



# Phytotherapy and its uses in Periodontics -A Review

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## Abstract:

Over the past decade, interest in drugs derived from medicinal plants has markedly increased. This literature review focuses on studies investigating herbal drugs and other natural products, as well as their therapeutic application, side effects and possible drug interactions. Few studies were found to support their rational use in dentistry. Since there is an increasing use of phytotherapeutic agents in dentistry, further studies are needed to evaluate their safety and effectiveness for clinical use.

**Keywords:** Phytotherapy, Medicinal plants.

## INTRODUCTION:

The biological properties of plants have always aroused curiosity in the scientific community because, since ancient times, man has used phytotherapy to prevent and cure diseases. Currently, many studies prove the pharmacological effects of vegetables and medicinal applications ranging from pain relief, control of inflammation and infections, antioxidant action to antitumor action. In dentistry, the use of phytotherapy has been extensively tried out and currently a lot of research into the use of plant derivatives on periodontal and endodontic infections, caries, and oral candidiasis is expanding. The objective of the present review was to diagnose the current panorama of research on herbal medicine in dentistry based on scientific evidence present in the literature. Works available in the PUBMED, BVS, Google academic, and Scielo databases were used. In the present review, it was found that many *in vitro*, *in vivo*, and clinical trials are being carried out to prove the efficacy and safety of plant compounds and in dentistry, it is observed that the study and use of phytotherapy are increasingly broad. Among the main therapeutic applications of plants in dentistry, the analgesic, anti-inflammatory, antimicrobial (including antibacterial and antifungal action), and anxiolytic activity are of more use. The main phytotherapeutics frequently used are: *Malva sylvestris*, *Camellia sinensis*, propolis, *Carica papaya*, *Glycyrrhiza glabra*, *Valeriana officinalis*, and *Passiflora incarnata*. Thus, it can be concluded that the benefits of phytotherapy in dentistry are numerous and the continuity of research is essential for plant products.

Phytotherapy is the study of the use of extracts from the natural origin as medicines or health-promoting agents. Traditional phytotherapy is often used as a synonym for herbalism and regarded as alternative medicine. The term "Phyto Dentistry" implies the use of plants and their products in the process of treating disease directly or indirectly. A crucial role is played by phytotherapy in the treatment of stomatological problems.

It started with the use of miswak (chewing stick), and it is still relevant today as herbal toothpaste in many parts of the country. India is the largest producer of medicinal herbs. The use of this readily available, natural, and safe resource as a part of dental practice has great potential for a more "Natural and Green Dental Practice".

Finding healing powers in plants is an ancient idea. Herbs have been used as a traditional form of medicine since time immemorial. The natural products derived from medicinal plants have proven to be an abundant source of biologically active compounds, many of which have been the basis for the development of new chemicals for pharmaceuticals.

### **Historical review and Indian system:**

Nature always stands out as an excellent representation to epitomize the outstanding marvel of symbiosis. Throughout the history of mankind, many infectious diseases have been treated with herbals. Medicinal plants play a vital role in the development of new drugs.

Hippocrates, in the late fifth century, cited 300–400 medicinal plants. In the first century AD, Dioscorides wrote “De Materia Medica”, a medicinal plant catalog that became the prototype for modern pharmacopeia. The Bible offers descriptions of ~30 healing plants. It is also a fact that one-quarter of all medical prescriptions today are formulations based on substances derived from plants or plant-derived synthetic analogs, and according to the WHO, 80% of the world’s population, primarily those of developing countries, rely on plant-derived medicines for their health care.

In this regard, India has a unique position in the world, where a number of recognized indigenous systems of medicine viz., Ayurveda, Siddha, Unani, Homeopathy, Yoga, and Naturopathy are being utilized for the health care of people. India is the largest producer of medicinal herbs and is called the botanical garden of the world.

According to Gurib-Fakim, there are four basic ways in which plants that are used by tribal peoples are valuable for modern medicine – Plants used as sources of direct therapeutic agents – Plants are also used as sources of starting points for the elaboration of semi-synthetic compounds – Plants can serve as sources of substances that can be used as models for new synthetic compounds. – Plants can also be used as taxonomic markers for the discovery of new compounds.

