

Phytherapeutic Agents in Periodontal Therapy: A Review

Dr. Rizwan Sanadi¹, Dr. Kahkashan Kadri^{2*}, Dr. Medha Sawarkar³,

Dr. Amit Benjamin⁴

¹Professor, Department of Periodontics, YMT Dental College, Kharghar, Navi Mumbai

^{2,3}Third year Post Graduate students, Department of Periodontics, YMT Dental College, Kharghar, Navi Mumbai

⁴Professor and Head of Department, Department of Periodontics, YMT Dental College, Kharghar, Navi Mumbai

Abstract:

The understanding of the etiology and pathogenesis of periodontal diseases is continuously evolving and so is the management and control of the disease. Current management of periodontal diseases, centers, primarily on non-specific reduction of the microbial load by mechanical debridement and adjunctive use of antimicrobial agents. However, with increased awareness of the deleterious effects of synthetic antimicrobials, the limelight has now shifted on naturally occurring plant derived agents. Phytherapeutic agents are safe, cost effective and efficient antimicrobials and their utility as adjuncts in prevention and treatment of periodontal diseases looks promising.

Keywords: periodontitis, phytherapeutic agents, herbs, periodontal therapy

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I. Introduction

Periodontal disease is a major public health problem in the world and is most common cause of tooth loss. Successful periodontal therapy depends upon dealing with the negative environmental and behavioural factors and elimination or reduction of pathogenic bacteria causing periodontal disease¹. There has been a rise in the awareness and interest in alternative natural preparations among population; specially to avoid the harmful effects caused by synthetic antimicrobials². Abdollahzdeh et al. (2011)³ concluded that natural phytochemicals can be good alternatives to harmful synthetic agents. Phytotherapy (phyto-plant, therapia-to treat) is the use of extracts of natural origin as medicines or health-promoting agents. It uses plant derived complexes or substances, which are homogenous compounds of a particular chemical structure². Phytotherapeutic agents have various bioactive components which possess enormous medicinal value with least side effects⁴.

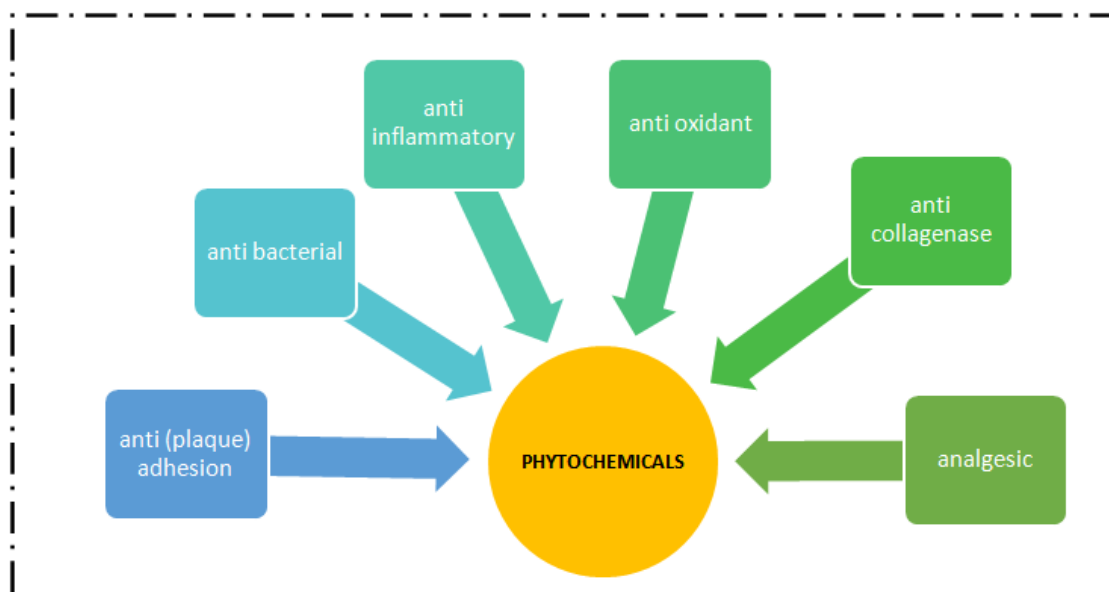
Use of herbal extracts in the form of dentifrice, mouthwash, local drug delivery systems have been used efficiently in preventing and treating periodontal disease since ages. This review throws light on the commonly used phytotherapeutic agents that are useful in the prevention and treatment of periodontal diseases, as well as during maintenance post periodontal treatment.

