PHYTOTHERAPY: AN ALTERNATE MEDICINE FOR PERIODONTITIS

Noorul Aneesa. N[1*], Arvina Rajasekar[2]

[1*] Intern, Saveetha Dental College and Hospitals, Chennai-600077, Tamil Nadu, India
[2] Senior Lecturer, Department of Periodontology, Saveetha Dental College and Hospitals, Chennai-600077, Tamil Nadu, India

Corresponding Author:
Noorul Aneesa. N
Intern,
Saveetha Dental College and Hospitals,
Saveetha Institute of Medical and Technical Sciences,
Chennai - 600077.

Running title: **Phytotherapy for Management of Periodontal Diseases**

***Abstract*: Gingival and periodontal infections are the most common diseases of the oral cavity. Thge treatment ranges from non surgical treatment like scaling and root planning to surgical treatment like open flap debridement along with use of local and systemic antimicrobials. These chemotherapeutic agents eventhough display significant efficacy in improving periodontal health but results in undesirable side effects. The usage of herbal products has increased nowadays and could be especially of high benefit to lower socioeconomic populations. This review highlights on the effect of various herbs on the periodontium.**

***Keywords*: Gingivitis, Periodontitis, Herbs, Antimicrobials**

INTRODUCTION

During the last few decades, the human race has experienced an inclination towards evidence-based research and interest in the effects of medicinal plants and their conventional use globally.

Phytotherapy is about the use of plant-derived medications in the treatment and prevention of disease. All plants produce chemical compounds called phytochemicals, which have the potential for use as drugs.[1] The use of plant-based materials including herbal or natural health products with supposed health benefits, is increasing nowadays.

Oral diseases are considered a major public health problem. There is an immediate need for promoting preventive strategies that are socially acceptable, easily available and at the same time be cost-effective. One such strategy would be to explore and use the abundantly available medicinal plants in nature and their active ingredients either exclusively or in combination. This can be used an alternative to synthetic antimicrobials due to their lower negative impact and to overcome the resistance to the drug during therapy.

This review is an attempt to understand the role of various plant-based phytochemicals in preventing and treating the periodontal diseases.

Gingivitis

Gingivitis is the inflammation of the gum tissue. The microbial content of the plaque produces toxins that irritate the gums causing them to become inflamed, making them red and causing them to bleed. In the absence of treatment, gingivitis progresses to periodontitis, which is a severe and destructive form of periodontal disease.

Neem (Azadirachta indica)

Neem has astringent, antiseptic, antiulcer and many other medicinal properties. The neem plant contains anti-plaque agents, like gallotannins, which during the early stages of plaque formation could effectively reduce the number of bacteria available for binding to the tooth surface by increasing their mechanical/physical removal from the oral cavity by aggregate formation.[2]

In a study, were 45 subjects with plaque-induced gingivitis divided into three groups were asked to rinse with 15 ml of neem mouthwash twice a day showed that A. indica was effective in reducing periodontitis like chlorhexidine, by reducing gingival bleeding and plaque indices significantly.[3]

Tulsi (Ocimum sanctum)

Ayurveda mentions the importance of a variety of medicinal uses of tulsi recognized thousands of years ago as one of the India's greatest healing herb. In an in-vitro study, the various concentrations of the Tulsi extracts have been assessed against *S. mutans* and

concluded that the Tulsi extract 4% has a maximum antimicrobial potential.[4] Tulsi has antimicrobial property against a variety of microbes like *C. albicans*, *S. aureus*, *E. coli* by its phytoconstituents. Ocimum sanctum was also found to reduce gingival index and plaque index scores after one month of treatment in 108 subjects in a randomized controlled clinical trial on dental plaque and gingival inflammation.[5]

Aloe vera

Aloe vera gel has been reported to sooth gum tissue and relieve pain and discomfort when applied on gums suggesting its potential as an antibacterial, antifungal and antiviral. The antimicrobial effects of aloe vera have been attributed to the plant's natural anthraquinones. In small concentrations, along with the gel fraction, these anthraquinones provide analgesic, antibacterial, antifungal and antiviral activities, although in high concentrations, they could be toxic. A study done using aloe vera gel as a local drug delivery showed a significant reduction in pocket depth when compared to controls and reduction in gingival index.[6]

Turmeric (Curcuma longa)

Turmeric has been used widely in ayurvedic medicine as it is nontoxic and has a variety of therapeutic properties including antioxidant, analgesic, anti-inflammatory, antiseptic activity and anticarcinogenic activity along with its hepatoprotective, immunostimulant, antimutagenic and many more properties. The efficacy of 0.1% turmeric mouthwash as an antiplaque agent and was found that it can be effectively used as an adjunct to mechanical plaque control in prevention of plaque and gingivitis.[7,8]

