. For plant after plant, isolates demonstrate effects that are immune-enhancing, anti-inflammatory and anti-cancer (Lee, 2005). Some phytotherapy strategies have been well recognized since they have been extensively studied in chemistry and pharmacology and are partly proven by clinical trials (Jiang *et al*., 2005). There are also noted advantages of advocating phytotherapy which include (1) unique mechanisms of action, (2) typically low side-effect profiles, (3) low cost and (4) a high level of acceptance (Shoskes, 2002).

USEFUL PARTS AND ACTIVE CONSTITUENTS

Many plants are being studied for their potential as phytonutrients or phytotherapy materials (Jiang *et al*., 2005). The literature suggests several plants and plant parts which have anti-inflammatory, antioxidant,

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Table 1: List of useful plant parts and their active constituents

Plant	Generic name	Useful parts	Active constituents	Properties
Aloe	*Aloe barbadeusis*	Leaves	Anthraquinone	Anti-inflammatory
Amla	*Emblica officinalis*	Fruits	Vitamin C	Antioxidant
Babool	*Acacia arabica*	Bark	Tannins	Astringent
Blackberry	*Rubus fructicosus*	Leaves, root	Tannins	Astringent
Bloodroot	*Sanguinaria canadeusis*	Root	Alkaloids (primarily sanguinarine)	Astringent
Blueberry	*Vaccinium myrtillus*	Ripe berries	Anthocyanosides	Antioxidant
Caraway	*Caram carvi*	Dried ripe fruit, dried seeds	Volatile oil	Anti-inflammatory
Chamomile	*Matricaria chamomilla*	Dried flowers	Volatile oils, biflavanoids	Anti-inflammatory
Clove	*Syzgium aromaticum*	Flower buds	Volatile oil, tannins	Antiseptic, analgesic
Cranberry	*Vaccinium macrocarpon*	Fruits	Flavonoids, triterpinoids	Antioxidant
Echinacea	*Echinacea purpurea*	Root	Alkylamides	Immune system stimulant, increases interferon production
Eucalyptus	*Eucalyptus globosus*	Leaves	Volatile oil	Anti-inflammatory
Green tea	*Camellia sineusis*	Leaves	Polyphenols	Antibacterial
Horsetail	*Equisetum arveuse*	Stem	Silicic acid and silicates, K, Al, Mn, Biflavonoids	Antibacterial
Liquorice	*Glycyrrhiza glabra*	Root	Glycyrrhizin, flavonoids	Anti-inflammatory, antioxidant
Miswak	*Salvadora persica*	Bark, leaves	Tannins, volatile oils, alkaloids	Anti-inflammatory
Moringa	*Moringa oleifera*	Leaves, stem, roots	Carotenoids, vitamin C	Anti-inflammatory, antibacterial, astringent
Mulberry	*Morus alba*	Fruits	Anthocyanosides	Antioxidant
Myrrh	*Commiphora molmol*	Stem	Resin, gum, volatile oil	Antibacterial, astringent, analgesic, anticancer
Neem	*Azadirachta indica*	Leaves	Terpenoids	Antioxidant, anti-inflammatory, antibacterial
Peppermint	*Mentha piperita*	Leaves	Volatile oil containing menthol	Analgesic, counterirritant
Propolis	–	Resin itself	Flavonoids	Antibacterial, antioxidant, anticancer
Raspberry	*Rubus idaeus*	Leaves	Tannins	Astringent, anti-inflammatory
Rhatany	*Krameria triandra*	Root-bark	Tannic acid	Astringent
Rose	*Rosa canina*	Hips, leaves, flowers	Vitamin C, flavonoids, tannins, carotenoids, volatile oils	Antibacterial, antioxidant, astringent
Sage	*Salvia officinalis*	Leaves	Essential oil constituents	Antioxidant
Stinging nettle	*Urtica dioica*	Root, leaves	Polysaccharides, lectins	Anti-inflammatory
Tormentil	*Potentilla erecta*	Dried rhizomes (roots)	Tannins	Anti-inflammatory
Tulsi	*Ocimum sanctum*	Leaves	Ursolic acid, apigenin, luteolin	Anti-inflammatory
Turmeric	*Curcuma longa*	Dried rhizomes (roots)	Tannins	Analgesic, anti-inflammatory
White oak	*Qnercus alba*	Bark	Tannins	Astringent

