

Periodontal Disease and Phytotherapy

Petrović MS¹, Kesić LG^{1*}, Kitić DV², Milašin JM³, Obradović RR¹, Bojović MD¹, Simonović AA⁴

¹Department of Oral Medicine and Periodontology, Dental Clinic, Faculty of Medicine, University of Niš, Serbia

²Department of Pharmacy, Faculty of Medicine, University of Niš, Serbia

³Department of Molecular Biology and Genetics, Faculty of Dental Medicine, University of Belgrade, Serbia

⁴Faculty of Medicine, University of Niš, Serbia

*Corresponding author: Ljiljana Kesić, Dental clinic, Medical faculty University of Niš, Department for Oral Medicine and Periodontology, Bulevar Zorana Đinđića 81, 18 000 Niš, Serbia, Tel: +381-64-26-700-99; E-mail: kesic.ljiljana@gmail.com

Received: January 26, 2015; Accepted: March 03 2015; Published: March 10, 2015

Copyright: © 2015 Petrovic et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract:

Phytotherapy is used as an additional therapeutic method of treatment for gingivitis and periodontal disease. Besides its therapeutic effects, it has a role in improving general immunity. Herbs and their extracts have antimicrobial, antioxidative and antiinflammatory effects. Aim of this review article is to give a basic overview of usage of herbal species in treatment of periodontal disease. Besides causal treatment for periodontal disease, which represents "gold standard" of periodontal therapy, the proper combination of herbal species and their extracts can improve the usual therapeutic procedure in patients with gingivitis and periodontal disease.

Keywords Phytotherapy; Periodontal disease; Gingivitis

Introduction

The periodontal disease is a major public health problem, which affects up to 90% of the worldwide population [1]. Gingivitis always precedes periodontal disease. The main characteristic of periodontal disease is destruction of supporting tissue of the tooth. The main etiological factor is microbial oral biofilm. Periodontal pathogens are: *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Treponema denticola* etc. *Aggregatibacter actinomycetemcomitans* is commonly associated with this disease, especially in young adults [2,3]. Some new studies [4,5] demonstrate that Herpes viruses can be involved in pathogenesis of periodontal disease. Periodontal inflammation is followed by release of bacterial leucotoxins, collagenases, fibrinolysins, and other proteases [6]. Increased leukocyte infiltration and changes in vascular permeability have always been present in periodontal tissues inflammation [7]. Antibiotics (tetracyclines and metronidazole), antiseptics (chlorhexidine), phenols, oils, and herbal compounds have been in use since 1980 [8].

Since the tooth cleaning is essential for maintaining of oral hygiene, indigenous people, worldwide, have used natural toothbrushes made of herbs. These natural toothbrushes, made of twigs, actually work quite well. They contain medical ingredients produced by the herb itself. In Asia, people often use twigs of the neem tree (*Azadirachta indica*) [9,10].

Haffajee et al. [11] have been examining herbal product, the Natural Dentist, Medford, Mass[®], that contains several anti-inflammatory agents: aloe vera, calendula, as well as antimicrobial agents such as Golden Seal, grapefruit seeds and they concluded that herbal mouth rinse had beneficial effects such as reducing gingival inflammation and inhibiting of aerobic and anaerobic bacterial growth.

It has been experimentally confirmed that extraction of certain chemicals from herbs destroys minerals, volatile oils, bioflavonoids

and other substances in high percentage [12,13]. Herbs and their extracts are used to stimulate superficial circulation, increase elimination of harmful substances and reduce inflammation and irritation. Herbal products may be used as pills, syrups and infusions or externally as creams, ointments and liniments. A topical application of clove oil, for instance, decreases the toothache [8]. Using new clinical trials about herbal products published every year [13], makes collecting evidence about herbs' medical properties a dynamic and quick process.

Herbal species with medical properties have been used for centuries to prevent and treat different diseases [8,9,12,13]. The biggest problem is the lack of information about effects of herbal species on periodontal tissues and mechanism of action. Herbal products may vary in their effectiveness, therefore it is necessary to select herbal species carefully. Herbs and their extracts can be used as adjuvant in periodontal disease treatment [8].

