

Herbs in Dentistry

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Abstract: Herbal extracts are used in dentistry for treatment of various dental disorders. The natural photochemical could offer an effective alternative to antibiotics and represent a promising approach to prevention and therapeutic strategies for various oral infections. The herbal remedies have an edge over conventional antibiotic treatment that suffer the limitation of low benefit to high risk as compared to herbal treatment that possess high benefit to low-risk ratio. The literature shows that several herbal formulations have the capacity to control the production of proinflammatory mediators, thereby managing many inflammatory processes. The use of such herbal anti-inflammatory formulations for a longer period of time was found to be safer than that of chemical anti-inflammatory drugs. Studies for assessment of safety and efficacy of herbal remedies are in its infancy. These herbal remedies are expected to widely use in future. There are much more opportunities for further research in the utility of herbal remedies for oral diseases.

Keywords: Dental diseases, Dental treatment, Herbal dentistry, Periodontitis

I. Introduction

Oral diseases continue to be a major health problem worldwide. Dental caries and periodontal diseases are among the most important global oral health problems, although other conditions like oral and pharyngeal cancers and oral tissue lesions are also of significant concern. Oral health is integral to general well-being and relates to the quality of life that extends beyond the functions of the craniofacial complex. Herbs have been used for centuries to prevent and control dental disease. Herbal extracts are effective because they interact with specific chemical receptors within the body. Herbal medicines have less side-effect in comparison with traditional medicines, but side-effects do occur. Herbal products can vary in their potency. [1] The global need for alternative prevention and treatment options and products for oral diseases that are safe, effective and economical comes from the rise in disease incidence (particularly in developing countries), increased resistance by pathogenic bacteria to currently used antibiotics and chemotherapeutics, opportunistic infections in immune-compromised individuals and financial considerations in developing countries. Despite several chemical agents being commercially available, these can alter oral microbiota and have undesirable side-effects such as vomiting, diarrhea and tooth staining. Hence, the search for alternative products continues and natural phytochemicals isolated from plants used in traditional medicine are considered as good alternatives to synthetic chemicals, herbal products are also being increasingly used as sedatives, or plaque reduction and healthy gums.

a. Phytotherapeutic substances are generally classified into three groups

- Plant products
- Animal products
- Mineral origin.

b. In dentistry, they are used as

- Antimicrobial agents
- Anti-inflammatory agents
- Sedative and anxiolytics.

c. Miscellaneous endodontic irrigants, medicaments and

Herbal compounds are recommended in the treatment of serious and purulent gingivitis and mucositis, superficial periodontitis, catarrhal tongue inflammation, toxic oral cavity inflammation, mycosal infections and difficult healing of post-operative wounds. Herbal medications are also administered to soothe oral symptoms of systemic diseases. Plant compound can be a powerful and the dominant drug when an inflammation caused by local irritating factor appears. Most important features of herbal medicament are its anti-inflammatory, antiseptic, analgesic, astringent, edema-reducing, soothing and healing accelerating properties. [2] Herbs owe their healing properties to biologically active compounds they contain. Some of these compounds were isolated or obtained by bio-guided isolation after previously detected characteristic activity of the part of the plant. These compounds are flavonoids, coumarins, iridoid glycosides, phenolic acids, resins, triterpens, phytoesters, choline, carotenoids, tannins, vitamins and mineral salts (magnesium, iron, lithium) and essential oils. The most popular are flavonoids and essential oils. [3, 4]

The natural products derived from medicinal plants such as neem, tulsi, amla, dhatura, nimbu etc., have proven to be abundant source of biologically active compounds, many of which have become the basis for the

development of new leadchemicals for pharmaceuticals. As there are approximately 500000 plant species occurring worldwide, of which only 1% has been phytochemically investigated, there is great potential for discovering novel bioactive compounds from these sources. Therefore, the purpose of this review is to present some recent examples of traditional medicinal plant extracts or phytochemicals that have been shown to inhibit the growth of oral pathogens, reduce the development of dental plaque, and reduce the symptoms of oral diseases. [4]

