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Herbal Treatments Used as an Alternative in the Treatment of Periodontal Diseases

Ramanarayana Boyapati[1-a*], Rohita Pendyala[1-b], Rama Brahmam Lanke[2-c], Deepa Anumala[1-d]

[1] *Department of Periodontics, Sibar Institute of Dental Sciences, Takkellapadu, Guntur, Andhra Pradesh, India.*
[2] *Associate General Dentist, Familia Dental, Midland, Texas 79707, USA.*
**Corresponding author*

Review

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ABSTRACT

Phytotherapy is the ancient practice of treating diseases with plant products. Herbal products were used in traditional medicine in both eastern and western medical ayurvedic traditions since ancient times. Periodontal diseases have been a major oral problem affecting humans for ages. The application of phytotherapy in treating periodontal diseases can help in solving many issues and answering many unanswered questions. This review on phytotherapy for periodontal diseases explains in detail about different plants and their products, which are used in various forms for treating bacterial, fungal, and viral infections causing periodontal diseases.

Key words: Ayurvedic, herbal, phytotherapy, periodontal disease.

[a] dr.ramanarayana@gmail.com https://orcid.org/0000-0002-9196-0183
[b] pendyalarohita@gmail.com https://orcid.org/0000-0002-4399-2025
[c] shara.lanke@gmail.com https://orcid.org/0000-0002-8369-2123
[d] anumala.deepas@gmail.com https://orcid.org/0000-0003-4334-8173

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Introduction

Periodontal diseases have been a major oral problem affecting humans for ages. Epidemiological studies have shown that these periodontal diseases have also affected humans in ancient times. Treatment methodologies have been changed and are evolving for many decades. Periodontal disease management has been influenced by these predispositions in the period due to recent advances in management.[1]

The word "phytotherapy" means treatment or management of disease with traditional plants that have pharmaceutical properties such as antioxidant, anti-inflammatory, and anti-microbial properties. Phytotherapy is a Latin term which is divided into the prefix "Phyto" which means plant, and "therapy" which means curing and healing.[2] Herbal products have been used in traditional medicine in eastern and western medical ayurvedic traditions since ancient times.

During the last 30 years, pharmaceutical industries have exponentially increased their research on converting herbal products to oral products as phototherapeutic agents with proven quality, safety and efficacy.[3] The plants act as anti-inflammatory agents, antiseptic, antioxidant agents, antimicrobial agents, and anti-collagenase properties.[4] In this study, the effect of plants or plant derivatives in the treatment of periodontal diseases is reviewed.

The main etiological factor for various gingival and periodontal diseases is microbial oral biofilm. Aggregatibacter actinomycetemcomitans (A. actinomycetemcomitans), Prevotella intermedia (P. intermedia), Porphyromonas gingivalis (P. gingivalis), Treponema denticola (T. denticola) are common periodontal pathogens which are found in microbial oral biofilm.[5]

Haffajee *et al.* have examined various plant products which had a benefit on the oral tissues. These plant products include anti-inflammatory agents such as aloe vera, calendula and anti-microbial agents such as grapefruit seeds, Golden Seal which were used as herbal mouth rinses. They reduced the inflammation of the gingiva and inhibited anaerobic and aerobic bacterial growth.[6]

Considering the above properties of various herbal products which had a beneficial effect on the oral tissues as well as periodontal complex, the present review aimed to investigate the role of few plant products in the management of periodontal disease and their efficacy.

Let us discuss a few plant products which are used as Phyto therapeutic agents:

Aloe vera (Aloe vera): It is recommended to add current studies examining the effect of aloe vera on periodontal disease.