Sage (*Salvia officinalis*)

Sage belongs to Lamiaceae family. Sage grows in the fields and along roadsides. It can be used as mouth rinse and it has been recommended for treatment of sore throat, stomatitis, gingivitis and periodontal disease [14]. Sage essential oils have antibiotic, antifungal and antiviral properties and it has been used to reduce inflammatory process in stomatitis and pharyngitis [14]. For therapy: 3g of sage chopped leaf could be added to 150 ml of boiling water for 10 minutes [15]. Then, it can be used as a mouth rinse several times a day. Another prescription for mouth rinse is: two tablespoon of sage chopped leaf immersed in half a liter of water, covered and brought to a boil and then left covered for 15 minutes-this can be used for gargling several times a day for 5 to 10 minutes [15]. Pistorius et al. [16] have reported a significant reduction in gingival indices with daily use of mouth rinse and concluded that it could be used every day as an adjunctive therapy to reduce gingival inflammation and it contains following herbal species: *Salvia officinalis*, *Mentha piperita* (menthol), *Matricaria chamomilla*, *Commiphora myrrha*, *Carum carvi*

(Umbelliferae), *Eugenia caryophyllus* (Myrtaceae) and *Ehinacea purpurea*. *Salvia officinalis* has aromatic, spasmolytic, antiseptic, astringent properties and when it is taken as a mouthwash, *Salvia* deals effectively with throat infections, gingivitis and mouth ulcers [17].

Drinking sage tea is not recommended during pregnancy and lactation, but mouth rinse and gargling is allowed [8].

Aloe vera (*Aloe vera*)

Aloe vera belongs to Asphodelaceae family. It contains vitamins, enzymes, minerals, sugars, fatty acids, amino and salicylic acids [18]. Aloe vera (in the form of a gel) improves wound healing and it can be used for burns, insect-bites and many other skin and mucosal lesions. Because of numerous healing properties of aloe vera, it has been used as dietary supplement and powerful antioxidant, as wound healing accelerator, after periodontal surgery, for traumatized gingival lesions by toothbrush, toothpick or solid food. Aloe vera (gel formula) is a non-toxic bactericide and it has antiviral, antifungal, anti-inflammatory, analgesic properties and immune-stimulating properties [18-20]. The anti-inflammatory activity of Aloe vera inhibits the cyclooxygenase pathway and reduces prostaglandin E2 production [21].

Scherer et al. [22] confirmed that a mouth rinse, which contains Aloe vera reduces gingival inflammation and bleeding. A short-term study by Bhat et al. [23] demonstrated that aloe vera gel showed significant decrease in pocket depth and relative decrease in gingival and plaque indices, when applied subgingivally.

Aloe vera gel applications directly to the site of periodontal surgery or to gingiva when it has been traumatized with a tooth brush dentifrice abrasion, sharp foods, dental floss and toothpick injuries have shown improved healing properties [24]. Aloe vera gel at optimum concentrations in toothpastes or mouthwashes could be useful for prevention of periodontal diseases and dental caries [25].

Chamomile (*Matricaria recutita* or *Matricaria chamomilla*)

Chamomile (*Matricaria recutita*) belongs to Asteraceae family and it is one of the most popular herbs. It is used as ingredient of mouth rinse and in prevention and treatment of gingivitis and periodontal disease. It can also be used in the form of capsules, tablets, or tinctures [8].

McKay and Blumberg [26] demonstrated anti-inflammatory activity in an animal model study. Lucena et al. [27], found a reduction in the gingiva bleeding index, confirming the 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 ($p < 0.05$) in the different assessment periods (0,7 and 15 days). Batista et al. [28] used chamomile and pomegranate extracts mouthwashes, which were effective in reducing gingival bleeding in periodontal disease, suggesting that both extracts have anti-inflammatory and antimicrobial actions similar to those of the chlorhexidine 0.12%, and thus can also be used as additional therapeutic agents to reestablish and maintain periodontal health.

There have been reports of allergic reactions to chamomile (*Matricaria recutita*) [29]. These reactions were followed by bronchial constriction with systemic administration and skin reactions after topical application [30].