II. Herbs In Practice [5,6,7,8]

Clove (*Syzygium aromaticum*)

Clove consists of essential oil, eugenol, eugenol acetate and β -caryophyllene. It has analgesic, antibacterial, antiviral, anti-inflammatory, antioxidant property. Clove essential oil has a safety record a mile long with documented use as a breath freshener. It has been used to relieve toothache, in periodontitis, as an anesthetic and also to treat bleeding gums. Clove gel can provide dentists with an alternative to benzocaine for topical anesthesia in their daily practice, especially for use with children and in areas where cost and availability limit access to pharmaceutical topical anesthetics. It is available as a tincture (1:5, 25% ethanol), lozenges and mouthwash.

Tea Tree Oil (*Melaleuca alternifolia*)

It is more commonly known Australian tea tree oil as, is a native Australian plant with many properties such as being an antiseptic, an antifungal agent, non-irritant and a mild solvent. Tea tree oil's major active component is terpinen-4-ol (30%–40%). It stimulates the immune system and is effective against a broad range of bacterial and fungal infections. Using tea tree oil orally is not recommended as it may cause possibly serious side effects such as confusion, loss of muscle control, or coma. In dentistry, tea tree oil has been used to destroy microorganisms in the mouth before dental surgery, removal of smear layer when used as a root canal irrigant and to relieve mouth soreness caused by dental procedures.

German Chamomile

It has been used for centuries as a medicinal plant mostly for its anti-inflammatory, analgesic, antimicrobial, antispasmodic and sedative properties. Chamomile is usually taken as a tea or a liquid extract. The common dose of chamomile extract is 1 ml to 4 ml in water three times a day. Major uses are in gingivitis, periodontal disease and ulcers as a mouth wash. Usually considered to be safe during pregnancy or breastfeeding. However, certain risks and adverse effects have been advocated like vomiting at high doses and multiple skin rashes and anti-platelet action resulting in uncontrolled bleeding with the use of this herb.

Coconut Water (*Cocos Nucifera*)

The name coconut comes from Spanish and Portuguese word coco, which means "monkey face." Coconuts are the fruit of the coconut palm, botanically known as *Cocos Nucifera*, with *nucifera* meaning "Nut-bearing." In Sanskrit, the coconut palm is known as *Kalpavriksha*, meaning "tree which gives all that is necessary for living," since nearly all parts of the tree can be used in some manner or another. Health benefit of coconut water includes low in carbohydrates, 99% fat free and low in sugar. Coconut water is very stuff of nature; biologically pure and full of natural sugars, salts, vitamins. Because its electrolyte (ionic mineral) content is similar to human plasma, it has gained international acclaim as natural sports drink for oral dehydration. Coconut water's unique nutritional profile makes an excellent oral rehydration, enhances immune function, possesses anti-aging properties, decreased swelling, relieve spasm, root canal irrigant (antiviral, antifungal and antimicrobial properties) and storage media for avulsed tooth. [9] A new storage media, coconut water, in maintaining viable periodontal ligament (PDL) cells on avulsed teeth, may be better alternative to Hank's Balanced Salt Solution or milk.

Cranberry

Could a cranberry a day keeps the dentist away? Cranberries contain numerous biologically active compounds including flavonoids, phenolic acids, anthocyanins, condensed tannins, and antioxidants. Researchers from the University of Rochester School of Medicine and Dentistry, and Rutgers University, New York, found that many of these substances can not only inhibit the enzymes associated with the formation of the dental plaque polysaccharide matrix film, but can stop the bacteria sticking to surfaces, ensuring that plaque is never given the chance to form. The compounds also prevent acid formation and reduce the acid tolerance of the bacteria that cause decay hence preventing prevent tooth decay and gum disease. However, these findings should be treated with a degree of caution because Cranberry juice is naturally very acidic and can cause erosion of teeth if taken too often. This can lead to pain and sensitivity in the teeth.

