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Natural products used in dentistry - A Review

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Abstract

Phytotherapy is the study of the use of extracts from natural origin as medicines or health-promoting agents. 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. The natural phytochemicals could offer an effective alternative to antibiotics and represent a promising approach in prevention and therapeutic strategies for dental caries and other oral infections.

Keywords: Anti-inflammatory, Antibacterial, Antifungal, Phytotherapy, Dental practice, Therapeutic strategies.

Introduction

Phytotherapy is the study of the use of extracts from natural origin as medicines or health-promoting agents. Herbs with medicinal properties are useful and effective source for treatment of various disease processes.[1] Indian subcontinent is a massive repository of medicinal plants that are used in traditional medical healings, which also form a rich source of knowledge. There are ~1,250 Indian medicinal plants that are used in formulating beneficial measures according to Ayurvedic or other ethnicity.[2]

In dentistry, they are classified according to use as

- Antimicrobial agents
- Anti-inflammatory agents
- Sedative and anxiolytics.

Miscellaneous- endodontic irrigants, medicaments and endodontic retreatment.[3]

Even though chemo-mechanical preparation of root canal is able to reduce the number of bacteria, the intracanal medicament with antibacterial action is required to maximize the disinfection of root canal system.[4]

A wide range of antimicrobial agents and herbal products are added to dentifrice and mouth rinsing solutions with the aim of preventing caries or biofilm formation.[5]

Various natural products such as *Curcuma zedoaria*, calendula, *Aloe vera* and other herbs have been used effectively to treat oral diseases.[6] The natural phytochemicals could offer an effective alternative to antibiotics and represent a promising approach in prevention and therapeutic strategies for dental caries and other oral infections.

Pharmacological applications

Antimicrobial and anti-inflammatory activity

Triphala consists of equal parts of the *Emblica officinalis*, *Terminalia chebula*, and *Terminalia belerica*.[7] Anti-microbial and anti-oxidant effect of Triphala has been proven *in-vitro* as it has been shown to inhibit *Streptococcus mutans* at concentrations as low as 50µg/ml. This anti-plaque effect probably may be due to the tannic acid in Triphala, which result in protein denaturation and bacterial cell death.[8] The extract of *T. chebula* may be an effective agent in the treatment of carious teeth, owing to its ability to inhibit the growth and accumulation of *S. mutans* on the surface of the tooth. This prevents the accumulation of acids on the surface of the tooth, and further demineralization and breakdown of the tooth enamel.[9]

Allium sativum(Garlic) has antimicrobial activity against oral microorganisms in which 2.5[10] and 3%[11] concentrations showed good antimicrobial activity against *S. mutans*.

Curcumin longa(Turmeric) is the bioactive component of turmeric and has a wide spectrum of actions like anti-inflammatory, anti-oxidant, antibacterial, antifungal, antiprotozoal and antiviral activities.[12]

*Psidium guajava(*Guava) has an anti-inflammatory action with its ability to inhibit prostaglandin, kinin and histamine.[13]

Punica granetum (Pomegranate) is found to be efficacious against *Candida* and the cariogenic bacteria with high reserves of tannins and polyphenols acknowledged for their antibacterial activity.[14]

*Azadirachta indica(*Neem) has been proved to be effective against E. faecalis and Candida albicans.[15]

Salvadora persica(Miswaak/tooth brush tree) is antimicrobial in its action and is used as a traditional oral hygiene aid.[16]

Sedative and anxiolytic activity

Melissa officinalis (Lemon balm), derived from dried leaves, contains volatile oils responsible for its mild sedative, anxiolytic and hypnotic effects.

Valerenic acid inhibits the enzyme system causing a breakdown of GABA in the brain and consequent increase in GABA levels is associated with sedation and decrease in CNS activity.[17]

Clinical applications

Herbs have been used as an antimicrobial agent against various endodontic pathogens. Herbs have also been long used in various endodontic medicaments and dressings with obtundent and soothening effects.