Peppermint (*Mentha piperita*)

Peppermint (Mint) belongs to Lamiaceae family, and it reduces inflammation. In addition, it has been used to reduce the toothache, with cotton balls soaked in peppermint oil and put in the tooth cavity [8]. Peppermint oil, when used locally, has an analgesic effect [15]. Peppermint leaf tablets and capsules, 3–6 g per day, diluted, could be used as a mouth rinse to reduce gingival inflammation after periodontal treatment [8]. Essential oil and peppermint leaves are used for making mouth rinses and gels that affect the periodontal bacteria [31].

The most important phenolic compounds in *Mentha* species are flavonoids and they are found to pose a wide range of pharmacological activity: antioxidant, antiulcer, cytoprotective, chemo preventive and anti-inflammatory [32].

Peppermint tea is generally considered safe for regular consumption. Peppermint oil can cause sensation in gastrointestinal tract for some people [33].

Tea tree (*Melaleuca alternifolia*)

Tea tree or *Melaleuca alternifolia* belongs to Myrtaceae family. It can be applied directly on the inflamed gums, for instant relief [8]. Mouth rinse reduces inflammation and it has been used in endodontic and necrotic pulp treatment [11]. *Melaleuca alternifolia* has shown good effectiveness in control of microbial biofilm, with a significant reduction of gingival bleeding index [34]. Santamaria et al. [35] evaluated the antimicrobial effects of tea tree essential oil gel in controlling of oral microbial biofilm formation and they established its effectiveness against bacteria.

Tea tree oil has demonstrated the ability to suppress the in vitro production of inflammatory cytokines, suggesting its potential as a therapeutic agent for inflammatory diseases, such as periodontal disease, via modulation of the host response [36].

Ehinacea (Purple coneflower)

Ehinacea, a herb that belongs to Asteraceae family, boosts the immune system [37]. Its constituents act together to increase production and activity of white blood cells (lymphocytes and macrophages). Mouth rinse with ehinacea, sage, mint oil and chamomile is used in gingivitis and periodontal disease treatment [37]. Kumar et al. [31] reported anti-inflammatory and antibacterial effects of ehinacea. Several studies [38-40] testified to its benefit for natural treatment of cold and flu symptoms.

Rosemary (*Rosmarinus officinalis*)

Rosemary belongs to Lamiaceae family and its volatile oil has antibacterial and antifungal properties. It is effective against chronic disseminated candidiasis [41]. The concentrated volatile oil should not be given orally [42]. Other studies [43,44] about the properties of rosemary's essential oil demonstrated its antimicrobial and antioxidative activity. Santoyo et al. [45] examined rosemary's antimicrobial activity and they concluded that the following five components of essential oil are responsible: borneol, 1,8-cineole, camphor, verbenone and α -Pinene. Borneol has given better results in antimicrobial activity, followed by camphor and verbenone [45]. Lee et al. [46] found that rosmarinic acid caused significant induction of alkaline phosphatase activity and induced mineralization in osteoblasts, so it could be used to prevent bone metabolic diseases.

Red clover (*Trifolium pretenase*)

Red clover belongs to Fabaceae family. Red clover mouthwash has been used in treatment of gingivitis and periodontal disease. After preparing the red clover tea, leaves and flowers can be used for preparing the gel with antibiotic properties. Ramos et al. [47] have shown the anti-inflammatory activity of red clover dry extract in their *in vitro* and *in vivo* studies.

Wintergreen (*Gaultheria procumbens*)

Wintergreen belongs to Ericaceae family. Wintergreen mouth rinse is an excellent adstringent and antiseptic. A cotton ball soaked in wintergreen oil is used for temporary relief and as remedy for sore throat and gum inflammation [9]. Nikolić et al. [48] have shown antimicrobial activity of Wintergreen essential oil against wide range of Gram-positive and Gram-negative bacteria and fungi, as well as its antioxidant potential.