BENEFITS OF HERBAL DRUGS

Herbal drugs have a long era of use, good patient tolerance and acceptance. They are a renewable source, thus ensuring sustainable supplies of cheaper medicines for the world's growing population. Availability of medicinal plants is easy in developing countries like India having rich agroclimatic, cultural and ethnic biodiversity⁵.

MODE OF ACTION OF PHYTOTHERAPEUTIC AGENTS

Plant compounds can be a powerful and dominant tool to combat an inflammation caused by local irritating factors such as periodontitis. Herbs owe their properties to biologically active compounds they contain like flavonoids, coumarins, glycosides, phenolic acids, resins, phytoesters, choline, carotenoids, tannins, vitamins, mineral salts (magnesium, iron, lithium) and essential oils. The most popular are flavonoids and essential oils⁵.



Anti oxidant and anti-inflammatory role of phytochemicals

Oxidative stress is an important cause of cell damage associated with the initiation and progression of periodontitis. Numerous studies have shown that the total antioxidant capacity in periodontitis patients is significantly lower when compared to healthy controls or in subjects who have received periodontal therapy⁶. These findings have triggered the use of exogenous antioxidants for the treatment of periodontal disease. Majority phytochemicals are strong antioxidants. They function by scavenging the free radicals and thereby preventing oxidative stress. Thus, herbal antioxidant remedies have been the focus of research in recent times⁷.

Phytochemicals with activity against bacteria

Phytochemicals (flavonoids) are said to be natural antibiotics, also effective against oncogenic viruses and carcinogens. A very important characteristic of some essential oils is their activity against microorganisms that are resistant to synthetic antibiotics. It is assumed, that microorganisms are unable to become resistant to essential oils. This has been proved in cases where peppermint, eucalyptus and dianthus oils were used.⁸

Phytochemicals inhibiting plaque formation

The phytochemicals prevent the adhesion of bacteria to the tooth surface or prevent the synthesis of the exopolysaccharide. A number of phytochemicals, exhibit bactericidal effects on the periodontal microbiome, prevent adherence of bacteria to tooth surfaces and inhibit glucan production.^{7,9}

ALOE VERA (GRITA KUMARI)

The botanical name of Aloe Vera is *Aloe barbadensis miller*. It belongs to Asphodelaceae (Liliaceae) family, and is a shrubby, arborescent, perennial, xerophytic, pea- green coloured plant.¹¹ There are various species of Aloe Vera known, but the main medicinal one is *Aloe vera barbadensi*¹²

ROLE OF ALOE VERA IN MANAGEMENT OF PERIODONTAL DISEASE

Aloe vera contains 75 potentially active constituents: nutrients, vitamins, enzymes, minerals, sugars, antiinflammatory substances, lignin, saponins, sterols, salicylic acids and amino acids.¹² Antioxidative phenolic compounds have been recently isolated from *Aloe barbadensis* and identified as aloeresin derivatives. These properties, along with the ease of availability, no known adverse effects, and cost effectiveness, make aloe vera an ideal candidate for plaque control, thereby reducing gingivitis and periodontitis.¹¹

GREEN TEA (CAMELLIA SINENSIS)

Green tea (*Camellia Sinensis*) belonging to the family Theaceae has been explored in recent years for its beneficial effects on periodontal health. It is available as a shrub or evergreen tree. It is reported that one third of the bioactive compounds in green tea are contributed by polyphenols¹³.

COMPOSITION¹³

The main type of polyphenols are catechins, also known as tannins that serve as astringency constituent. Most important catechins include epigallocatechin-3-gallate (EGCG; 59%), epigallocatechin (EGC; 19%), epicatechin-3-gallate (ECG; 13.6%) and epicatechin (EC; 6.4%). Large variations can be observed in the chemical structures of catechins due to dissimilar composition.

THERAPEUTIC EFFECTS ON PERIODONTAL HEALTH

Catechins (e.g. EGCG) restrict the development and colonization of periodontal bacteria. These restrain the release of toxic metabolites from periodontal bacteria. Green tea is well known for its antibacterial properties against anaerobic microorganisms and its use in halitosis. Green tea consumption can diminish oxidative and inflammatory tissue injuries in the oral cavity caused by cigarette smoking¹⁴.

TURMERIC (*CURCUMIN LONGA*)

Turmeric, otherwise known as *Curcuma longa*, is a member of the ginger family, Zingiberaceae. The Latin name is derived from the Persian word, 'kirkum', which means saffron, in reference to the rhizomes vibrant yellow-orange color^{15,16}.