Green Tea (*Camellia sinensis*)

Green tea contains polyphenol contents comprising catechin (C), epicatechin (EC), gallicocatechin (GC), epigallocatechin (EGC) epicatechingallate (ECG), and epigallocatechingallate. It is anti-inflammatory, antibacterial, antiviral. Used in the treatment of periodontal disease.

Propolis

Propolis is a complex mixture made up of plant-derived and bee released compounds. It has got a wide range of activity as anesthetic, antibacterial, antifungal, antiviral (including anti- HIV-1 activity), antioxidant, anticarcinogenic, antimutagenic, antithrombotic and immunomodulatory. It has been used in dental caries, gingivitis, storage medium, intracanal medicament, dentinal hypersensitivity, relief from denture ulceration, stomatitis, halitosis, mouth freshener, periodontal pocket/abscess, dentinal sensitivity, lichen planus, candidal infections, angular cheilitis, xerostomia, traumatic ulcers, pulp capping, temporary restorations and dressings, covering tooth preparations, dry socket, pre-anesthetic, and pericoronitis. [10]

Tulsi (*Ocimum sanctum*)

Tulsi consists of tannins (4.6%) and essential oil (up to 2%), eugenol (up to 62%), methyleugenol (up to 86%), and α - and β -caryophyllene (up to 42%), methylchavicol, linalool and 1,8-cineole. It has got antihelminthic, analgesic, antipyretic, immune stimulatory, antiulcer, antimicrobial, anti - inflammatory property. Used in periodontitis. Contraindicated in pregnant and lactating women, used with caution in children.

Triphala

Triphala is a well-known powdered preparation in the Indian system of medicine which is a combination of amalaki, haritaki and bibhitaki. Amalaki contains ascorbic acid, thiamin, riboflavin and niacin. It comprises β -sitosterol, gallic acid, ellagic acid, ethyl gallate, galloyl glucose and chebulagic acid, Haritaki contains chebulagic and chebulinic acid, as well as corilagin. It is antioxidant, antimicrobial. Used in dental caries, bleeding and ulcerated gums. Triphala has free radical scavenging property thus aiding in the protection of gum cells effectively from free radicals produced by the microorganisms. [11]

Marigold (*Calendula officinalis*L.)

It is native to the Mediterranean areas. It is used for the treatment of skin disorders and pain, to facilitate healing after oral surgery and in oral cavity inflammations. It has also anti-edematous activity

Garlic (*Allium sativum*L.)

It is chopped and held in the mouth for 5 minutes to sterilize the oral cavity, which is due to its strong antibacterial activity. Fresh garlic juice kills *Streptococcus pyogenes* and *orynbacteriumdiphtheriae* in 2-3 minutes time. [12,13]

Aloe (*Aloe arborescens*Mill.)

Aloe contains compound metals and vitamins as well as organic acids, mineral salts (zinc, copper, molybdenum), polysaccharides, amino acids, enzymes, saponins, resins, aloin. It has strong immunomodulating and healing properties. [2] It is analgesic, antibacterial, antiviral, antifungal, antioxidant immune modulating, antiseptic, anti-inflammatory. Aloe vera is used in the sites of periodontal surgery, toothpick injuries, chemical burns, aphthous ulcers, gum abscesses, dry socket, lichen planus, benign pemphigus and gingival problems associated with AIDS, leukemia, migratory glossitis, geographic tongue and burning mouth syndrome, denture sore mouth, candidiasis, desquamative gingivitis, vesiculobullous diseases, acute monocytic leukemia, xerostomia. [14]

Neem (*Azadirachta Indica*)

In India the neem tree has been reserved as the village pharmacy for centuries, with every part of this miracle tree being used. The twigs as a toothbrush, the bark for healing gum disease, the oil for soap, and the leaves for medicine. Neem is used in many preparations to improve health but is generally known for its marvelous powers of preventing and healing gum diseases and other dental problems. The inhibitory effects of neem upon bacterial growth, adhesion to hydroxyapatite on tooth surfaces, and production of insoluble glucan, which may affect in vitro plaque formation. [15]

Turmeric (*Curcuma longa*)

