



NATURAL AND HERBAL AGENTS IN PERIODONTAL THERAPY

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ABSTRACT

Since the dawn of civilization, herbal medicines have been used as a traditional and safest mode of medical care to treat various ailments and to prevent diseases. Use of plants or plant extracts that can be eaten / applied to the skin, is a method of cure which is known as herbalism. It assists in promoting both preventive and therapeutic properties in its approach with minimum adverse effects in comparison to the modern medicines, and have been reported to show negligible cytotoxic effects in in-vitro as well as in-vivo studies performed. It has been hypothesized that until date only 1% of available plant species have been phytochemically investigated. Thus, there is great potential for discovering novel bioactive compounds.^[1,2] It is due to their wide spectrum of biological and medicative activities, lower prices, and better margin of safety. This article aims at describing the varied herbs with inhibitor capability and their efficiency within the treatment of periodontal diseases.

KEYWORDS: herbal medicines, plant extracts.

INTRODUCTION

Periodontal treatment focuses mainly to eliminate gingival inflammation, bleeding, minimize periodontal pocket depth and arrest destruction of soft tissue and bone by removal of the microbial deposits from the supra and subgingival surfaces, along with shift the pathogenic microbiota on the side of periodontal health. Therapeutic approach includes mechanical scaling and root planing (SRP) which causes a conducive change in the subgingival microbiota.^[3]

Antimicrobials administered locally or systemically that specifically target subgingival organisms within the biofilm change the subgingival environment.^[4] A wide spectrum of anti-microbial agents have evolved in recent years. People now are becoming more aware of and interested in alternative natural preparations in order to avoid the problem of hazardous side effects brought on by synthetic allopathic treatments.^[5]

Herbal preparations act as active ingredient components of plants or alternative plant materials which are perceived to have therapeutic edges. A good number of anti-microbial agents have been evolved in recent times and the acceptance of these natural substances is gaining momentum in dental medicine.

The use of few such herbs for medicinal purposes is traced only in the recent evidence-based era where methodical and systematic approach to study their properties have been given utmost importance. This has paved a wider path for their application in all healthcare specialties including periodontics. Thus, this article aims to emphasize briefly about the various natural or herbal plant extracts which have found various applications in the field of periodontics.

HISTORY OF MEDICINAL HERBS

India holds a special place in the globe where several acknowledged indigenous medical systems, including Ayurveda, Siddha, Unani, Homeopathy, Yoga, and Naturopathy, are used in the field of healthcare. India is known as the world's botanical garden and is the nation that produces the most medicinal herbs.^[6] During the Dark Ages the Europeans considered the use of botanicals as invasive or toxic medicinal practice, however the Renaissance years saw a revival of ancient medicine, which was built largely on plant medicinals.^[7]

Hippocrates, in the late fifth century BC, cited 300– 400 medicinal plants. Dioscorides published De Materia Medica, a medicinal plant catalog in the first century AD, which served as the foundation for modern pharmacopoeias. The Bible offers descriptions of ~30 healing plants. The Mayan culture developed several

uses for medicinal plants. As an effective anaesthetic, they employed the root stem of chicalote (*Argemone Mexicana* L. [Papaveraceae]) to relieve tooth pain. According to WHO, 80% of the world's population, rely on plant-derived medicines for their health care.^[8]

BENEFITS OF HERBAL MEDICINE

Herbal medicine has a long era of use and patient tolerance along with higher public acceptance. These have fewer negative effects while also having preventive effects and stimulating the body's regulatory action of its defensive mechanisms against outside threats. In contrast to allopathic medicines that are prescribed for a selected or a predetermined condition, the herbal medicine might act on totally different targets at the same time or may act as a co-treatment with the standard medications with their therapeutic effect lasting longer owing to its higher versatility.

Plants used

- **Role of turmeric (*Curcuma longa*)**

Turmeric a herbaceous plant rhizomatous in nature belongs to the ginger family (Zingiberaceae). The most commonly used form of turmeric is in form of powder (Haldi) which is obtained from the root of the plant. It has a hot, peppery, and occasionally has a bitter flavour.

It is very helpful in dentistry since it possesses antibacterial, antioxidant, astringent, and anti-inflammatory qualities.^[9-10] Turmeric (*Curcuma Longa*) has been used as a pit and fissure sealant and also as an ingredient in a plaque detection system.^[11] Massaging the teeth with roast ground turmeric eliminates swelling and pain. A 2009 study by **Chaturvedi et al.** showed that turmeric gargle, comparable to chlorhexidine gluconate, is particularly effective when used as a complementary measure to mechanical plaque removal techniques to control of plaque build-up that results in gingivitis.