Babul (Acacia Arabica)

Babul has cyanogenic glycosides and numerous enzymes like oxidases, peroxidases and pectinases. Its bark contains tanins which are known to have analgesic, anti-inflammatory, antimicrobial, astringent and haemostatic effect. In a recent study researchers have tried using the gel and powder of this entity and found them to be equally effective. Both groups showed significant improvement in the gingival and plaque index scores and reduced microbial counts from baseline to 24 weeks with the results comparable to 1% chlorhexidine gel.[9]

Triphala

Triphala, a herbal cocktail which consists equal parts of Amalaki (Emblica officinalis), Haritaki (Terminalia chebula) and Bahera (Terminalia belerica). Triphala has strong antimicrobial, antioxidant and anti-collagenase properties. Clinical study has shown that Triphala mouthwash is as efficacious as chlorhexidine in anti-plaque and anti-inflammatory activities. The anti-plaque effect may be attributable to tannic acid present in Triphala, which is well adsorbed on the surface of bacterial cells resulting in protein denaturation and ultimately to bacterial cell death.[10]

.

Berberis vulgaris

Berberine is the most active alkaloid (isoquinolines group) extracted from the root and stem of the plant barberry which has shown high antimicrobial effects. A study was done to evaluate the clinical effects of dental gel containing barberry extracts from Berberis vulgaris on gingivitis and microbial plaque control, showed that barberry gel effectively controls microbial plaque and gingivitis. A kind of toothpaste from the extract of bark of barberry root and barberry stem which contains almost 1.5% berberin was formulated showing that it reduces plaque formation and prevents gingivitis.[11]

Periodontitis

Periodontitis in comparison with gingivitis is a more severe inflammation, which if not treated may lead to teeth loss.[12] Treatment generally involves mechanical therapy (non-surgical or surgical debridement) in conjunction with antibiotics. Herbal remedies have been the focus of research in recent times.

Aloe vera

A study was done in which aloe vera gel was used as a local drug delivery. A significant reduction in pocket depth when compared to controls and reduction in gingival index, which can be attributed to its anti-inflammatory, antibacterial and wound-healing properties was seen.[13] Thus, it can be hypothesized that aloe vera extracts can be useful in the control and treatment of periodontal diseases by virtue of their antioxidant properties as well.

Neem

Vennila et al. conducted a study in chronic periodontitis patients on the effect of 10% whole neem chip used as an addition to scaling and root planing and found that the clinical parameters were statistically improved and presence of P. gingivalis strains were significantly reduced on the sites where neem chips were used.[14]

Green tea

Green contains the highest concentrations of antioxidants called polyphenols, classified as catechins.[15] There are six primary catechin compounds in green tea: catechin, gallocatechin, epicatechin, epigallocatechin, epicatechin gallate and epigallocatechin gallate (EGCg). EGCg is a very potent antioxidant. Green tea catechins have been observed to have profound effects on periodontal pathogens, anaerobic bacteria like *Porphyromonas gingivalis* and *Prevotella intermedia* and *Prevotella nigrescens*.[16]

Triphala
Triphala has also been known to inhibit the collagenases derived from polymorphonuclear leukocytes which are responsible for connective tissue destruction in periodontal disease. In a randomized controlled clinical trial, the efficacy of triphala mouthwash was compared with 0.2% chlorhexidine in hospitalized periodontal disease patients and was found that triphala mouthwash is an effective antiplaque agent like 0.2% chlorhexidine.[17]

Garlic (Allium sativum)
Garlic consists of alliin, ajoene, diallyl sulfide, dithiin, S-acetylcysteine and enzymes, B vitamins, proteins, minerals and has antibacterial, antiviral, and antifungal, antiseptic, bacteriostatic, antihelminthic effects. Studies have been done using garlic to treat dental caries and periodontitis. It is chopped and held in the mouth for 5 minutes to sterilize the oral cavity, which is due to its strong antibacterial activity.[18]

Curcumin
Curcumin downregulates the expression of cyclooxygenase-2, an enzyme that catalyzes the synthesis of prostaglandins which is linked to most forms of inflammation, including periodontitis. It also inhibits synthesis of inducible nitric oxide synthase, a strong pro-inflammatory molecule that is regulated by NF-κB, and promotes its direct degradation thereby reducing periodontitis. It has a synergistic antibacterial effects against *P. aeruginosa* and *S. aureus* by negatively affecting their virulence, quorum sensing and biofilm initiation.[19]