### **DISCUSSION :**

The Phytotherapeutic effects and uses considering the Endodontic field it is used as anti-bacterial, anti-inflammatory agent. The anti-bacteria spectrum of the agents mostly cover *S. pyogenes* and *E. faecalis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus subtilis* & *Candida albicans*<sup>[1]</sup>. They also act as Anti-adhesive agents and help in removal of the smear layer. because of which they are used as endodontic irrigants. In Periodontics, the usage of Phytotherapeutic agents is because of their ability to act as an antioxidant by neutralizing the free radicals, its antimicrobial activity and anti-inflammatory activity.

### **Review of Dental applications:**

#### **Application in Periodontology:**

The prevention of gingivitis by daily and effective supragingival plaque control using toothbrushing and dental floss is necessary to arrest a possible progression to periodontitis. Although mechanical plaque control methods have the potential to maintain adequate levels of oral hygiene, clinical experience, and population-based studies have shown that such methods are not being employed as accurately as they should by a large number of people. Therefore, several chemotherapeutic agents such as triclosan, essential oils, and chlorhexidine have been developed to control bacterial plaque, aiming at improving the efficacy of daily hygiene control measures. The interest in plants with antibacterial and anti-inflammatory activity has increased as a consequence of current problems associated with the wide-scale misuse of antibiotics that induced microbial drug resistance. Natural products such as *Astronium urundeuva*, *Calendula*, *A. vera*, *Curcuma zedoaria*, and other herbal products have been tested with effective results.

A wide range of antimicrobial agents and herbal products are added to dentifrice and mouth rinsing solutions to prevent caries or biofilm formation. Among the herbal products available in the market today, Parodontax<sup>®</sup><sup>[11],[12]</sup> (GlaxoSmithKline, Middlesex, UK) has been widely tested in dentistry. Besides sodium bicarbonate and sodium fluoride (1,400 ppm), it contains the following herbal products: *Matricaria chamomilla* (Asteraceae) has anti-inflammatory properties that reduce gingival inflammation; *Echinacea purpurea* (Asteraceae) stimulates immune response; *S. officinalis* (Lamiaceae) has antihemorrhagic properties; *Commiphora myrrha* (Burseraceae) has natural antiseptic properties and *M. Piperita* (Lamiaceae) has analgesic, antiseptic and anti-inflammatory properties. Ozaki, et al. reported that both Parodontax<sup>®</sup> and a triclosan dentifrice were effective in reducing plaque and gingival indices.

Pistorius et al. reported a significant reduction in the Gingival Index for an herbal-based mouth rinse containing *S. Officinalis*, *M. Piperita*, *menthol*, *M. chamomilla*, *C. Myrrha*, *Carum carvi* (Umbelliferae), *Eugenia caryophyllus* (Myrtaceae) and *E. purpurea*. They concluded that the mouth rinse could be used daily in patients with periodontal diseases as an adjunctive procedure to reduce gingival inflammation. The commonly investigated phytomedicines in this regard are medicinal aloe, bloodwort, neem tree, mustard tree, pomegranate, and Indian gum tree<sup>[13]</sup>.

Maleev et al. reviewed the presence of anti-inflammatory and antioxidant activity of *Rosa damascena*. *R. damascena* proved to have a positive effect on reduction of inflammation in raw paw by Carrageenan et al. The Plant acts by inhibiting the inflammatory mediators. The inflammatory activity is also due to the presence of Vitamin-c in *R. damascena*<sup>[4]</sup>. Like most of the aromatic plants *R. damascena* exhibits antioxidant properties. The presence of this antioxidant property is because of the phenolic compound found in them. also the flavonol glycosides quercetin-3-O-glucoside, kaempferol-3-O-rhamnoside and kaempferol-3-O-arabinoside percent in it have antioxidant activity<sup>[5]</sup>.