antibacterial, astringent and other useful properties. These properties can be made use of in the treatment of gingival and periodontal diseases. Compared to plant-derived drugs that often consist of one single natural compound in combination with other minor chemicals, herbs or phytotherapy materials often contain multiple bioactive components with multiple targets during intake and therapy (Jiang *et al*., 2005). Various plants along with their useful parts and active constituents have been listed in Table 1.

Alkaloids are naturally occurring chemical compounds containing basic nitrogen atoms. They often have pharmacological effects and are used as medications (http://en.wikipedia.org/wiki/Alkaloids). Volatile oils are concentrated, hydrophobic liquids containing volatile aroma compounds from plants. Various essential oils have been used medicinally at different periods in history. Medical applications range from skin treatments to remedies for cancer (http://en.wikipedia.org /wiki/Volatile_oils).

Polyphenols are a group of chemical substances found in plants, characterized by the presence of more than one phenol unit. Polyphenols can be mainly divided into tannins, lignins and flavonoids (http: //en.wikipedia.org/wiki/Polyphenols). Tannins are astringent, bitter plant polyphenols that either bind and precipitate or shrink proteins. The anti-inflammatory effect of tannins helps control all indications of inflammation. The ability of tannins to form a protective layer over the exposed tissue keeps wounds from being infected further. Tannins are also beneficial when applied to the mucosal lining of the mouth (http://en.wikipedia.org/wiki/Tannins). Flavonoids are water soluble polyphenolic molecules containing 15 carbon atoms. They have antioxidant activityActivities attributed to flavonoids include: anti-allergic, anti-cancer, antioxidant, anti-inflammatory and anti-viral (http://www.phytochemicals.info /phytochemicals/flavonoids.php).

Vitamin C is essential to prevent disease associated with connective tissue and to improve immune cell functions. It is also used to regenerate vitamin E (Jiang *et al*., 2005). Carotenoids are organic pigments that are naturally occurring in the chloroplasts and chromoplasts of plants and some other photosynthetic

organisms like algae, some types of fungus and some bacteria. Most carotenoids have antioxidant activity and they are efficient free-radical scavengers (http://en.wikipedia.org/wiki/Carotenoids).

PREPARATIONS AND MARKERS

Phytonutrients have been traditionally used as tinctures, oils or as components of toothpastes and mouthrinses. They are predominantly for topical usage only and not for systemic consumption. Some phytonutrients may also be taken in the form of tea or boiled syrup.

Fine *et al.* (2007) stated that rinsing with an essential oil mouthrinse can have an impact on the subgingival plaque flora. Yamanaka *et al.* (2007) conducted a study in which it was concluded that cranberry polyphenol fraction inhibits biofilm formation and the Arg-gingipain and Lys-gingipain activities of *P. gingivalis*.

Al-Bayati and Sulaiman (2008) investigated the aqueous extracts of *Salvadora persica* for its antimicrobial activity against 7 isolated oral pathogens (*Staphylococcus aureus*, *Streptococcus mutans*, *Streptococcus faecalis*, *Streptococcus pyogenis*, *Lactobacillus acidophilus*, *Pseudomonas aeruginosa* and *Candida albicans*) and found that the extracts inhibited all the isolated microorganisms.

Hirasawa *et al.* (2002) determined the usefulness of green tea catechin for the improvement of periodontal disease using a slow-release local drug delivery system. Green tea catechin showed a bactericidal effect against black-pigmented, Gram-negative anaerobic rods and the combined use of mechanical treatment and the application of green tea catechin using a slow release local delivery system was effective in improving periodontal status.