Tulsi
In periodontitis patients, Tulsi demonstrated effective antimicrobial property against *A. actinomycetemcomitans*, suggesting its possible use as an alternate medicine in the management of periodontal conditions. Also, the 2% tulsi gel showed good anti-inflammatory effect resulting in reduction of gingival inflammation and pocket depth confirming its use as an adjunct.[20]

Safflower seed extract (Carthamus tinctorius)
Recently, safflower seed extract has attracted attention with reference to some of the cellular events like chemotactic response, proliferation and alkaline phosphatase activity of periodontal ligament cells and osteoblasts to promote the mineralisation process.[21] Also, the extract (a) stimulates the formation of calcification nodules and mRNA expression of bone sialoprotein in periodontal ligament and MC3T3 E1 cells (b) facilitates the influx of Ca^{2+} from the extracellular fluid to the intracellular fluid and thus activates Ca^{2+} channel of osteoblastic cells.[22] Thus, safflower seed extract may be a novel approach in regeneration of the periodontal tissues. In another study, safflower extract was placed in two-walled infrabony defects. Significant reduction in mean probing pocket depth, gain in mean clinical attachment level and significant mean defect fill was observed.[23]

Eucalyptus (Globulus labill)
Eucalyptus extracts have demonstrated anticariogenic and antiplaque activity. A recent study has demonstrated inhibitory activity on virulence factors of *Porphyromonas gingivalis*, including Arg-and Lys-specific cysteine proteinases. 60% ethanol extracts from the Eucalyptus leaf displayed antibacterial activity against several periodontopathic bacteria, including *P. gingivalis* and *Prevotella intermedia*, in particular, among periodontopathic bacteria, the growth of P. gingivalis was strongly inhibited even with a low concentration (10 mg/ml) of eucalyptus extracts.[24]

Tea tree oil
The local delivery of tea tree oil gel in case of chronic periodontitis may have some beneficial effects, augmenting the conventional periodontal therapy. Moreover, it focuses on the value of monitoring gingival crevicular fluid levels of pentraxin-3 (PTX3) as a marker of periodontal tissue healing. There is effectiveness of adjunctive treatment of TTO on the clinical parameters and the level of PTX3 in chronic periodontitis.[25]

Chamomile
Two species of Chamomile are Matricaria chamomilla (German chamomile) and Chamaemelum nobile (Roman chamomile). German chamomile is most commonly used. Chamomile oil (concentration of 25mg/mL) demonstrates antibacterial activity against Grampositive bacteria such as *Bacillus subtilis, Staphylococcus aureus, Strptococcus mutans* and *Strptococcus salivarius.* It also has fungicidal activity against Candidia albicans.[26] Chamomile helps the body to resist or destroy microorganisms. Chamomile helps to reduce inflammation from periodontitis and also reduces the level of unhealthy bacteria in the mouth.[27]

CONCLUSION
Herbal medicine is proving to be an effective competitor to modern medicines as an adjunct to conventional therapies in the management of periodontitis. However more clinical trials are required to further confirm herbal medication as a reliable treatment modality for periodontal disease management.

REFERENCES
1. Lev E. Ethno-diversity within current ethno-pharmacology as part of Israeli traditional medicine - A review. J Ethnobiol Ethnomed. 2006;2(4):1-12.
2. Wolinsky LE, Mania S, Nachnani S, Ling S. The inhibiting effect of aqueous azadirachta indica (neem) extract upon bacterial properties influencing in vitro plaque formation. J Dent Res. 1996;75:

816-22.
3. Chatterjee A, Saluja M, Singh N, Kandwal A. To evaluate the antigingivitis and antiplaque effects of an Azadirachta indica (neem) mouthrinse on plaque induced gingivitis: A double-blind, randomized, controlled trial. J Indian Soc Periodontol. 2011;15:398-401.
4. Agarwal P, Nageshl L, Murlikrishnan. Evaluation of the antimicrobial activity of various concentrations of Tulsi (Ocimum sanctum) extract against Streptococcus mutans. Ind J Dent Res. 2010; 21:357-59.
5. Somu CA, Ravindra S, Ajith S, Ahamed MG. Efficacy of a herbal extract gel in the treatment of gingivitis: A clinical study. J Ayurveda Integr Med. 2012;3:85-90.
6. Mali AM, Behal R, Gilda SS. Comparative evaluation of 0.1% turmeric mouthwash with 0.2% chlorhexidine gluconate in prevention of plaque and gingivitis: A clinical and microbiological study. J Indian Soc Periodontol. 2012;16:386-91.
7. Giuliani C, Napolitano G, Bucci I, Montani V, Monaco F. Nf-kB transcription factor: Role in the pathogenesis of inflammatory, autoimmune, and neoplastic diseases and therapy implications. Clin Ter. 2001;152:249-53.
8. Gadagi JS, Chava VK, Reddy VR. Green tea extract as a local drug therapy on periodontitis patients with diabetes mellitus: A randomized case–control study. J Indian Soc Periodontol. 2013;17(2):198-203.
9. Pradeep AR, Agarwal E, Bajaj P, Naik SB, Shanbhag N, Uma SR. Clinical and microbiologic effects of commercially available gel and powder containing Acacia arabica on gingivitis. Aust Dent J. 2012;57(3):312-18.
10. Jagdish L, Anand Kumar VK, Kaviyarasan V. Effect of triphala on dental biofilm. Indian J Sci Technol. 2009;2:30-3.
11. Makarem A, Asodeh NK. Efficacy of barberry aqueous extracts dental gel on control of plaque and gingivitis. Acta Medica Iranica. 2007;44(2):91-4.
12. Reddy PD, Satyanarayana T, Purushothaman M. Local drug delivery of herbs for treatment of periodontitis. J Innov Trends Pharm Sci. 2010;1(5):245-51.
13. Bhat G, Kudva P, Dodwad V. Aloe vera: nature's soothing healer to periodontal disease. J Indian Soc Periodontol. 2011;15(3): 205-9.
14. Vennila K, Elanchezhiyan S, Ilavarasu S. Efficacy of 10% whole Azadirachta indica (neem) chip as an adjunct to scaling and root planning in chronic periodontitis: A clinical and microbiological study. Indian J Dent Res. 2016;27(1):15-21.
15. Asahi Y, Noiri Y, Miura J, Maezono H, Yamaguchi M, Yamamoto R, et al. Effects of the tea catechin epigallocatechin gallate on Porphyromonas gingivalis biofilms. J Appl Microbiol. 2014;116:1164-71.
16. Araghizadeh A, Kohanteb J, Fani MM. Inhibitory activity of green tea (Camellia sinensis) extract on some clinically isolated cariogenic and periodontopathic bacteria. Med Princ Pract. 2013;22:368-72.
17. Naiktari RS, Gaonkar P, Gurav AN, Khiste SV. A randomized clinical trial to evaluate and compare the efficacy of triphala mouthwash with 0.2% chlorhexidine in hospitalized patients with periodontal diseases. J Periodontal Implant Sci. 2014;44:134-40.
18. Bialonska D, Ramnani P, Kasimsetty SG, Muntha KR, Gibson GR, Ferreira D. The influence of pomegranate by-product and punicalagins on selected groups of human intestinal microbiota. Int J Food Microbiol. 2010;140:175-82.
19. Twetman S, Derawi B, Keller M, Ekstrand K, Yucel-Lindberg T, Stecksen-Blicks C. Short-term effect of chewing gums containing probiotic Lactobacillus reuteri on the levels of inflammatory mediators in gingival crevicular fluid. Acta Odontol Scand. 2009;67:19-24.
20. Hosadurga RR, Rao SN, Edavanputhalath R, et al. Evaluation of the efficacy of 2% Ocimum sanctum gel in the treatment of experimental periodontitis. Int J Pharm Investig. 2015;5(1):35-42.
21. Rhyu IC, Lee YM, Ku Y, Bae KW, Chung CP. The biologic effects of safflower extract and Dipsasi radix extract on periodontal ligament cells and osteoblastic cells. J Korean Acad Periodontol. 1997;27:867-82.
22. Monika B, Jaya D, Dhan PT. Safflower seed extract in the treatment of human periodontal osseous defects. J Indian Dent Assoc. 2014;8(2):8-17.
23. Mandeville FB. Aloe vera in the treatment of radiation ulcers of mucous menbranes. Radiology. 1939;32:598-99.
24. Nagata H, Inagaki Y, Yamamoto Y, Maeda K, Kataoka K, Osawa K, et al. Inhibitory effects of macrocarpals on the biological activity of Porphyromonas gingivalis and other periodontopathic bacteria. Oral Microbiol Immunol. 2006;21:159-63.
25. Mali AM, Behal R, Gilda SS. Comparative evaluation of 0.1% turmeric mouthwash with 0.2% chlorhexidine gluconate in prevention of plaque and gingivitis: A clinical and microbiological study. J Indian Soc Periodontol. 2012;16:386-91.
26. Garnick JJ, Singh B,Winkley G. Effectiveness of a medicament containing silicon dioxide, aloe, and allantoin on aphthous ulcers. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998;86:550-56.
27. Berry M. The chamomiles. Pharm J. 1995;254:191-93.