COMPOSITION

The different active constituents of turmeric are the flavonoid curcumin (diferuloylmethane) and various volatile oils including tumerone, atlantone, and zingiberone. Other constituents comprise of sugars, proteins, and resins.¹⁷

ROLE IN THE MANAGEMENT OF PERIODONTAL DISEASE:

The effect of turmeric observed is because of its anti-inflammatory properties. A significant reduction in the trypsin-like enzyme activity of "red complex" species has been reported. It is antimutagenic, anticarcinogenic, antioxidant, antibacterial, anti-inflammatory, and used in dental caries, oral lichen planus, gingivitis, halitosis, pit and fissure sealant, healing, photodynamic therapy and dental plaque detection system.¹⁶

POMEGRANATE (*PUNICA GRANATUM*)

Punicagranatum belonging to family *Punicaceae* is more commonly known as pomegranate. The genus name, *Punica*, was derived from the Roman name for Carthage. The word pomegranate means apple ("pomum") and seeded ("granatus")¹⁸.

ROLE IN PERIODONTAL THERAPY^{18,19}

The major ingredient of pomegranate fatty acids, punicic acid, is an excellent anti-inflammatory compound with a property to suppress prostaglandin production. Pomegranate fruit extract has a broad inhibitory effect on matrix metalloproteinases (MMPs) expression and IL-1 β induced tissue destruction. Apart from the above mechanisms, it is also said to be immunoregulatory. These extracts have the ability to scavenge free radicals and decrease macrophage oxidative stress and lipid peroxidation. Pomegranate may be a rich source of compounds to overcome pathogenic bacteria and development of antibiotic resistance.

PSIDIUM GUAJAVA (*GUAVA*)

P. guajava is commonly known as guava, guayaba, goiaba, perala, pichi, posh, enand.²⁰

COMPOSITION²⁰

The important constituents of guava are vitamins, tannins, phenolic compounds, quercetin flavonoids, essential oils, sesquiterpene alcohols and triterpenoid acids.

THERAPEUTIC APPLICATIONS IN PERIODONTAL DISEASE²¹

The paste of tender leaves of guava has been traditionally used to maintain oral hygiene. Guava has shown antibacterial activity (mainly attributed to flavonoids, guajaverin and quercetin) against both Gram⁺ positive and Gram⁻ negative bacteria. The bark has exhibited antibacterial properties due to the presence of tannins.

Quercetin has shown excellent antibacterial actions against key periodontal pathogens probably due to the ability to disrupt the membrane and inactivation of extracellular proteins by forming irreversible complexes. Guajaverin decreases the hydrophobicity, one of the most important initial factors for the oral pathogenic bacteria to adhere to the tooth surface. This occurs as the guava extracts bind to the cell surface proteins reducing the overall cell hydrophobicity. Hence, guava may have potential for development as a natural antiplaque agent. Guava extract has demonstrated in vitro antiplaque actions by inhibiting growth, adherence

and co- aggregation of dental plaque bacteria. Thus, guava as an excellent antibacterial and antiplaque agent may be a good adjunct to the mainstream periodontal treatment. Guava has been known for its anti-inflammatory action. The anti-inflammatory action of guava is in its ability to inhibit prostaglandin, kinin and histamine. The antioxidant action can be attributed to quercetin, carotenoids, vitamin C, polyphenols present in guava.

Guava contains high levels of vitamin C (ascorbic acid). Vitamin C is essential to maintain the overall integrity of the periodontium. Vitamin C supports immune functions, maintains structural and functional integrity of epithelial tissues and physiological or metabolic parameters relevant to periodontal health. Vitamin C along with bioflavonoids speed up the healing process.

II. Conclusion

The cornerstone of successful periodontal treatment starts with establishing mechanical plaque control. The use of antimicrobial agents is a valuable aid in controlling microbial colonization and recolonization. Phytotherapy presents an attractive potential as an adjunct to mechanical periodontal therapy. However, most of the studies are in vitro studies and use single herbal extracts as the research is still in its infancy. Hence, focused methodological researches are mandatory to establish therapeutic and preventive applications of phytotherapy in periodontal therapy. Standardization, quality assurance and mode of delivery of these agents is a key area which is to be focused on in future studies and clinical trials. There is much more to be explored as there are a myriad of opportunities for further research in the utility of phytotherapeutic agents for periodontal diseases.

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