Barberry (*Berberis vulgaris*)

Barberry belongs to Berberidaceae family. Berberine, alkaloid from *Berberis vulgaris*, has been added to toothpastes and mouth rinses due to its antimicrobial activities [49]. Barberry gel has been used as efficient adjuvant for oral biofilm control and for reduction of gingival inflammation in children [50]. Barberry juice contains high level of vitamin C and increases host-immune response and stimulates iron absorption [51]. Enzo i Palombo [52] have demonstrated that alkaloids such as berberine were more effective against bacteria such as *Aggregatibacter actinomycetemcomitans* and *Porfyromonas gingivalis* than against lactobacilli and streptococci. Berberine also inhibited collagenase activity of *Aggregatibacter actinomycetemcomitans* and *Porfyromonas gingivalis*.

Makarem et al. [50] examined berberine gel and concluded that it reduces oral biofilm by 56% and gingival index by 33% (GI). Studies [53,54] have indicated that berberine has multiple pharmacological activities including anti-inflammatory, anti-cyclooxygenase, and anti-inducible nitric oxide synthases effects. It is suggested that berberine may decrease the periodontal tissue degradation through the regulation of matrix metalloproteinase during the progression of periodontal disease [55].

Conclusion

Phytotherapy, as additional therapeutic method, has been expanding rapidly, conquering the whole world. Herbs and their extracts have been used as adjuvants in periodontal treatment because they reduce inflammation and act as antioxidants and antibiotics. The usage of herbal products in periodontal treatment has a great potential, but it is a challenge to determine the proper combination of herbal species and their extracts.

References

1. Pihlstrom BL, Michalowicz BS, Johnson NW (2005) Periodontal diseases. Lancet 366: 1809-1820.
2. Socransky SS, Haffajee AD (1994) Evidence of bacterial etiology: a historical perspective. Periodontol 5: 7-25.
3. Mandell RL, Socransky SS (1981) A selective medium for *Actinobacillus actinomycetemcomitans* and the incidence of the organism in juvenile periodontitis. J Periodontol 52: 593-598.

4. Kubar A, Saygun I, Ozdemir A, Yapar M, Slots J (2005) Real-time polymerase chain reaction quantification of human cytomegalovirus and Epstein-Barr virus in periodontal pockets and the adjacent gingiva of periodontitis lesions. J Periodontol Res 40: 97-104.
5. Michalowicz BS, Ronderos M, Camara-Silva R, Contreras A, Slots J (2000) Human herpesviruses and *Porphyromonas gingivalis* are associated with juvenile periodontitis. J Periodontol 71: 981-988.
6. Slots J (2004) Herpes viruses, the missing link between gingivitis and periodontitis? J Int Acad Periodontol 6: 113-119.
7. Newman MG, Takai HH, Carranza FA (2006) Carranza's Clinical Periodontology. (10th edn), WB Saunders Company, Philadelphia, PA.
8. Taheri JB, Azimi S, Rafieian N, Akhavan Zanjani H (2011) Herbs in dentistry. Int Dent J 61: 287-296.