Aloe vera is a succulent, cactus plant and belongs to the Liliaceae family. Aloe vera has more than 300 species, but only Aloe barbadense Miller and Aloe aborescens are used for their pharmaceutical properties.[7]

It contains vitamins, minerals, amino acids, salicylic acids, enzymes, sugars, and fatty acids. The central mucilaginous part of aloe vera acts as a gel and improves wound healing in various skin and mucosal lesions.[7]

Aloe vera's healing capabilities have been used in conditions such as after periodontal surgery, for damaged gingival sores caused by a toothbrush, and so on. It can be taken as a food supplement or administered topically as a gel. Aloe vera is a bactericide that is non-toxic and contains anti-fungal, anti-viral, analgesic, anti-inflammatory, and immune-stimulating characteristics. Aloe vera's anti-inflammatory properties hinder the cyclooxygenase pathway, lowering prostaglandin E2 synthesis.[8]

Researchers have investigated various forms of Aloe vera and the ones currently in use include: 1. Toothpaste 2. Mouthwash 3. Gel- protects the wound and promotes healing. It also keeps the wound moisturized. 4. Aloe activator topical spray - useful in throat infections, dental and joint pains 5. Aloe vera juice - useful as a strong detoxifying agent and an immune enhancer.[9]

Jing et al, (2022)[10] in a systematic review and meta-analysis demonstrated that the adjunctive use of Aloe vera in SRP results in improved treatment outcomes compared to SRP alone or placebo.

Sharmasita vijay *et al.*, (2022)[11] in a randomized controlled clinical trial investigated the role of aloe vera gel as an adjunct to scaling and root planning in chronic periodontitis patients. Results demonstrated that aloe vera gel an herbal product is proved to be advantageous as adjunctive use of aloe vera gel compared with placebo gel, which is associated with greater reduction in plaque index, bleeding index and probing depth as well as more clinical attachment gain.

Nasreen *et al.* (2021)[12] investigated the effect of using aloe vera mouthwash on improving periodontal health among secondary school children in her quasi-experimental study. The observed results revealed that use of aloe vera mouthwash can be used as an alternative product for the prevention and treatment of gingivitis.

Nazir *et al.* (2019)[13] investigated the effect of aloe vera gel as an adjunctive to scaling and root planning among 40 patients and demonstrated that aloe vera gel shown significant decrease in periodontitis and improved the clinical parameters.

Penmetsa *et al.* (2019)[14] in a randomized controlled comparative clinical study with double blind design with ocimum mouth wash, chlorhexidine mouthwash and aloevera mouthwash. The obtained results signify that aloe vera and ocimum mouthwash proven to be effective as chlorhexidine mouthwash in its ability to reduces plaque index, gingival index and bleeding index scores by reducing plaque accumulation, gingival inflammation and bleeding when used in long-term.

Ahouri *et al.* (2017)[8] in single blind clinical trial with split mouth design investigated the effect of local application of aloe vera gel as an adjunct to scaling and root planning. The observed results revealed that local application of aloe vera gel could be considered as an adjunctive to Scaling and root planning for chronic periodontitis.

Vangipuram *et al.* (2016)[15] in a randomized controlled clinical study where they compared aloe vera and chlorhexidine mouthwash demonstrated that aloe vera being an herbal product has shown equal effectiveness as chlorhexidine. Hence aloe vera mouthwash can be used as an alternative product for curing and preventing gingivitis.

Bhat *et al.*[7] confirmed that using an Aloe vera mouth rinse lowers gingival inflammation and bleeding. They also found out that when aloe vera gel was administered sub gingivally, it resulted in considerable pocket depth reduction and a relative drop in gingival and plaque indices in short-term research.

Improved healing properties were seen in areas that were traumatized by dentifrice abrasion, sharp foods, dental floss and after periodontal surgeries when aloe vera gel was applied. Aloe vera gel in toothpaste or mouthwashes at optimal quantities could help prevent periodontal disease and dental cavities.[7]

Sage (Salvia officinalis): There are recent studies investigating its effect on the treatment of periodontal disease. By adding these studies, the results can be discussed.