1. Endodontic applications:

1.1 Endodontic irrigants:

High antimicrobial activity of *Salvadora persica(*Miswaak) extract against aerobic and anaerobic microorganisms was demonstrated at 15% concentration.[18] Use of *Azadirachta indica* (Neem) as an endodontic irrigant might be advantageous because it is a biocompatible antioxidant and thus not likely to cause the severe injuries to patients that might occur via NaOCl accidents.[19] *Morinda citrifolia*(Indian mulberry) was more effective than chlorhexidine in removing the smear layer. The efficacy of M. citrifolia was similar to sodium hypochloride (NaOCl) in conjunction with EDTA as an intracanal irrigant.Green tea exhibits antibacterial activity on E.faecalis cells. It is also found to be a good chelating agent.[20]

Aqueous extracts of both *Allium cepa* (Liliaceae) and *Allium sativum* (Liliaceae) have shown good antimicrobial activity against Gram-positive and Gram negative bacterial species and fungi, with the *A. sativum* (garlic) extract showing better results.[21]

Propolis is a resinous mixture that honey bees collect from tree buds, sap flows, or other botanical sources and contains flavonoids .Its actions include antimicrobial, antiinflammatory, anesthetic, cytostatic and cariostatic effects.[16]

1.2 Endodontic retreatment

Orange oil was suggested as an alternative to chloroform and xylol for endodontic re-treatment, since both have toxic and carcinogenic effects.This is composed mostly of d-limonene. It also has a long chain aliphatic hydrocarbon alcohols, aldehydes like octanal. It is suggested as an alternative to chloroform or xylene for gutta‑percha softening and also in dissolving endodontic sealers.[22]

1.3 Intracanal medicaments

Propolis exhibited good in vitro antibacterial activity against E. faecalis in root canals, suggesting that it could be used as an alternative intracanal medicament.[23]

Articum lappa(Common or great burdock) has been investigated due to its antimicrobial potential against oral microorganisms specifically those associated with endodontic infections.[24]

2. Pulp capping applications:

Propolis promotes bone regeneration and induction of hard tissue bridge formation in pulpotomy and pulp capping.[25] The response of pulps to propolis as a pulp capping agent was comparable to MTA and Dycal.[26]

3. Surgical applications:

Ankaferd Blood Stopper(ABS) is a standardized extract from the following plants: *Thymus vulgaris, Glycyrrhiza glabra, Vitis vinifera, Alpinia officinarum and Urtica dioica* in a weight ratio of 6:8:7:7:5, respectively.The basic mechanism of action of ABS is through the formation of encapsulated protein network providing focal points for vital erythrocytes to aggregate on.ABS was found to be effective within 10–20 min in controlling bleeding in most of the patients after dental surgery.[27]

Calendula officinalis(English marigold) flower extract treatment promotes wound to heal much faster attributable to its capability to enhance the synthesis of connective tissue, especially collagen[28] Aloe vera extract reduces incidence of alveolar osteitis compared with clindamycin-soaked Gelfoam.[29]

*Curcumin longa(*Turmeric) was shown to be effective in reducing wound-healing time and acts as proangiogenic agent, playing a role in remodeling phase of wound repair.[30]

4. Periodontal applications:

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.

A mouthrinse containing Aloe vera was found to reduce gingival inflammation and gingival bleeding and was more effective than Listerine in reducing counts of aerobic, microaerophilic and anaerobic bacteria.[31] *Punicia granatum* (Pomegranate) extract decreased the number of colony forming units of dental plaque bacteria by 84%, comparable to chlorhexidine.[32] Use of *Salvadora persica(*Miswaak) mouthwash resulted in improved gingival health and lower carriage rate of cariogenic bacteria when compared with the pre-treatment values.[33]

5. Oral mucosal healing applications:

Herbal treatments are generally palliative in character.Aloe vera gel accelerates the healing of apthous ulcers and reduces the pain associated with them.[34] *Krameria triandra*(Rhatany) acts by the astringent rhataniatannic acid whose infusions have been used as a gargle and lozenges.[35] *Glycyrrhiza glabra*(licorice) controls the pain and reduces the healing time of recurrent apthous ulcer.[36] The activity of *Coriander sativum* oil has the potential as natural antifungal formulation.[37] Cytopathic effect of herpes simplex virus (HSV-2) was reduced with the use of *Melissa Officinalis* (Lemon balm).[38]

6. Dental trauma applications:

In vivo studies showed that teeth maintained in propolis medium exhibited replacement resorption with significant reduction in tooth length, similar to teeth maintained in saliva and dried teeth.[39] *Salvia officinalis*(Garden sage) extracts serve as a storage medium for the maintenance of PDL cell viability of avulsed teeth.[40] skimmed and whole milk, followed by natural coconut water and HBSS, were the most effective media in maintaining cell viability of PDL fibroblasts.[41] *Morus rubra* (Indian mulberry) can be recommended as a suitable transport medium for avulsed teeth.[42] Efficacy of *Camellia sinensis(*Green Tea) extract in maintaining the viability of human PDL cells is similar to that of HBSS and higher than that of milk.[43]

7. Applications in dental materials:

The commonly used materials in routine dental practice of herbal origin includes zinc oxide eugenol cement, impression materials (agar agar and alginate), gutta-percha root canal filling material, citric acid, camphorated monochlorophenol medicament and thymol.