9. Kumar G, Jalaluddin M, Rout P, Mohanty R, Dileep CL (2013) Emerging Trends of Herbal Care in Dentistry. J Clin Diagn Res 7: 1827-1829.
10. Almas K (2001) The antimicrobial effects of seven different types of Asian chewing sticks. Odontostomatol Trop 96: 17-20.
11. Haffajee AD, Yaskell T, Socransky SS (2008) Antimicrobial effectiveness of an herbal mouthrinse compared with an essential oil and a chlorhexidine mouthrinse. J Am Dent Assoc 139: 606-611.
12. Duke JA (1985) CRC Handbook of Medicinal Herbs. CRC Press, Boca Raton, Florida.
13. Rotblatt M, Ziment I (2002) Evidence-based Herbal Medicine. Hanley and Belfus, Philadelphia, PA, USA
14. ESCOP 1996. *Salviae folium* (Sage leaf). Monographs on the Medicinal Use of Plant Drugs. Exeter, UK: European Scientific Cooperative on Phytotherapy; 1997.
15. Blumenthal M, Busse WR, Goldberg A, Gruenwald J, Hall, Riggins CW, Klein S, Rister RS. The Complete German Commission E Monographs: Therapeutic Guide to Herbal Medicines. Austin, American Botanical Council and Boston: Integrative Medicine Communications; 1998. pp. 180-182.
16. Pistorius A, Willershausen B, Steinmeier EM, Kreisler M (2003) Efficacy of subgingival irrigation using herbal extracts on gingival inflammation. J Periodontol 74: 616-622.
17. Narayanan N, Thangavelu L (2015) *Salvia officinalis* in dentistry. Dent Hypotheses 6: 27-30.
18. Danhof IE, McAnally BH (1983) Stabilized aloe vera: effect on human skin cells. Drug Cosmet Ind 133: 52-106.
19. Winters WD, Benavides R, Clouse WJ (1981) Effects of aloe extracts on human normal and tumor cells in vitro. Eco Bot 35: 89-95.
20. Ulbricht C, Armstrong J, Basch E, Basch S, Bent S et al. (2008) An evidence-based systematic review of Aloe vera by the natural standard research collaboration. J Herb Pharmacother 7: 279-323.
21. Sajjad A, Subhani Sajjad S (2014) Aloe vera: An Ancient Herb for Modern Dentistry-A Literature Review. J Dent Surg Article ID 210463.
22. Scherer W, Gultz J, Lee SS, Kaim J (1998) The ability of an herbal mouthrinse to reduce gingival bleeding. J Clin Dent 9: 97-100.
23. Bhat G, Kudva P, Dodwad V (2011) Aloe vera: nature's soothing healer to periodontal disease. J Indian Soc Periodontol 15: 205-209.
24. Wynn RL (2005) Aloe vera gel: Update for dentistry. Gen Dent 53: 6-9.
25. Subhash AV, Suneela S, Anuradha C, Bhavani SN, Minor Babu MS (2014) The role of Aloe vera in various fields of medicine and dentistry. J Orofac Sci 6: 5-9.
26. McKay DL, Blumberg JB (2006) A review of the bioactivity and potential health benefits of chamomile tea (*Matricaria recutita* L). Phytother Res 20: 519-530.
27. Lucena RN, Lins RDAU, Ramos INC, Cavalcanti AL, Gomes RCB et al. (2009) Estudo clínico comparativo do efeito anti-inflamatório da *Matricaria recutita* e da clorexidina em pacientes com gengivite crônica. Rev Bras Pesqui 11: 31-36.
28. Batista ALA, Lins RDAU, de Souza CR, do Nascimento BD, Belém NM, Celestino FJA (2014) Clinical efficacy analysis of the mouth rinsing with pomegranate and chamomile plant extracts in the gingival bleeding reduction. Complement Ther Clin Pract 20: 93-98.