Hirasawa et al. evaluated the anti-inflammatory activity of green tea catechin. The green tea catechin is applied using hydrophobic cellulose strips as in a slow drug delivering system. This is carried out for 8 weeks. anti bacterial effects were seen against *Porphyromonas gingivalis* and *Prevotella* spp. *in vitro* with an MIC of 1.0mg/ml<sup>[6]</sup>. The results of the study stated that there was a decrease in the count of Black pigmented Gram negative Anaerobes and the periodontal probing depth<sup>[6]</sup>.

Fine DH et al. assessed the effects of using essential oils in mouthrinses in which they concluded that the presence of essential oils in mouth rinses have significantly reduced the occurrence of supra and subgingival bacteria which are associated with gingivitis. Bacteria like *Veillonella* sp, *Capnocytophaga* sp, *Fusobacterium nucleatum* and most of the anaerobes showed reduced occurrence rate<sup>[7]</sup>.

Mimica et al. evaluated the ability of essential oil, mainly *Mentha.L* to act as an anti inflammatory agent, carminative, recent researches have also identified the ability of *mentha.l* to act as an anti aging ingredient. This is due to the presence of monoterpenoids and the phenolic compound in the plant extract. The research concluded that *Mentha.L* sp. showed high ability to act as an anti inflammatory agent, in anti aging activities<sup>[8,9]</sup>.

Veloso et al. assessed the activity of *Punica granatum* L. (Pomegranate) to reduce halitosis and to inhibit the growth of *Fusobacterium nucleatum*, *Porphyromonas gingivalis*, *Prevotella intermedia*, and *Parvimonas micra*. Pomegranate showed higher levels of polyphenol when tested by using the prussian blue method<sup>[10]</sup>.

### **Applications in Conservatie dentistry and Endodontics:**

**Dental caries prevention:** It is postulated that the phytomedicines aid in dental caries prevention as well as treatment by combating bacteria through various modes as follows.

1. Inhibitors of bacterial growth – Inhibitors of acid production and acidurance
2. Inhibition of exopolysaccharide synthesis
3. Inhibition of bacterial adherence
4. Increase the susceptibility of the microorganism through the action of secondary metabolites.

Chen, et al. examined the effects of filtered garlic extracts on the acid production and the growth of *S. mutans*. Results showed that garlic extracts could enhance the rate of acid production and inhibit the growth of *S. mutans*<sup>[25]</sup>. They concluded that despite the stimulation of acid production, garlic might prevent dental caries by the stimulation of salivary secretion and inhibition of bacterial growth in the oral cavity. Thus, garlic may have the potential to prevent dental caries.

Rasooli, et al. assessed the antimicrobial and biofilm formation preventive properties of *Mentha piperita* and *Rosmarinus officinalis* essential oils and chlorhexidine against *S. mutans* and *Streptococcus pyogenes*. The minimal bactericidal concentrations of the *M. Piperita* and *R. officinalis* oils and chlorhexidine were 6,000, 2,000, 8,000ppm, and 1,000, 4,000, 1,000ppm for *S. mutans* and *S. pyogenes*, respectively<sup>[26]</sup>.

Kim, et al. evaluated the antibacterial effects of turmeric on an *S. mutans* biofilm by examining the bactericidal activity, inhibition of angiogenesis, and morphological alteration. It showed a similar bactericidal effect to that of chlorhexidine but the dose of turmeric was one-twentieth that of chlorhexidine. Turmeric has strong bactericidal activity, inhibitory effects on acidogenesis, and alters the microstructure of *S. mutans* biofilm. Thus, turmeric has the potential to be anti-*S. mutans* therapy in the prevention of dental caries.

These include: – a direct bactericidal effect against *S. mutans* and *S. sobrinus*; – prevention of bacterial adherence to teeth; – inhibition of glucosyltransferase, thus limiting the biosynthesis of sticky glucan; – inhibition of human and bacterial amylases. Studies in animal models show that these *in vitro* effects can translate into caries prevention. A limited number of clinical trials in men suggest that regular tea drinking may reduce the incidence and severity of caries. If substantiated, this could offer a very economical public health intervention.