Side effects of phytodentistry

Allergy: Tea tree oil, extracted from *M. alternifolia*, has been reported as causing allergic contact dermatitis.[44,45] Allergic reactions might also be associated with *E. purpurea*. *M.officinalis* and *A.sativum*, might also cause contact dermatitis.[46,47] Allergic conjunctivitis has been associated with chamomile (*M. chamomilla*) tea.[48]

Gastrointestinal effects: *E. purpurea* and *V. officinalis* might cause gastrointestinal upsets or dysfunction.[49]Nausea and diarrhoea were reported when lemon balm was used at doses of 900 and 1200 mg/day.[50]

Central nervous system effects and other systems:*V. officinalis* showed side effects such as headache/ dizziness and residual sedation was observed at 900 mg doses.[51]

P. incarnata caused vasculitis in patients suffering from insomnia.[52]

Phytotherapeutic interactions

M. chamomilla has a theoretical risk for potentiation of the anticoagulation effects of warfarin.[53] *V. officinalis* was reported to prolong thiopental and pentobarbital induced sleep. It is wise to avoid the concurrent use of valerian and barbiturates and/or benzodiazepines.[54] *P. incarnata* should be taken cautiously when used concomitantly with other CNS depressants, stimulants and phenelzine, a MAO inhibitor agent.[55]

M. officinalis combined with alcohol and barbiturates might increase sedative and hypnotic effects.[56]

Conclusion

Many herbal drugs have potential medicinal properties; however, the literature is scarce with regard to information on the quality, safety and efficacy of herbal plants for use in dentistry. Further studies are needed to investigate the side effects, toxicity and drug interactions of these plants for dental applications.

References

1. Patil DR. Cultural History from the Vayupurana. 1st ed. New Delhi: Motilal Banarasidas Publishers; 1973.p.230.
2. Chatterjee A, Pakrashi SC. The treatise on Indian medicinal plants. New Delhi: Publication and Information Directorate, 1991.
3. Groppo FC, Bergamaschi Cde C, Cogo K, Franz‐Montan M, Motta RH, de Andrade ED. Use of phytotherapy in dentistry. Phytother Res 2008;22:993‐8.
4. Gomes BP, Souza SF, Ferraz CC, Teixeira FB, Zaia AA, Valdrighi L, *et al*. Effectiveness of 2% chlorhexidine gel and calcium hydroxide against *Enterococcus faecalis* in bovine root dentine *in vitro*. Int Endod J 2003;36:267‐75.
5. Pistorius A, Willershausen B, Steinmeier EM, Kreislert M. 2003. Efficacy of subgingival irrigation using herbal extracts on gingival inflammation. J Periodontol 74:616–622.
6. 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.
7. Mukherjee PK, Rai S, Bhattacharyya S, Debnath P, Biswas TK, Jana U, et al. Clinical Study of 'Triphala': A well-known phytomedicine from India. Iran J Pharmacol Ther. 2006;5:51–4.
8. Jagdish L, Anand Kumar VK, Kaviyarasan V. Effect of Triphala on dental biofilm. Indian J Sci Technol. 2009;2:30–3.
9. Jagtap AG, Karkera SG. Potential of the aqueous extract of *Terminalia chebula* as an anticaries agent. J Ethnopharmacol. 1999;68:299–306.
10. Groppo FC, Ramacciato JC, Simoes RP, Florio FM, Sartoratto A. Antimicrobial activity of garlic, tea tree oil and chlorhexidine against oral microorganisms. Int Dent J. 2002;52:433–7.
11. Devanand S, Nagesh L, Muralikrishna K. Comparative evaluation of garlic extract mouthwash and chlorhexidine mouthwash on salivary streptococcus mutans count- an invivo study. Oral Health Prev Dent.2010;8:369–74.
12. Sinha DJ, Vasudeva A, Gowhar O, Garg P, Sinha A, Prakash P.Comparison of antimicrobial efficacy of propolis, *Azadirachta indica* (Neem), *Melaleuca alternifolia* (Tea tree oil), *Curcuma longa* (Turmeric) and 5% sodium hypochlorite on *Candida albicans* biofilm formed on tooth substrate: An *in-vitro* study.J Pharm Biomed Sci 2015;5:469-74.
13. Kavimani S, Ilango R, Vertichelvan T. Anti-inflammatory activity of volatile oil of *Psidium guajava*. Anc Sci Life. 1998;17:300–4.
14. Abdollahzadeh S, Mashouf RY, Mortazavi H, Moghaddam MH, Roozbahani N, Vahedi M. Antibacterial and Antifungal Activities of *Punica granatum* Peel Extracts Against Oral Pathogens. *J Dent* (Tehran). 2011;8(1):1-6.
15. Bohora A, Hegde V, Kokate S. Comparison of antibacterial efficacy of neem leaf extract and 2% sodium hypochlorite against *E. faecalis*, *C. albicans* and mixed culture‐an *in vitro* study. Endodontology 2010;22:8‐12.