Habiboallah *et al.* (2008) formulated a novel cost-benefit material by mixing ghee from sheep butterfat with the powdered rhizomes of *Curcuma longa* and evaluated its potential therapeutic effect on acceleration of surgical wound healing. They suggested a positive potential therapeutic effect on surgical wound healing particularly improvement of periodontal treatment consequences after surgery.

For comparison chlorhexidine gluconate 0.2% is considered to be the gold standard to treat human gingival disease (Rahmani and Radvar, 2005). A spartate aminotransferase appears to have the potential to serve as a biological marker to monitor orthodontic tooth movement (Rohaya *et al.*, 2009). Human gingival fibroblast (GHF1) cell lines were used to assess plant phytonutrients cytotoxicity using clonogenic assay and the total cellular GSH level was analyzed using a photometrical assay (Shokrzadeh and Ebadi, 2006). The bony turnover specifically the bone formation can be monitored through the expression of alkaline phosphatase activity in the gingival crevicular fluid during orthodontic treatment (Asma *et al.*, 2008). Spectrum of pathogenicity of the periodontal disease and effective management of diagnosis by use of multiplex PCR using the subgingival plaque samples (Faghri *et al.*, 2007). Subgingival plaque samples were used for presence of Epstein-Barr virus type 1 (EBV-1) in patients with chronic periodontitis with nested-PCR (Moghim *et al.*, 2007). The analysis of plaque index, gingival index and bleeding on probing can give vital data on gingival inflammation and plaque formation (Amoian *et al.*, 2010).

SIDE EFFECTS

Most phytotherapy strategies are ahead of the scientific basis and without strict controls in quality, safety and efficiency (Zhao, 2007). Certain herbals may cause direct effects on oral tissues, including tongue numbness, burning of the tongue and mouth/throat irritation (Cohan and Jacobsen, 2000). Toxicity is usually seen only when excessive amounts of phytochemicals are ingested. This is rarely encountered because phytotherapy for gingival inflammation usually involves only topical application and systemic administration is not required.

Another risk with herbal supplements, as with exposure to nearly all substances, is that of an allergic reaction that can manifest in the oral mucous membranes, gingiva, tongue, or elsewhere. Indirect oral effects may also be seen which include halitosis, excess saliva and blood pressure increase and irritability (Cohan and Jacobsen, 2000).

PHYTOTHERAPY RESEARCH IN INDIA

Use of plants as a source of medicine has been inherited and is an important component of the health care system in India. India is the largest producer of medicinal herbs and is appropriately called the botanical garden of the world. The officially documented plants with medicinal potential in India are 3000 but traditional practitioners use more than 6000 (Seth and Sharma, 2004). Several institutes in the country are working extensively in this area in order produce newer and more effective phytochemicals which can be manufactured on a mass scale and made available

to the common man at low and affordable costs. These include The Central Institute of Medicinal and Aromatic Plants (CIMAP) at Lucknow, The Indian Council of Medical Research (ICMR) at New Delhi, The French Institute of Pondicherry (FIP) at Pondicherry, The Central Drug Research Institute (CDRI) at Lucknow, The National Botanical Research Institute (NBRI) at Lucknow, The Tropical Botanic Garden Research Institute (TBGRI) at Thiruvananthapurnam and The Medicinal Plant Conservation Park at Auroville.

CONCLUSION

Phytotherapy, the most ancient medication, is still useful today. It can be believed that many unstudied plants might have some secrets for the medical world (http://www.wisegeek.com/what-is-phytotherapy.htm). However, concerns from scientists, professionals and customers continuously arise, due to increases in the use of phytochemicals. Quality, safety, long-term adverse effects and toxicity are the primary concerns (Zhao, 2007). A systematic approach through experimental and clinical validation of efficacy is required for a plant identified for phytotherapy, as is done in modern medicine; animal toxicity studies are also required to establish the potential adverse effects.

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