Libério, et al. reviewed the *in vitro* and *in vivo* effects of propolis on *S. mutans* growth, bacterial adherence, glucosyltransferase activity, and caries indicators. Investigations carried out with crude propolis extracts, isolated fractions, and purified compounds showed reductions in *S. mutans* counts and interference with their adhesion capacity and glucosyltransferase activity, which are considered major properties in the establishment of the cariogenic process<sup>[27]</sup>.

Vanka, et al. evaluated the antibacterial effect of neem mouthwash against salivary levels of *S. mutans* and lactobacillus tested for 2 months. Also, its effect in reversing incipient carious lesions was assessed. Results showed that *S. mutans* were inhibited by neem mouthwashes, with or without alcohol as well as chlorhexidine<sup>[28]</sup>.

**Endodontic irrigants:** They are commonly used for root canal debridement as part of chemo-mechanical preparation which is a main step in root canal treatment to prevent the tooth from being a source of infection. Sodium hypochlorite solutions which has a broad anti- microbial activity and ability to cause the remaining pulp necrosis is mostly used but, sodium hypochlorite can lead to severe tissue reactions characterized by pain, swelling, hemorrhage, and potentially secondary infection or lasting paresthesia when injected beyond the dermis and into soft tissue. If the area becomes secondarily infected by pathogenic flora, there is a risk for sepsis and endocarditis. These chemical and toxicological concerns related to their use have renewed the interest in the search for newer alternatives.

The medicinal plants investigated as potential endodontic irrigants are chamomile, white tea tree, mustard tree, neem tree, Indian mulberry tree, and Green Tea Extracts (GTEs). In addition, propolis, which is a resinous mixture that honeybees collect from tree buds, sap flows, or other botanical sources has also been investigated for endodontic purposes.

*Matricaria recutita* (German chamomile) and tea tree oil have been considered effective agents in removing the root canal smear layer. Both showed better properties than 2.5% sodium hypochlorite (NaOCl) and distilled water<sup>[3]</sup>. Also, a high antimicrobial activity of *Salvadora persica* (Miswak Tree) extract against aerobic and anaerobic microorganisms was demonstrated at a 15% concentration. Such antimicrobial effect of alcoholic extract of *S. persica* is believed to be due to its high chemical contents of chlorides, tannins, trimethylamine, Salvadoran, nitrate, thiocyanate, and sulfur.

*Azadirachta indica* (Neem Tree) is a common medicinal tree in India. In an in vitro study comparing the antibacterial efficiency of neem leaf extract and 2% sodium hypochlorite against *Enterococcus faecalis*, *Candida albicans*, and mixed culture, it was concluded that neem leaf extract has a significant antimicrobial effect against all the microorganisms. The use of neem as an endodontic irrigant might be advantageous because it is biocompatible, antioxidant and thus not likely to cause severe injuries to patients that might occur via NaOCl accident<sup>[2]</sup>.

Similarly, propolis and *Morinda citrifolia* (Noni) juice were found to be effective against *E. faecalis* in the dentine of extracted teeth as an antimicrobial irrigant<sup>[28][29]</sup>. Green tea polyphenols, the traditional drink of Japan and China, is prepared from the young shoots of the tea plant *Camellia sinensis*. The antimicrobial activity is due to the inhibition of bacterial enzyme gyrase by binding to the ATP-B subunit<sup>[30]</sup>.

*Arctium lappa* (Greater burdock) is a plant that is widely used in folk medicine all over the world for its well-known therapeutic applications. It has antibacterial and antifungal activity, diuretic, antioxidant<sup>[31]</sup> and anxiolytic action, platelet anti-aggregation effect, and HIV-inhibitory action. In dentistry, Pereira, et al. evaluated in vitro antimicrobial activity of rough extracts from leaves of *A. lappa* against *E. faecalis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *C. Albicans*<sup>[32]</sup>. They concluded that *A. lappa* constituents exhibited a great microbial inhibition potential against the tested endodontic pathogens.