Chemical constituents of turmeric include volatile oil (6%) composed of a number of monoterpenes and sesquiterpenes, including zingiberene, curcumin, α - and β -turmerone. It is antimutagenic, anticarcinogenic, antioxidant, antibacterial and used in dental caries, oral lichen planus, gingivitis, halitosis, pit and fissure

sealant, dental plaque detection system. Massaging the aching teeth with roasted, ground turmeric eliminates pain and swelling. [16]

ArctiumLappa

This plant has been brought from Japan and acclimated in Brazil, which is widely used in popular medicine all over the world for its well-known therapeutic applications. It has anti-bacterial and antifungal activity, diuretic, anti-oxidant and anxiolytic action, anti-platelet effect and HIV-inhibitory action. It has been demonstrated that *A. lappa* exhibits antimicrobial activity against oral microorganisms and can be used as intracanal medication for 5 days in teeth infected with *C. albicans*, *E. coli*, *L. acidophylus*, *P. aeruginosa* and *S. mutans* inhibited microbial growth after 14 days.

Evening Primrose Oil

It is an interesting and known modulator of inflammation. It has been tested as a possible means of controlling inflammatory conditions such as arthritis and Sjögren syndrome. Gamma Linolenic acid levels are depressed in patients with Sjögren syndrome. Early studies showed evening primrose oil, combined with B-complex vitamin supplementation, had a positive effect on Sjögren syndrome after 8 weeks of treatment as measured by tear production.

Grape Seed Extract

Grape seed extract contains proanthocyanidins (PA) which are potent antioxidants and are known to possess anti-inflammatory, antibacterial and immune-stimulating effects. It has been reported to strengthen collagen based tissues by increasing collagen cross-links. In a study conducted to determine re-mineralizing effects of grape seed extract on artificial root caries, results showed that is a promising natural agent for non-invasive root caries therapy. [17]

Papaine

Papaine is a proteolytic enzyme that comes from the latex of the leaves and fruits of the green adult papaya. It has an anti-inflammatory, bacteriostatic, bactericidal characteristic and is effective against gram positive and gram negative organisms. Similar to human pepsin, papaine acts as a chemical debridement anti-inflammatory agent, which does not damage healthy tissues and accelerates cicatrization process. Papaine acts only in infected tissue as it lacks a plasmatic antiprotease called α -1-anti-trypsin. The absence of this enzyme in infected tissues allows papaine to break the partially degraded collagen molecules only, contributing to the degradation and elimination of fibrin "mantle" formed by carious process. The principle that an active ingredient acts on the predegraded collagen of the lesion, promoting its softening, without acting on healthy adjacent tissue and without causing pain, has made this technique an effective alternative for treatment of carious injuries.

Septilin

Septilin is an ayurvedic preparation which contains various herbs and minerals. These medicinal plants possess immunomodulatory and anti-inflammatory properties that aid in strengthening the immune system and potentiating the nonspecific immune responses of the body. Septilin has been shown to have antibacterial, anti-inflammatory, antiexudative, and immunostimulatory effects and is effective in respiratory tract infections, tonsillitis, and other infections [18]

III. Side Effects Of Phytoedicine [19,20]

It is a very common belief worldwide that 'herbal products' are safe. Therefore, people increasingly rely on their medicinal properties for different purposes (Little, 2004). There has been an increasing concern regarding such products in dentistry. However, few reports concerning the adverse effects of these natural products were found in the literature. Despite a wide range of side effects associated with phytoedicine in humans, the following adverse effects are limited to the phytotherapeutic agents most commonly used in dentistry.