16. Hotwani K, Baliga S and Sharma K Phytodentistry: use of medicinal plants.J Complement Integr Med. 2014;11(4):233–251.
17. Riedel E, Hansel R, Ehrke G. 1982. Inhibition of gammaaminobutyric acid catabolism by valerenic acid derivatives. Planta Med 46: 219–220.
18. Calixto JB. 2000. Efficacy, safety, quality control, marketing and regulatory guidelines for herbal medicines (phytotherapeutic agents). Braz J Med Biol Res 33:179–189.
19. Bohora A, Hegde V, Kokate S. Comparison of the antibacterial efficiency of neem leaf extract and 2% sodium hypochlorite against E. faecalis, C. albicans and mixed culture – an in vitro study. Endodontology 2010;22:8–12.
20. Kamat S, Rajeev K, Prahald S. Role of herbs in endodontics: an update. Endodontology 2011;23:96–100.
21. Elnima EI, Ahmed SA, Mekkawi AG, Mossa JS. 1983. The antimicrobial activity of garlic and onion extracts. Pharmazie 38:747–748.
22. Oyama KO, Siqueira EL, Santos M. 2002. In vitro study of effect of solvent on root canal retreatment. Braz Dent J 13:208–211.
23. Oncag O, Cogulu D, Uzel A, Sorkun K. Efficacy of propolis as an intracanal medicament against enterococcus faecalis. Gen Dent 2006;54:319–22.
24. Pujar M, Makandar S. Herbal usage in endodontics – a review. Int J Contem Dent 2011;2:34–7.
25. Ozorio JE, Carvalho LF, de Oliveira DA, de Sousa-Neto MD, Perez DE. Standardized propolis extract and calcium hydroxide as pulpotomy agents in primary pig teeth. J Dent Child(Chic) 2012;79:53-58.
26. Baykul T, Alanoglu E, Kocer G. Use of ankaferd blood stopper asa hemostatic agent: a clinical experience. J Contemp Dent Pract 2010;11:E088–94.
27. Parolia A, Kundabala M, Rao NN, Acharya SR, Agrawal P, Mohan M, et al. A comparative histological analysis of human pulp following direct pulp capping with propolis, mineral trioxide aggregate and dycal. Aust Dent J 2010;55:59–64.
28. Preethi KC, Kuttan R. Wound healing activity of flower extract of calendula officinalis. J Basic Clin Physiol Pharmacol 2009;20:73-9.
29. Wynn RL. Aloe vera gel: update for dentistry. Gen Dent 2005;53:6–9.
30. Thangapazham RL, Sharma A, Maheshwari RK. Beneficial role of curcumin in skin diseases. Adv Exp Med Biol 2007;595:343-57.
31. Kaim JM, Gultz J, Do L, Scherer W. An in vitro investigation of the antimicrobial activity of an herbal mouthrinse. J Clin Dent 1998;9:46–8.
32. Menezes SM, Cordeiro LN, Viana GS. Punica granatum (pomegranate) extract is active against dental plaque. J Herb Pharmacother 2006;6:79–92.
33. Khalessi AM, Pack AR, Thomson WM, Tompkins GR. An in vivo study of the plaque control efficacy of persica: a commercially available herbal mouthwash containing extracts of salvadora persica. Int Dent J 2004;54:279–83.
34. Anonymous. Oral ulcers remedy gets FDA clearance. J Am Dent Assoc 1994;125:1308,10.
35. Khare CP. Indian medicinal plants an illustrated dictionary, 1st ed. Berlin: Springer, 2008.
36. Moghadamnia AA, Motallebnejad M, Khanian M. The efficacy of the bioadhesive patches containing licorice extract in the management of recurrent aphthous stomatitis. Phytother Res 2009;23:246–50.