Sage is a member of the Laminaceae family that can be found in fields and along roadsides. It is advised for the management of stomatitis, sore throat, gingivitis, and periodontitis and can be used as a mouth rinse. Sage essential oils offer anti-inflammatory characteristics that help with stomatitis and pharyngitis, as well as antibacterial, antifungal, and antiviral properties that can help with periodontitis progression.[16]

For Mouthwash preparation:[17]

1. As a mouth rinse: In 150 ml of boiling water, 3gms chopped leaf of sage is added and boiled for 10 minutes and used as mouthwash 3-4 times a day.

2. For gargling: In a half-liter water, chopped leaf of sage (two tablespoons) is immersed, and boiled. This boiled mixture is covered for 15 minutes. This is used for gargling 3-4 times a day for 5-10 minutes.

3. As a gel: One gram of Carbopol 940 was dissolved in 25 mL of distilled water to obtain 4% gel, 0.4 grams of S. officinalis alcoholic extract was dissolved in 10 mL of 5 mL of ethanol absolute, 3 mL of propylene glycol, and 2 mL of distilled water, to obtain 4% of active ingredients, after that 10 mL of the gel was added to 10 mL of active ingredients, triethanolamine was added to adjust the pH above 7. The gel was prepared with the final concentration of 2% for both of the gelling agent and the S. officinalis extract, and the gel set aside for 24 hours before loading in the syringes.[18]

Aljuboori *et al.* (2020)[18] in randomized controlled clinical study investigated both clinical and immunological parameters depending on the application of gel

containing sage extract preceded by scaling and root planning procedure. Thus, it has been concluded that a significant difference between the control group (SRP alone) and test group (Sage extract gel).

Mendes *et al.* (2019)[19] investigated the antibacterial activity of salvia officinalis against periodontal pathogens in an invitro study. It has been concluded that the extract has a moderate effect on periodontopathic bacteria and proved the activity against S. Mutans in the combination of dichloromethane – soluble fraction with chlorhexidine only.

Junger *et al.* (2020)[20] in a randomized placebo controlled double blind study did not confirm the beneficial effect of the mouthwash with S. Officinalis on inflammatory parameters and plaque indices compared with placebo after 6 weeks. On the other hand S.officinalis gel has a potential anti-inflammatory role in the management of chronic periodontitis.

Beheshti-Rouy *et al.* (2015)[21] in a randomized clinical trial aimed to evaluate clinical effects of a mouthwash containing salvia officinalis extract on S. Mutans bacteria causing dental plaque demonstrated the effectiveness of sage mouthwash in reduction in the count of S. Mutans in dental plaque.

Pistorius *et al.* (2003)[22] have reported that with daily use of mouth rinse, there was a significant improvement in gingival indices and concluded that it can be used every day as an additional therapy for reduction in inflammation of the gingiva.[21]

Salvia officinalis which is commonly used as mouth rinse has spasmolytic, aromatic, astringent, and antiseptic properties.[17] Salvia treats gingivitis, throat infections, and mouth ulcers efficiently. Precautionary measures should be taken while using in pregnancy and lactation but gargling and mouthwash were allowed.[21]

Peppermint (Menthapiperita): There has been little mention of research on the effect of periodontal treatment. It is recommended to include studies investigating the effect of periodontal treatment.

Peppermint (Mint) is a member of the Laminaceae family that helps to relieve inflammation. To relieve toothache, cotton balls soaked in peppermint oil and placed in the tooth cavity were used. Peppermint oil has analgesic properties when applied locally. Peppermint leaf pills and capsules, diluted to 3–6 g per day, are used as a mouth rinse following periodontal therapy to minimize gingival inflammation. Mouth rinses and gels containing peppermint leaves and essential oil as bases are used to combat periodontal germs (streptococcus species).[23,24]

Flavonoids are the most essential phenolic compounds discovered in Mentha species, and they have a wide spectrum of pharmacological action, including anti-ulcer, antioxidant, cytoprotective, anti-inflammatory and chemo preventive properties. Peppermint tea is generally safe to drink on a regular basis. Peppermint oil can cause headaches.[25]

It is well documented that the essential oil and extracts of Mentha species have antimicrobial, anti-inflammatory, and antioxidant properties with antimicrobial activity against pathogens involved in the development of periodontal disease.[26]