In a study, when scaling and root planing was done in combination with the local drug delivery system, containing 2% turmeric gel **Behal et al 2011**; noted a huge reduction within the trypsin-like enzyme activity of "red complex" species.^[12]

- **Role of Neem (*Azadirachta indica*)**

The ayurvedic procedure of using Neem (Arishth) plant comprises of healing and rejuvenate gum tissues, arresting tooth decay and further preventing gum diseases. A number of anti-plaque activity of Arishth chew sticks had been discovered which helped in mechanical plaque control. However, it is not only limited to that, the plant additionally contains chemotherapeutic antiplaque agents like the Gallo tannins, which at the starting stages of plaque formation effectively scale down the measure of pathogenic microbes from binding to the tooth surface by increasing their physical removal from the oral fissures through aggregate formation.^[13]

Neem leaf extract helped to reduce bacteria and plaque levels that cause the progression of periodontitis. In a study conducted, when compared to a control group, patients who used neem gel saw an improvement in their periodontal health. (**Pai et al 2004**).^[14]

- **Role of Tulsi (*Ocimum sanctum*)**

Ancient history suggests of Tulsi "The Queen of Herbs" also known as Holy Basil, have been adored in India for its health benefits. It is an aromatic plant which by chewing a few raw leaves facilitates in maintaining oral hygiene.

This plant hosts Carracrol and Tetpene as the antibacterial agents along with Sesquiterpene β – caryophyllene.^[15] The anti-inflammatory properties of Tulsi, which also make it a for gingivitis and periodontal disease, have also been found to be beneficial in preventing bad breath.^[16] A clinical study conducted by **Bansal et al.** assessed the effectiveness of a herbal mouthwash containing Tulsi and found that while it was less effective than chlorhexidine gluconate, the rinse was still a powerful plaque inhibitor.^[17]

- **Role of Acacia catechu (*Wild*)**

The herb Acacia catechu is a member of the Fabaceae family and Mimosoideae subfamily. Commercially, it can be supplied as Katha or Black Khair (a concentrated filtered extract). The crystalline portion of this concentration is chewed with the betel leaf. This plant is used as a mouthwash for gingival infection like gingivitis, stomatitis. Another form of cutch known as "khersal" is found in wood cavities, which is available as crystalline deposits and are reported to have an antibacterial action.^[18]

An herbal tooth powder formulation that contained powder from Acacia catechu, menthol, and camphor in equal amounts was tested in a clinical study by **Ernst et al.** in 2000. Without using any abrasives, it efficiently removed plaque stains or patches, cleansed, and polished tooth surfaces. The dentifrice herbal tooth powder reported a significant reductions in plaque, gingivitis, and dental calculus scores of about 87-95%, 70-72%, and 80-95% after 15 days.^[19]

- **Role of Pomegranate (*Punica granatum*)**

Pomegranate is a deciduous or evergreen tree whose fruit is used for the treatment of throat infections, coughs, and fever due to its anti-inflammatory as well as anti-microbial properties.^[20] Analysis shows that pomegranate extract was better against the adherence of biofilm species than a pharmaceutical antifungal when 3 or 4 microorganisms were involved.^[21] Researchers found that active components of pomegranate, which include polyphenolic flavonoids (such as punicalagins and ellagic acid), reduce oxidative stress in the oral cavity, possess direct antioxidant activity, anti-inflammatory effects, antibacterial activity, and

mechanical removal of plaque (from the teeth) directly.^[22-29]

In a study, evaluating the results of pomegranate on gingivitis, the findings showed an impressive reduction in gingival haemorrhage after employing a dentifrice containing the pomegranate extract. In another study, pomegranate fruit extract gel was found to be active against *S. sanguis*, *S. mutans* and *S. mitis* by inhibiting their adhesion on to the glass surface and that it could be used to prevent adherence of various microorganisms in the oral cavity (Atal *et al* 1982).^[29]