29. Brown DJ (1996) *Herbal Prescriptions for Better Health: Your Everyday Guide to Prevention, Treatment, and Care*. Prima Publishing, Rocklin, California, USA.
30. Foti C, Nettis E, Panebianco R, Cassano N, Diaferio A et al. (2000) Contact urticaria from *Matricaria chemomilla*. *Contact Derm* 42: 360-361.
31. Kumar P, Ansari SH, Ali J (2009) Herbal remedies for the treatment of periodontal disease-a patent review. *Recent Pat Drug Deliv Formul* 3: 221-228.
32. Mimica-Dukic N, Bozin B (2008) *Mentha L. species* (Lamiaceae) as promising sources of bioactive secondary metabolites. *Curr Pharm Des* 14: 3141-3150.
33. Wichtl M. *Herbal (1994) Drugs and Phytopharmaceuticals*. CRC Press, Boca Raton, Florida, USA
34. Soukoulis S, Hirsch R (2004) The effects of a tea tree oil-containing gel on plaque and chronic gingivitis. *Aust Dent J* 49: 78-83.
35. Santamaria JM, Petermann KD, Vedovello SAS, Degan V, Lucato A, et al. (2014) Antimicrobial effect of *Melaleuca alternifolia* dental gel in orthodontic patients. *Am J Orthod Dentofacial Orthop* 145: 198-202.
36. Nogueira MNM, Aquino SG, Junior SR, Spolidorio DMP (2014) Terpinen-4-ol and alpha-terpineol (tea tree oil components) inhibit the production of IL-1 β , IL-6 and IL-10 on human macrophages. *Inflamm Res* 63: 769-778.
37. Modarai M, Silva E, Suter A, Heinrich M, Kortenkamp A (2011) Safety of Herbal Medicinal Products: echinacea and Selected Alkylamides Do Not Induce CYP3A4 mRNA Expression. *Evid Based Complement Alternat Med* Article Id: 213021.
38. Carabin IG, Flamm WG (1999) Evaluation of safety of inulin and oligofructose as dietary fiber. *Regul Toxicol Pharmacol* 30: 268-282.
39. Coussement PA (1999) Inulin and oligofructose: safe intakes and legal status. *J Nutr* 129: 1412S-1417S.
40. Gay-Crosier F, Schreiber G, Hauser C (2000) Anaphylaxis from inulin in vegetables and processed food. *N Engl J Med* 342: 1372.
41. Huhtanen C. (1980) Inhibition of *Clostridium botulinum* by spice extract and aliphatic alcohols. *J Food Protect* 43: 195-196.
42. Rakover Y, Ben-Arye E, Goldstein LH (2008) The treatment of respiratory ailments with essential oils of some aromatic medicinal plants. *Harefuah* 147: 783-788.
43. Newall CA, Anderson LA, Phillipson JD (1996) *Herbal Medicine: A Guide for Health-Care Professionals*. Pharmaceutical Press, London.
44. Bozin B, Mimica-Dukic N, Samojlik I, Jovin E (2007) Antimicrobial and antioxidant properties of rosemary and sage (*Rosmarinus officinalis L.* and *Salvia officinalis L.*, Lamiaceae) essential oils. *J Agric Food Chem* 55: 7879-7885.
45. Santoyo S, Cavero S, Jaime L, Ibanez E, Senorans FJ (2005) Chemical composition and antimicrobial activity of *Rosmarinus officinalis L.* essential oil obtained via supercritical fluid extraction. *J Food Prot* 68: 790-795.
46. Lee JW, Asai M, Jeon SK, Iimura T, Yonezawa T et al. (2015) Rosmarinic acid exerts an antiosteoporotic effect in the RANKL-induced mouse model of bone loss by promotion of osteoblastic differentiation and inhibition of osteoclastic differentiation. *Mol Nutr Food Res* 59: 386-400.
47. Ramos GP, Apel MA, Morais CBD, Ceoloto PC, Schapoval EE et al. (2012) In vivo and in vitro anti-inflammatory activity of red clover *Trifolium pratense* dry extract. *Rev bras farmacogn* 22: 176-180.
48. Nikolić M, Marković T, Mojović M, Pejin B, Savić A, et al. (2013) Chemical composition and biological activity of *Gaultheria procumbens L.* essential oil. *Ind Crops Prod* 49: 561-567.
49. Taghavi AM, Shabzendedar M, Parissay I, Makarem A, Orafaei H, et al. (2012) Effect of Berberine Gel on Periodontal Inflammation: Clinical and Histological. *J Periodontol* 4: 7-11.
50. Makarem A, Khalili N, Asodeh R (2007) Efficacy of barberry aqueous extracts dental gel on control of plaque and gingivitis. *Acta Med Iran* 45: 91-94.
51. Javadzadeh SM, Fallah SR (2012) Therapeutic application of different parts *Berberis vulgaris*. *Intl J Agri Crop Sci* 4: 404-408.
52. Palombo EA (2011) Traditional medicinal plant extracts and natural products with activity against oral bacteria: potential application in the prevention and treatment of oral diseases. *Evid Based Complement Alternat Med* Article ID 680354.
53. Jiang Q, Liu P, Wu X, Liu W, Shen X et al. (2011) Berberine attenuates lipopolysaccharide-induced extracellular matrix accumulation and inflammation in rat mesangial cells: involvement of NF κ B signaling pathway. *Mol Cell Endocrinol* 331: 34-40.
54. Lee CH, Chen JC, Hsiang CY, Wu SL, Wu HC et al. (2007) Berberine suppresses inflammatory agents-induced interleukin-1 β and tumor necrosis factor- α productions via the inhibition of IkappaB degradation in human lung cells. *Pharmacol Res* 56: 193-201.
55. Tu HP, Fu MM, Kuo PJ, Chin YT, Chiang CY et al. (2013) Berberine's effect on periodontal tissue degradation by matrix metalloproteinases: an in vitro and in vivo experiment. *Phytomedicine* 20: 1203-1210.