Propolis is the most investigated plant product when it comes to pulp regeneration. Parolia, et al. investigated the response of human pulp tissues that were mechanically exposed to propolis and compared it with two existing and commonly used pulp capping agents [mineral trioxide acetate (MTA) and Dycal]<sup>[33]</sup>. The response of pulps to propolis as a pulp capping agent was comparable to MTA and Dycal.

**Retreatment agents:** Eucalyptus oil and orange oil were reported as being as effective as chloroform and xylene to dissolve or soften gutta-percha. Orange oil is readily available, inexpensive, and displays a solvent effect that is close to that of chloroform. In addition, it has antimicrobial activity. Orange solvent has the advantage over other plant-derived solvents such as eucalyptus oil in that its viscosity is closer to that of water and it can thus easily be administered through an endodontic irrigating syringe. In addition, the orange solvent has a pleasant smell, which is easily acceptable to patients.

### **Applications in Dental Traumatology:**

Dental avulsion is a traumatic injury characterized by the complete displacement of the tooth from its socket, with damage to the periodontal ligament, cementum, alveolar bone, gingival, and pulp tissues. The most indicated procedure for this kind of dental trauma is re-implantation, which is a surgical technique consisting of reinserting a tooth in its socket after it has been extracted on purpose or accidentally.

Healing following avulsion and replantation is dependent on the extent of pulpal and periodontal ligament tissue damage. Therefore, immediate replantation is the recommended treatment of choice for an avulsed permanent tooth. To achieve a more favorable prognosis following tooth replantation, the use of an appropriate interim transport medium is usually advocated. Numerous studies have researched and advocated the use of media like saliva, milk, Hank's Balanced Salt Solution (HBSS), and ViaSpan. However, current research has indicated the use of newer herbal agents as promising interim transport media for an avulsed

tooth. The plant-based herbal media in this regard includes propolis, red mulberry juice, garden sage extracts, coconut water, and Green Tea Extracts.

Ozan, et al. determined the ability of the juice of *Morus rubra* fruit to serve as a temporary storage medium for the maintenance of PDL cell viability of avulsed teeth. Results showed that the efficacy of 4.0% and 2.5% M. Rubra at 3, 6 and 12h was found to be significantly better than HBSS. At 24h, 4% M. Rubra was found to be similar to HBSS. Thus the results showed that juice of the fruit sample of M. rubra studied at a concentration of 4% was a more effective storage medium than other groups<sup>[24]</sup>. Hence the juice of the fruit of M. Rubra can be recommended as a suitable transport medium for avulsed teeth.

Polat, et al. determined the ability of *Salvia officinalis* extracts to serve as a storage medium for the maintenance of PDL cell viability of avulsed teeth. The results showed that 2.5% S. Officinalis was a more effective storage medium than the other experimental solutions. In another investigation, skimmed and whole milk, followed by natural coconut water and HBSS, were the most effective media in maintaining the cell viability of PDL fibroblasts<sup>[22]</sup>.

Green Tea Extract has been reported to have remarkable anti-inflammatory, antioxidant and anticarcinogenic effects. Hwang, et al. investigated in vitro the efficacy of Green Tea Extract as a storage medium for avulsed teeth<sup>[23]</sup>. The result indicates that there was no difference in cell viability between Green Tea Extract and Hank's Balanced Salt Solution media, whereas Green Tea Extract showed higher cell viability than other media. Thus, the efficacy of Green Tea Extract in maintaining the viability of human PDL cells is similar to that of Hank's Balanced Salt Solution and higher than that of milk. Therefore, it was concluded that Green Tea Extract could be a suitable, alternative storage medium for avulsed teeth.

### **Herb based dental materials**

Traditional herbs have an array of applications as biomaterials. Almost all modern dental materials have their roots in these phyto compounds. The commonly used materials in the routine dental practice of herbal origin include zinc oxide eugenol cement, impression materials (agar-agar and alginate), gutta-percha root canal filling material, citric acid, camphorated monochlorophenol medicament and thymol.