- **Role of Aloe Vera (*Aloe barbadensis miller*)**

The name was derived from the Arabic 'alloe' means "bitter" because of the bitter liquid found in the leaves, while 'vera' in Latin means "true".^[30] The Aloe Vera plant produces a transparent, skinny tasteless jelly-like material referred to as aloe vera gel. This gel enhances the wound healing method by eliminating that bacterium which are considered to cause inflammation.^[31] Studies determined a huge reduction in plaque and gingivitis when use of mouth rinse containing aloe with toothbrushing occurred monthly. In type 2 diabetes mellitus patients with chronic periodontitis, a clinical trial by Pradeep *et al.* (2015) showed that intra-pocket application of aloe vera gel improved clinical parameters like plaque index, probing pocket depth, and gain in clinical attachment.^[33]

- **Role of Garlic (*Allium sativum*)**

Garlic extracts (*Allium sativum*) have demonstrated anticaries activity. *S. mutans* is one within the topmost etiological organisms in caries development. The use of garlic extracts has shown to be effective against *S. mutans*. In a study, the antibacterial effects of garlic's allicin on periodontal infections were evaluated. In spite of *P. gingivalis* appearing to be rather insensitive to allicin, a study found that *Aggregatibacter actinomycetemcomitans* and *Fusobacterium nucleatum* growth were suppressed at a minimum allicin concentration of 300 g/ml (Bachrach *et al* 2011).^[35]

Grosso *et al.* revealed that a mouthwash containing garlic extract was more efficient at lowering the total number of bacteria in the saliva as well as the number of streptococcal mutans. Garlic has a notable inhibitory impact on *C. albicans*, according to Ghannoum *et al.*^[37]

- **Role of Cloves (*Syzygium aromaticum*)**

Popularly used as a spice, cloves are the dried flower buds of an East Indian archipelago evergreen tree. Clove preparations containing eugenol are frequently used in dentistry for gum soreness, temporary fillings, and root canal treatment. All food-borne organisms tested, including *Escherichia coli* (*E. coli*), *Staphylococcus aureus*, and *Bacillus cereus*, were nearly killed by 38-3% aqueous clove extract. Clove extract also had significant inhibitory effect at 1% concentration.^[39] Since the 13th century, clove has been utilized as analgesic for toothaches, joint pain, and as an antispasmodic; the

primary component responsible for this effect is eugenol. The mechanism responsible is due to the activation of calcium and chloride channels in ganglionic cells.^[40]

- **Role of Mango (*Mangifera indica*)**

Mango is a fruit that belongs to family of Anacardiaceae which contains ascorbic and phenolplastic acids that are believed to possess medicament and antibacterial properties.

Shabani *et al* 2014 demonstrated that the aqueous and ethanol extract of leaves and stems of mango at 50 and 25 mg/mL had antibacterial activity against; *Staphylococcus aureus*, *Streptococcus pyogenes*, *Streptococcus pneumoniae*, *Pseudomonas aeruginosa*, *Candida albicans*, *Enterococcus faecalis*.^[41]

Mango is also a reservoir of anti-inflammatory, antimicrobial, antioxidant, radioprotective, immunomodulatory, antitumor, anti-allergic and antidiabetic properties. Mangiferin has demonstrated promising therapeutic potential both in the prevention and treatment of periodontitis. Few in-vitro studies suggest, neem and mango stick extracts are rivals to oral streptococci responsible for variety of oral illnesses. According to literature reviews, few vivo studies conducted made a tremendous impact of neem and mango stick extracts on plaque and gingiva on experiments conducted globally.^[42]

- **Role of Lemongrass (*Cymbopogon citratus*)**

Lemongrass oil is derived from the medicinal plant lemon grass (*Cymbopogon citratus*), a member of the Germinae family of Andropogon plants and of the Cymbopogon division. In a study Shah *G. et al.* reported that due to its chemical components like phenol and flavonoid, in many vitro and in vivo biological activities lemon grass shows anti-oxidant, anti-inflammatory action and antimutagenic activities.^[43]

At a concentration $\leq 2\%$, lemongrass essential oil could inhibit the growth of several kinds of microorganisms. Lemongrass essential oil shows antimicrobial effects against periodontal pathogens, particularly the reference strains of *Actinomyces naeslundii* and *Porphyromonas gingivalis*, according to an in vitro study conducted by Khongkhunthian *et al.*^[44,46]

Lemongrass essential oil in the form of mouthwash has been proven to be a positive contributor to SRP when used in adjunct to mechanical therapy for the treatment of gingivitis.^[46,47] According to a different study, *S. mutans*, *P. intermedia*, and *P. gingivalis* were seen to be highly susceptible to the antimicrobial effects of lemongrass essential oil.^[48]

- **Role of Cinnamon**

Cinnamon is the dry bark of a small evergreen tree belonging to the Lauraceae family.