Essential oils of Mentha piperita showed good antibacterial and antibiofilm activities in the study conducted by Karicheri *et al.* concerning Aggregatibacter actinomycetemcomitans, a strain identified in periodontopathogenesis.[27]

Peppermint oil is also used in novel formulations, for example as an anti-ulcer and anti-inflammatory agent in self-emulsifying drug delivery system for the improvement of meloxicam's solubility used in periodontal disease.[28]

Chamomile (*Matricariachamomilla or Matricariarecutita*):

Studies comparing the effect of Chamomile and chemical antiseptic agents on periodontal treatment can be added. Thus, the advantages and disadvantages of using instead of chemical agents can be evaluated.

Chamomile is one of the most popular herbs and belongs to the Asteraceae family. Chamomile, has been shown to be anxiolytic, antistress and anti-allergic reactions. Chamomile flowers are used for herbal tea. It is integrated as one of the ingredients of mouth rinse and used in the prevention and management of periodontitis. They are given in the form of tinctures, tablets, and capsules.[17,29]

Chamomile mouthwashes preparation: Dried Chamomile flowers were immersed in ethanol 55% at room temperature, and impurities were removed from the mixture. Ethanol was completely evaporated at a temperature of 79 ◦C by the rotary evaporator device. The pure Chamomile extract was obtained and then dissolved in distilled water, and spearmint flavour was added to the mixture.[33]

McKay and Blumberg in an animal study demonstrated the anti-inflammatory activity of chamomile.[17]

Batista *et al.* (2014)[30] combined pomegranate and chamomile extracts which are used as mouthwash and is effective in inflammation reduction and bleeding of gingiva in periodontitis, suggesting that both extracts when combined or used individually had anti-inflammatory and anti-microbial actions similar to those of gold standard mouth wash chlorhexidine 0.12%. As a result, these can be employed as supplementary therapeutic agents to aid in the restoration and maintenance of periodontal health.

Lucena *et al.* (2009)[31] found reduction in gingiva bleeding index, confirming that findings of this study, in which the mouthwash with Matricaria recutita extract also reduced the bleeding index, both in gingivitis and in chronic periodontitis, showing statistically significant results.

Agarwal *et al.* (2020)[32] conducted comparative clinical and microbiological study with 1% Matricaria chamomilla mouth rinse on chronic periodontitis patients. The observed results signify that Matricaria chamomilla mouth rinse was found to improve the clinical and microbiological parameters. Its outcomes commensurate the gold standard mouthwash chlorhexidine. Therefore, chamomilla mouth rinse can be a potential therapeutic agent for chronic periodontitis patient.

Nemma *et al.* (2020)[33] compared the effect of chamomilla, aloe vera and chlorhexidine 0.12% mouthwash on gingival health among visually impaired persons and evaluated for parameters such as plaque index and gingival index. Results revealed that chamomilla mouthwash have a distinguished impact on gingival inflammation.

The comparative studies reported that chamomilla mouthwash is effective owing to its properties such as analgesic, anti-inflammatory, and antibacterial.[34]

The only disadvantage of chamomile is that it is reported to have allergic reactions which were skin reactions on topical application followed by bronchitis leading to constriction on systemic administration.[30]

Tea tree (Melaleuca alternifolia):

Melaleuca alternifolia, or tea tree, is a member of the Myrtaceae family. It can be immediately administered to swollen gums for immediate relief. Mouth rinse has been utilized in endodontic and irreversible pulpitis treatment to minimize inflammation. Tea tree has demonstrated good efficacy in microbial biofilm control, resulting in a considerable reduction in a gingival bleeding index.

Elgendy *et al.* (2013)[35] investigated the antimicrobial effects of tea tree essential oil and gel in preventing the formation of oral microbial biofilms and found it to be effective against bacteria.