### **Herbs acting on oral mucosal lesions:**

Mucosal lesions include gingivitis, aphthous ulcers, thrush, and various bacterial and viral lesions. Many of these conditions are self-limiting; consequently, herbal treatments are generally palliative in character. A variety of herbs are found to have a beneficial effect on the treatment of these lesions like Aloe vera, rhatany, gum myrrh, licorice, myrtle, coriander, garlic, clove, and so on.

It has been reported that A. vera gel accelerates the healing of aphthous ulcers and reduces the pain associated with them. Ninety patients with histories of recurrent aphthous ulcers were separated into three groups, with each group receiving a different treatment (either acemannan hydrogel i.e. A. vera, freeze-dried acemannan hydrogel, or an unspecified over-the-counter product as an active control) four times a day. The groups using acemannan hydrogel in either form healed faster than those using the over-the-counter remedies. The report noted that compared with other remedies for aphthous ulcers, the acemannan hydrogel did not have the disagreeable taste and texture associated with traditional therapies and did not sting when applied<sup>[14]</sup>.

Moghadamnia, et al. evaluated the efficacy of licorice bioadhesive hydrogel patches to control the pain and reduce the healing time of recurrent aphthous ulcers. Licorice patches caused a significant reduction in the diameter of the inflammatory halo and necrotic center compared with the placebo group. According to the results of this study, a licorice bioadhesive hydrogel patch can be effective in the reduction of pain and the inflammatory halo and necrotic center of aphthous ulcers<sup>[15]</sup>.

The clinical efficacy of a paste containing *Myrtus communis* (Myrtle) in the treatment of recurrent stomatitis<sup>[16][17]</sup> was evaluated. The data indicated a significant reduction in ulcer size, pain severity, erythema, and exudation level with the paste. Also, the patients' overall assessment of treatment improved after applying a paste containing myrtle. No side effects were reported.

Mazzanti, et al. evaluated the antiviral activity of a hydroalcoholic extract of lemon balm. It was found that the cytopathic effect of the herpes simplex virus (HSV-2) was reduced with the use of lemon balm. The maximum inhibiting effect (60%) was obtained with 0.5 mg/mL. The authors support the use of lemon balm for treating herpes simplex lesions and encourage clinical trials on this medicinal plant<sup>[18]</sup>.

Similarly, Schuhmacher, et al. examined the virucidal effect of peppermint oil against the herpes simplex virus. The 50% inhibitory concentration of peppermint oil for herpes simplex virus plaque formation was determined to be 0.002% and 0.0008% for HSV-1 and HSV-2, respectively<sup>[19]</sup>. Peppermint oil exhibited high levels of virucidal activity against HSV-1 and HSV-2 in viral suspension tests. Considering the lipophilic nature of the oil that enables it to penetrate the skin, peppermint oil might be suitable for topical therapeutic use as a virucidal agent in recurrent herpes infection.

Hosseini, et al. evaluated the effectiveness of purslane in the treatment of Oral Lichen Planus (OLP). Approximately 83% of the purslane patients showed partial to complete clinical improvement but 17% had no response<sup>[20]</sup>. A partial to complete response was observed in all purslane-treated patients. According to these findings, purslane is clinically effective in the treatment of OLP<sup>[21]</sup>.

## **CONCLUSION:**

Phytotherapy is the study of the use of extracts from the natural origin as medicines or health-promoting agents. Plant products have long been used in dentistry as part of various dental materials right from impression materials to eugenol, which forms an integral part of the dental clinic. The use of herbs in dental practice is not limited to only material sciences. A single herb shows a variety of effects like anti-inflammatory, antibacterial, antifungal activity, and many more. Hence the incorporation of these herbs in dental practice will prove to be a valuable adjunct to dental treatment. Many research related to this field must be done in order to utilize the natural products which relatively have less side effects in comparison to the currently available Pharmaceutical drugs.

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