Allergy [21]

Tea tree oil, extracted from *M. alternifolia*, has been reported as causing allergic contact dermatitis. Its essential oil contains turpentine (limonene, alpha-pinene, phellandrene) which is potentially allergenic (Khanna *et al.*, 2000; Fritz *et al.*, 2001). Several studies were found to investigate the allergenic properties of castor beans, from which castor oil is extracted. Individuals have reported asthma after exposure to castor beans (Panzani and Johansson, 1986). Castor oil might cause contact dermatitis (Di Berardino and Della Torre, 2003). Allergic reactions might also be associated with *E. purpurea*. Therefore, patients with allergy or

asthma should consider not using *E. purpurea*. Other plants, such as *M. officinalis* and *A. sativum*, might also cause contact dermatitis (West and Maibach, 1995; Messina, 2006). Allergic conjunctivitis has been associated with chamomile (*M. chamomilla*) tea (Subiza *et al.*, 1990).

Gastrointestinal effects [22,23]

Ricinoleic acid (active component of castor oil) is commonly used in laxative formulations. The cathartic dose of castor oil ranges from 15–60 mL (15–60 g) in adult humans. However, laxative effects have been reported at 4 mL doses. Other castor-oil-related side effects are nausea, vomiting and colic (Burdock *et al.*, 2006). *E. purpurea* and *V. officinalis* might cause gastrointestinal upsets or dysfunction (Huntley *et al.*, 2005; Hadley and Petry, 2003). Few individuals have experienced emesis with passionflower at medicinal doses, while moderate doses might cause antispasmodic or somewhat narcotic effects, and excessive doses have produced spasms and even paralysis in animals (Smith *et al.*, 1993). Nausea and diarrhea were reported when lemon balm was used at doses of 900 and 1200 mg/day (West and Maibach, 1995).

Central nervous system effects and other systems

Other effects of the lemon balm at high doses include increasing intraocular pressure, headache, tiredness, sleep disturbances and palpitation (West and Maibach, 1995). *V. officinalis* showed side effects such as headache/dizziness and residual sedation was observed at 900 mg doses (Hadley and Petry, 2003). *P. incarnate* caused vasculitis in patients suffering from insomnia (Smith *et al.*, 1993). There are some evidences that labour induction is associated with castor oil (Lippert, 1997). Rodrigues (2007) identified 57 plants, including castor oil, and restricted their use in the case of pregnancy due to their abortive, contraceptive or toxic properties. However, none of them are currently used in dentistry.

IV. Phytotherapeutic Interactions [22,24]

Important drug interactions can occur between some herbal products and conventional drugs; however, information on such association is scarce in the literature. *M. chamomilla* has a theoretical risk for potentiation of the anticoagulation effects of warfarin. In a case report, a 70-year-old woman who, while being treated with warfarin, was referred to the hospital with multiple internal hemorrhage after using chamomile products (Segal and Pilote, 2006). *V. officinalis* was reported to prolong thiopental and pentobarbital-induced sleep. It might be expected to potentiate the sedative activity of drugs such as midazolam and diazepam. It is wise to avoid the concurrent use of valerian and barbiturates and/or benzodiazepines (Ang-Lee *et al.*, 2001). *P. incarnate* should be taken with caution when used concomitantly with other CNS depressants, stimulants and phenelzine, a MAO inhibitor agent (Miller, 1998). Its muscle relaxing action has been enhanced by the concomitant use of aminoglycoside antibiotics. *M. officinalis* combined with alcohol and barbiturates might increase sedative and hypnotic effects (Kennedy *et al.*, 2004).

V. Perspectives Of Phytomedicine Use In Dentistry [22,25,26,27]

The present study has addressed many plants with potential source for new therapies in dentistry. Almost all studies listed here have shown important medicinal activities of plants; however, most of them were *in vitro* studies, suggesting the need for further clinical or more specific assays. Many plants have shown lower toxic potential and good pharmacological activity, but there are few studies investigating these plants. In addition, there is a great demand in dentistry for new and better substances to inhibit or suppress bacteria and biofilm formation, to improve the quality of the dental treatment, and to facilitate some dental procedures.