Tea tree oil showed a significant reduction in the production of inflammatory cytokines in vitro, implying that it could be used to treat inflammatory disorders like a periodontal disease by modulating the host response.[36]

Ripari *et al.* (2020)[37] evaluated the efficacy of tea tree oil for the treatment of gingivitis and compared with chlorhexidine mouthwash. The comparative results signify that tea tree oil offered a better improvement in the evaluation of plaque index, bleeding on probing and plaque index. Tea tree oil could be an effective non – toxic substitute for therapy of gingivitis.

Soulissa *et al.* (2020)[38] conducted an invitro study for evaluating the effect of tea tree oil in inhibiting the adhesion of pathogenic periodontal biofilms. The study reported that tea tree oil inhibits the adhesion of P. Gingivalis and A. Actinomycetemcomitans biofilms to enamel surfaces and may be useful as a treatment for oral diseases.

Singh *et al.* (2019)[39] evaluated the effectiveness of tea tree oil versus chlorhexidine in the treatment of periodontal diseases in a systematic review demonstrated that tea tree oil may be used as an alternative to chlorhexidine for reduction of gingival inflammation in conjunction with efficient plaque control measures. Tea tree oil found to be superior to chlorhexidine in reducing signs of gingival inflammation.

Echinacea (Purple coneflower):

Echinacea helps improving defects in immune system and belongs to an Asteraceae family herb. Its constituents work together to increase white blood cell (lymphocytes and macrophages) production and activity. Gingivitis and periodontal disease are treated with a mouth rinse containing echinacea, mint oil, sage, and chamomile. Ehinacea has anti-inflammatory and antibacterial properties, according to Kumar *et al.* Several studies have attested to its efficacy in the fastest and rapid management of flu like symptoms.[40,41]

Safarabadi *et al.* (2017)[42] in a randomized controlled comparative clinical study where they compared the efficacy of Echinacea versus chlorhexidine mouthwash on microbial flora of intubated patients in intensive care unit. The results demonstrated that Echinacea solution was more effective in decreasing the oral microbial flora of patients in intensive care unit owing to its phagocytic property and anti-inflammatory effect and immunomodulatory.

Kharaeva *et al.* (2020)[43] evaluated the antibacterial and anti-inflammatory effect of tooth paste for gingivitis and periodontitis patients demonstrated that antiseptic action and antibacterial action attributed for the safety of the usage of herbal product.

Rosemary (Rosmarinus officinalis):

The effect of Rosemary on Periodontal disease was not mentioned. It is recommended to add studies investigating the effect of periodontitis and gingivitis.

Rosemary is a volatile oil and a member of the Lamiaceae family and has various anti- bacterial and anti-fungal properties. It works well against chronic disseminated candidiasis. Oral administration of the concentrated volatile oil is not recommended. Other research on the antioxidant and antimicrobial properties of rosemary essential oil has been conducted. Santoyo *et al.* (2005)[44] investigated the antimicrobial activity of rosemary and determined that the following five essential oil components are to blame: 1,8-cineole, Pinene, camphor, borneol, and verbenone.

According to Lee *et al.* (2015)[45] rosmarinic acid significantly induced mineralization in osteoblasts and increased alcalin-fosfatase activity, suggesting that it can be used to arrest metabolic bone diseases.

Gunther *et al.* (2022)[46] evaluated the antimicrobial effect of Rosmarinus officinalis extracts on oral initial adhesion and demonstrated that the use of R. Officinalis extracts in biofilm control and thus in the treatment of caries and periodontitis as herbal adjuvant to synthetic substances.

Oliveria *et al.* (2017)[47] evaluated the effect of Rosamarinus officinalis on biofilms demonstrated that rosemary extract had a significant vitality reduction in the microflora such as S. Aureus, S. Mutans and E. Faecalis.

Valones *et al.* (2019)[48] assessed the effect of rosemary based tooth paste in clinical double blind randomized study which compared with conventional fluoridated tooth paste on clinical parameters such as plaque index and gingival bleeding scores. The observed results signify that rosemary based tooth paste effectively treated gingival bleeding and reduced bacterial plaque when compared with conventional tooth paste.