37. Furletti VF, Teixeira IP, Obando-Pereda G, Mardegan RC, Sartoratto A, Figueira GM, et al. Action of Coriandrum sativum L. essential oil upon oral candida albicans biofilm formation. Evid Based Complement Alternat Med 2011:1–9.
38. Mazzanti G, Battinelli L, Pompeo C, Serrilli AM, Rossi R, Sauzullo I, et al. Inhibitory activity of Melissa officinalis extract on herpes simplex virus type 2 replication. Nat Prod Res 2008;22:1433–40.
39. Casaroto AR, Hidalgo MM, Sell AM, Franco SL, Cuman RK, Moreschi E, et al. Study of the effectiveness of propolis extract as a storage medium for avulsed teeth. Dent Traumatol 2010;26:323–31.
40. Ozan F, Polat ZA, Tepe B, Er K. Influence of storage media containing salvia officinalis on survival of periodontal ligament cells. J Contemp Dent Pract 2008;9:17–24.
41. Souza BD, Lückemeyer DD, Reyes-Carmona JF, Felippe WT, Simões CM, Felippe MC. Viability of human periodontal ligament fibroblasts in milk, Hank's balanced salt solution and coconut water as storage media. Int Endod J 2011;44:111–15.
42. Ozan F, Tepe B, Polat ZA, Er K. Evaluation of in vitro effect of morus rubra (red mulberry) on survival of periodontal ligament cells. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;105:e66–9.
43. Hwang JY, Choi SC, Park JH, Kang SW. The use of green tea extract as a storage medium for the avulsed tooth. J Endod 2011;37:962–7.
44. Fritz TM, Burg G, Krasovec M. 2001. Allergic contact dermatitis to cosmetics containing Melaleuca alternifolia (tea tree oil). Ann Dermatol Venereol 128:123–126.
45. Khanna M, Qasem K, Sasseville D. 2000. Allergic contact dermatitis to tea tree oil with erythema multiforme-like id reaction. Am J Contact Dermat 11: 238–242.
46. West I, Maibach HI. 1995. Contact urticaria syndrome from multiple cosmetic components. Contact Dermatitis 32:121.
47. Messina BA. 2006. Herbal supplements: Facts and myths –talking to your patients about herbal supplements. J Perianesth Nurs 21:268–278.
48. Subiza J, Subiza JL, Alonso M et al. 1990. Allergic conjunctivitis to chamomile tea. Ann Allergy 65:127–132.
49. Huntley AL, Thompson Coon J, Ernst E. 2005. The safety of herbal medicinal products derived from Echinacea species: a systematic review. Drug Saf 28:387–400.
50. I, Maibach HI. 1995. Contact urticaria syndrome from multiple cosmetic components. Contact Dermatitis 32:121.
51. Hadley S, Petry JJ. 2003. Valerian. Review. Am Fam Physician 67:1755–1758.
52. Smith GW, Chalmers TM, Nuki G. 1993. Vasculitis associated with herbal preparation containing Passiflora extract. Br J Rheumatol 32:87– 88.
53. Segal R, Pilote L. 2006. Warfarin interaction with Matricaria chamomilla. CMAJ 25:1281–1282.
54. Ang-Lee MK, Moss J, Yuan CS. 2001. Herbal medicines and perioperative care. JAMA 286:208–216.
55. Miller LG. 1998. Herbal medicinals: selected clinical considerations focusing on known or potential drug–herb interactions. Arch Intern Med 158:2200–2211.
56. Kennedy DO, Little W, Scholey AB. 2004. Attenuation of laboratory-induced stress in humans after acute administration of Melissa officinalis (Lemon Balm). Psychosom Med 66:607–613.