VI. Conclusion

The use of plants and herbs for dental care is a very common indigenous system of medicine and it must be included in everyday life. The active principles of plants should be incorporated into modern oral health-care practices and dentists should be encouraged to use natural remedies in various oral health treatments. Herbs are used to reduce inflammation, and calm and soothe irritation. Herbs may be used internally as pills, syrups, and infusions, or externally as poultices, plasters, and liniments. This will make dentistry much safer, affordable and more accessible for the lower socio-economic groups in society. In future, studies on efficacy of ayurvedic herbs should be carried out in developing countries like India to establish their therapeutic benefits either alone or in combination with conventional therapies.

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Table 1.List of useful plant parts and their active constituents [19]

Plant	Generic Name	Useful parts	Active constituents	Properties
Aloe	<i>Embliaofficinalis</i>	Fruit	Vitamin C	Anti-inflammatory
Amla	<i>Aloe barbadensis</i>	Leaves	Anthraquinone	Antioxidant
Babool	<i>Acacia Arabica</i>	Bark	Tannins	Astringent
Blackberry	<i>Rubusfruticosus</i>	Leaves, root	Tannins	Astringent
Bloodroot	<i>Sanguinaria canadensis</i>	Root	Alkanoids	Astringent
Blueberry	<i>Vacciniummyrtillus</i>	Ripe berries	Anthocyanosides	Antioxidant
Caraway	<i>Caramcarvi</i>	Dried ripe fruit	Volatile oil	Anti-inflammatory
Chamomile	<i>Matricariachamomilla</i>	Dried flowers	Volatile oils, biflavanoids	Anti-inflammatory
Clove	<i>Syzygiumaromaticum</i>	Flower buds	Volatile oil, Tannins	Antiseptic, analgesic
Eucalyptus	<i>Eucalyptus globosus</i>	Leaves	Volatile oil	Anti-inflammatory
Green tea	<i>Camellia sinensis</i>	Leaves	Polyphenols	Antibacterial
Horsetail	<i>Equisetum arvense</i>	Stem	Silicic acid and silicates	Antibacterial
Liquorice	<i>Glycyrrhizaglabra</i>	Root	Glycyrrhizin, flavanoids	Anti-inflammatory, antioxidant
Miswak	<i>Salvadorapersica</i>	Bark, leaves	Tannins, volatile oils	Anti-inflammatory
Moringa	<i>Moringaoleifera</i>	Leaves, stem, roots	Carotenoids, vitamin C	Anti-inflammatory, Astringent
Mulberry	<i>Morus alba</i>	Fruits	Anthocyanosides	Antioxidant
Myrrh	<i>Commiphoramolmol</i>	Stem	Resin, gums, volatile oil	Antibacterial, astringent, analgesic, anticancer
Neem	<i>Azadirachtaindica</i>	Leaves	Terpenoids	Antioxidant, anti-inflammatory, antibacterial
Peppermint	<i>Menthe piperita</i>	Leaves	Volatile oils	Analgesic, counterirritant
Propolis	Resin itself	Flavonoids		Antioxidant, antibacterial, antibacterial,
Raspberry	<i>Rubusidaeus</i>	Leaves	Tannins	Anti-inflammatory, Astringent
Rhatany	<i>Krameriatriandra</i>	Root-bark	Tannic acid	Astringent
Rose	<i>Rosa canina</i>	Hips, leaves, flower	Tannins, vitaminC	Astringent, Antibacterial
Sage	<i>Salvia officinalis</i>	Leaves	Essential oil	Antioxidant
Stinging nettle	<i>Urticadioica</i>	Root, leaves	Polysaccharides, lectins	Anti-inflammatory
Tormentil	<i>Potentillaerecta</i>	Dried roots	Tannins	Anti-inflammatory
Tulsi	<i>Ocimum sanctum</i>	Leaves	Ursolic acid, apigenin, luteolin	Anti-inflammatory
Turmeric	<i>Curcuma longa</i>	Dried roots	Tannins	Analgesic, anti-inflammatory
White oak	<i>Quercus alba</i>	Bark	Tannins	Astringent
Cranberry	<i>Vacciniummacrocarpon</i>	Fruits	Flavanoids, triterpinoids	Anti-oxidant
Echinacea	<i>Echinacea purpurea</i>	Root	Alkylamides	Immune system stimulant