Azad *et al.* (2016)[49] evaluated the adjunctive use of mouthwash containing extract of Rosmarinus officinalis along with scaling and root planning. It had been concluded that the adjunctive use of a mouth rinse containing essential oils following scaling and root planning has a positive effect on clinical variables and on bacterial levels in the subgingival biofilm.

Wintergreen (Gaultheria procumbens):

Wintergreen is a member of the Ericaceae family. Its mouthwash is an antiseptic and also acts as an astringent. Wintergreen oil-soaked cotton ball is used as a remedy for sore throats and gum inflammation. Wintergreen essential oil has been shown to have antimicrobial activity against a wide range of wide-spectrum bacteria and fungi, as well as antioxidant potential, according to Nikolifietal[50]

Michel *et al.*[51] evaluated the effect of standardized leaf extract of Gaultheria procumbens on multiple oxidant, inflammation related enzymes and pro oxidants and pro-inflammatory functions of human neutrophils. The obtained results might partially explain the ethnomedicinal application of G. Procumbens leaves and support the usage of the standardized leaf extract in the adjuvant treatment of oxidative stress and inflammation-related chronic diseases.

Red clover (Trifolium pretense):

The Fabaceae family includes red clover. Gingivitis and periodontal disease have been treated with red clover mouthwash. After making the red clover tea, the flowers and leaves can be used to make an antibiotic gel. In their animal and human studies, Ramos *et al.*[52] discovered that red clover dry extract has anti-inflammatory properties.

Barberry (Berberis vulgaris):

The Berberidaceae family includes barberry. Berberine, an alkaloid derived from Berberis vulgaris, has antimicrobial properties and has been used in toothpaste and mouthwashes. Barberry gel has been shown to be an effective adjuvant for oral biofilm control and gingival inflammation reduction in children. Berberry juice is rich in vitamin C, which boosts immunity and helps with the absorption of iron.[53]

Alkaloids like berberine were more efficient against bacteria like A. actinomycetemcomitans and P. gingivalis than lactobacillus and streptococcus, according to Palombo EI *et al.* Berberine also inhibited A. actinomycetemcomitans and P. gingivalis collagenase activity.[54]

Berberine gel decreases gingival index by 33 % and oral biofilm by 56 %, according to Makarem *et al*.

According to various researchers, Berberine has a variety of pharmacological actions such as anti-cyclooxygenase, anti-inflammatory, and anti-inducible nitric oxide synthase properties. Berberine has been suggested to reduce periodontal tissue degradation by regulating matrix metalloproteinase during periodontal disease progression.[55]

Periodontitis is the main etiological factor for bone loss and is considered a global public problem. Though conventional periodontal therapy like scaling and root planning and antibiotics were used as adjunctive, they have side effects such as gastrointestinal irritation, antibiotic resistance, and systemic alterations. Phytotherapy is an alternative therapy with beneficial effects and little or no side effects.

Gaetti-Jardim *et al.* tested the minimum inhibitory concentration and Minimum bactericidal concentration of aqueous and alcohol extracts of Anacardiaceae, Cattley guava / strawberry guava / cherry guava and Ficusenormis against four strains: A. actinomycetemcomitans, P. gingivalis, F. nucleatum, and P. intermedia. MBC values were 2 to 16 times higher than MIC values.[56]

Conclusions

Phytotherapy is the most ancient method of treating diseases and is still in demand today. It is believed that many plants with various benefits such as anti-inflammatory, healing, anti- bacterial, anti- viral and anti-fungal properties are yet to be discovered and used in medicine and in periodontal diseases. The major and primary concerns during the research of various new plants used in phytotherapy are quality, safety, toxicity and allergic reactions. Based on the investigations ‘thus, concluded as 'the fact that medicinal plants have fewer side effects compared to conventional drugs, being affordable and accessible makes their use widespread in dental treatments as well'. However, more clinical research is needed to prevent unpredictable toxic effects and adverse drug interactions. A systematic approach that includes experimental and clinical validation of efficacy is required to introduce phytotherapy to modern medicine

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