Cinnamomum zeylanicum is the preferred variety of cinnamon for medical use.

The chemical makeup of cinnamon includes cinnamic acid, cinnamaldehyde, tannin, eugenol, coumarin, ethyl cinnamate, and linalool. This contributes to the spice's extensive list of therapeutic advantages, which also includes its, anti-cancer, antiseptic, anti-inflammatory, local anaesthetic, anticlotting, weight-reducing and antioxidant properties. Commercially found cinnamon products include powders, dried barks, oils from the bark, and capsules.^[49]

C. zeylanicum is found to be effective against *C. albicans* and can be used in management of oral thrush.^[50] Volatile oils from cinnamon demonstrated significant activity against *Streptococcus faecalis*.^[51]

Cinnamon was found to be a beneficial agent due to its capacity to lessen plaque level and gingivitis, according to a 2003 study by **Jayaprakasha et al** on the effects of cinnamon extracts on gingival health.^[52]

• Role of Chamomile flower

Chamomile flower (*Chamomilla recutita*/*Chamaemelum nobile*) extracts have been used as a remedy for mucositis, oral ulceration, and sore throat. **Saderi et al.**, in 2005 evaluated of the antimicrobial properties of chamomile (*Anthemis nobilis*, Compositae) flower head extracts and essential oil against *P. gingivalis*. The results gave solid evidence for the prospective use of chamomile as mouthwash for the treatment of periodontitis.^[53] A significant decline in plaque and gingival scores was seen in a study conducted by **Pourabbasa R et.al**, after the usage of a German chamomile mouth rinse.^[54]

• Role of Green tea

Green tea is well known for its benefits of aiding weight loss. Periodontal pathogens like *Porphyromonas*

gingivalis and *Prevotella* spp. have been shown to be significantly affected by green tea catechins. According to few in-vitro studies done, it was revealed that *Prevotella gingivalis*, *Prevotella intermedia*, and *Prevotella nigrescens* are the primary etiological agents in periodontitis and that the green tea compounds suppress their activity.^[55-57] It also hinders *P. gingivalis*'s adhesion to human buccal epithelial cells (Sakanaka et al 1996).^[58] Catechin also suppresses the bone resorption mediated by an inflammatory response as seen in periodontal disease.^[59] Patients with chronic periodontitis have seen an improvement in their periodontal health as a result of pilot studies conducted using green tea as a local drug delivery agent and dentifrice.^[60,61]

• Role of Triphala

Triphala is a well-known powdered preparation in ayurvedic medicine used since ancient time. It consists of equal parts of Amalaki (*Emblia officinalis*), Haritaki (*Terminalia chebula*) and Bahera (*Terminalia bellerica*). Triphala has a strong antimicrobial, antioxidant and anti-collagenase properties.^[62] The antioxidants present in Triphala reduce the oxidative burden and protect cells from the damage caused by free radicals. Bahera is the most active antioxidant followed by Amalaki and Haritaki. **Naiktari et al 2014** conducted a clinical trial, and demonstrated that Triphala mouthwash is as efficacious as 0.2% chlorhexidine in antiplaque and anti-inflammatory activities.^[63] **Abraham S** in 2005 in conducted a study to evaluate the inhibitory activity where MMP's were extracted from the gingival tissue samples of 10 patients with chronic periodontitis and treated with drug solutions of triphala, kamillosan, doxycycline and another ayurvedic drug. Triphala showed maximum reduction (76.6%) of MMP-9 activity when compared to other drugs. Triphala has potent antioxidant and antimicrobial activity and inhibited the growth of *S. mutans* involved in plaque formation when it adsorbed to the tooth surface.^[64]

Advantages and disadvantages of herbal agents

Advantages	Disadvantages
Seen to have minimal harmful effects as compared to allopathic drugs, since they are natural.	Slower acting than conventional or synthetic medications.
Has less likelihood that drug resistance may occur.	Established formulation for the preparation of the medication is not available which may cause ineffectiveness of the agent
Strengthens the doctor-patient relationship and creates a healthy environment.	Inadequate supply of phytotherapeutic drugs
Allows for the population to be in contact with its history, recovering traditional and cultural habits.	Insufficient knowledge by health professionals.
Lower cost and beneficial to the economy.	Scientific knowledge empirical knowledge, such as therapeutic recommendations, toxicity, contraindications, and possible interactions are not validated yet
Easier accessibility.	Immediate and stronger results are not found

Generic name (common name)	Part used	Medicinal properties	Used as
Curcuma Longa (Turmeric)	Root/rhizome and bulb	Anti-inflammatory, antioxidant, anti-mutagenic, antiviral, antibacterial, hepatoprotective, astringent properties	Mouthwash. Curcumin Gel for LDD (Local drug delivery), Dentifrice/Toothpaste
Azadirachta indica (Neem)	Bark, fruit and leaf	Antibacterial, astringent, antiseptic, inhibits prostaglandin-E2 and 5-hydroxytryptamin production, anti-arrhythmic, anti-arthritis, antiviral, antioxidant, hepatoprotective activity, anti-ulcer activity, antifungal, and anticarcinogenic properties	Mouthwash Extract Gel for LDD (Local drug delivery) Root canal irrigant Azadirachta indica (neem) chip. Toothpaste
Ocimum Sanctum L. (Tulsi)	Leaves, seed, stem and root	Anti-stress as well as analgesic properties	Mouthwash Toothpaste
Acacia catechu Willd.	Bark	Antipyretic, anti-inflammatory, hypoglycemic, hepatoprotective, antioxidant and antimicrobial activity	Mouthwash
Punica granatum (Pomegranate)	Fruit, seed, rind, root and bark	Antiviral, antibacterial, antioxidant, anticarcinogenic, anti-inflammatory activities	Mouthwash Pomegranate fruit extract gel
Aloe barbadensis Miller. (Aloe vera)	Leaf	Anti-inflammatory agent, Antiviral, antibacterial, antioxidant, anticarcinogenic, anti-inflammatory activities	Aloe vera extract gel Topical gel, Mouthwash
Allium sativum (Garlic)	Bulb	Antibacterial, antifungal and antiviral, anticarcinogenic and antioxidant property.	Garlic extract gel, Mouthwash
Syzygium aromaticum (Cloves)	Flower, buds, leaves and stems	Antimicrobial, Antiseptic, Antifungal	Mouthwash, Essential oil, Essential oil gel
Mangifera indica (Mango)	Fruit, bark, and leaves	Anti-inflammatory, antioxidant, antitumoral and antiallergic properties	Mango extract mouthwash, Mango nectar gel
Cymbopogon citratus (Lemongrass)	Leaves	Anti-oxidant, anti-inflammatory action, antimutagenic and anti-spasmodic activities	Mouthwash, Lemongrass essential oil gel
Cinnamomum zeylanicum (Cinnamon)	Bark	Antioxidative, antimicrobial, anti-inflammatory, antidiabetic, anticancer, antiseptic, local anaesthetic, weight reducer, anticlotting, and carminative.	Cinnamon essential oil gel, Mouthwash
Chamomilla recutita, (Chamomile flower)	Flower	Antibacterial, antifungal, anti-ulcer activity, anti-inflammatory, antioxidant and mild astringent property	Dentifrice, Mouthwash, German chamomile extract gel
Green tea (Camellia sinensis)	Leaves	Antioxidant, anti-collagenase, anti-inflammatory, anti-caries, antifungal, antiviral and antibacterial effects.	Mouthwash Green tea extract gel
Triphala	Fruits	Antioxidant, antimicrobial, antibacterial activity	Triphala extract gel, Mouthwash, Dentifrice

CONCLUSION

Herbal therapy since the ancient era has been an attractive potential which may still have hidden secrets for the medical world. With the increase in the use of phytochemicals, scientists and research professionals are conducting researches regarding their quality, safety, long-term adverse effects and toxicity. In addition, natural agents are found to be less toxic to host cells; XTT assays, gas chromatography and live imaging show no changes in the fibroblast cell viability when tested for cytotoxicity.

The use of plants and herbs for dental care is gaining popularity in all the fields of medicine as herbs are seen to reduce inflammation and soothe irritation.

In future, studies on the efficacy of ayurvedic herbs should be carried out in developing countries to establish their therapeutic benefits either alone or in combination with conventional therapies. Additionally, the use of ayurvedic herbs need to be advocated in general practice by clinicians to accentuate the treatment as well as eliminate occurrences of allopathic hypersensitivity and resistance.

Phytotherapy is seen to aid in the effectiveness, safety, accessibility and control over treatment of various diseases and conditions. Hence, they have been tried in dentistry as they are used in medicine since time immemorial. Numerous studies, have shown the mightiness of herbal medicines as an alternative but there always lies a void in research which is not yet fulfilled' in the field of periodontics.

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