



REVIEW ARTICLE

ROLE OF BONE KNITTING HERBS IN THE MANAGEMENT OF PERIODONTITIS

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Abstract

Periodontitis is a chronic inflammatory disease affecting supporting structures of teeth leading to bleeding gums, soft tissue loss, mobility of teeth, and loss of a tooth. Periodontal disease is multifactorial in nature, the conventional therapies such as plaque control methods, the use of antimicrobial agents, and various surgical approaches demonstrated limited effectiveness in its management. Hence, the search for alternative therapies has been focused, among which herbal products have gained importance owing to their inherent properties of antioxidant, anti-inflammatory, anti-collagenase, stimulation of osteoblasts, and inhibition of osteoclasts, therefore, helping in the formation of bone. The present review focuses on various types of herbs which are used in treating periodontal disease.

Keywords: Periodontal disease; Herbs; Anti-oxidants; Free radicals; Bacteria; Oxidative stress.

Introduction

Periodontal disease is one of the most important concerns for dentists and patients, can affect up to 90% of the world population, and are highly prevalent. Gingivitis is the mild reversible form that can progress into irreversible form i.e., periodontitis leading to loss of supporting structures of the teeth.¹ It is recognized as a major public health problem worldwide and is considered the commonest cause of tooth mobility in adults. Periodontal pathogens play a crucial role in the aetiopathogenesis of periodontitis, contributing to

chronic and aggressive periodontitis. *Porphyromonas gingivalis* and *A. actinomycetemcomitans* are associated with resistance to standard treatments for gum disease.²

Other major shreds of evidence are suggesting oxidative stress plays a pivotal role in the initiation and progression of periodontal disease. The severity of periodontal disease was attributed to increased levels of biomarkers for tissue damage induced by reactive oxygen species (ROS).³ Though many novel treatments have been proposed for periodontitis and gingivitis, ancient methods of using herbal medicines

which are practiced by the Sumerians, the Babylonians, and the Assyrians since ages have long been used for various ailments in India.⁴ Thus, the focus of attention has revolved back to herbal medicines owing to their wide spectrum of biological and medicinal activities, lower costs, and higher safety margin.⁵

Herbal medicines or finished herbal products contain plants or plant materials with therapeutic benefits as active ingredients. About 80% of the population worldwide use herbal products for their basic health care such as extracts, teas, and other active principles because of their properties such as no side effects and antibiotic resistance.⁶

Various anti-microbials and chemotherapeutic agents, such as chlorhexidine, triclosan, and cetylpyridinium chloride are being used as adjuncts to eliminate the periodontal disease from the oral cavity.⁷ But due to its multi-factorial etiology and complex disease process, the treatment of periodontitis is still a dilemma. As herbal medicines have antimicrobial, antioxidant, antiseptic, anti-inflammatory, and anti-collagenase effects, they are believed to cope with the multi-factorial nature of periodontitis.⁸

Bone knitting herbs

Bone knitting herbs are the herbs that help in stimulating the osteoblasts and inhibiting osteoclasts to form bone.

Let us discuss in detail bone knitting herbs.

Triphala⁹

Triphala is a combination of three components in equal parts of Amalaki (*Emblica Officinalis*), Haritaki (*Terminalia chebula*), and Bahera (*Terminalia bellerica*). These three components are potent antioxidants and have a wide range of pharmacological activity.

Amalaki is an excellent source of vitamin C and also contains phyllemblic acid, nicotinic acid, carotene, D fructose, D-glucose, Empicol, riboflavin, and mucic and Haritaki also contains vitamin C, arachidonic, linoleic, oleic, palmitic, stearic acids, anthraquinone glycoside, chebulinic acid, tannic acid, and terchebin Bahera contains gallic acid, chebulagic acid, ellagic acid, ethyl ester, galactose, glucose, fructose, mannitol, and rhamnase.

Role of Triphala in Periodontitis

It is strong antimicrobial, antioxidant, and anti-collagenase properties.

- Anti-oxidant property: Protect the cells from free radicals and reduce the oxidative burden. Bahera followed by Amalaki and Haritaki is the most active antioxidant.
- As a mouthwash: A clinical trial has shown that Triphala mouthwash is as efficacious as 0.2% chlorhexidine in antiplaque and anti-inflammatory activities when used for 1 week.
- Anti-bacterial effect: 50 µg/ml Triphala concentrations inhibited *Streptococcus mutans* species.
- Anti-plaque effect: Tannic acid causes protein denaturation and ultimately bacterial cell death and is well adsorbed on the surface of bacterial cells.
- Anti-collagenase effect: Inhibits collagenases derived from polymorphonuclear leukocytes which are responsible for connective tissue destruction in periodontal disease.

Green tea

Camellia sinensis leaves which are minimally oxidized make up green tea. Green tea is rich in antioxidants called polyphenols which are classified as catechins in teas.¹¹ There are six primary catechin compounds in green tea: Epicatechin, Catechin, epigallocatechin, gallocatechin, epicatechin gallate (ECG), and epigallocatechin gallate (EGCg). EGCg is a very potent antioxidant. Green tea also contains ascorbic acid, carotenoids, tocopherols, minerals such as selenium, chromium, zinc, and certain phytochemical compounds.¹²

Role of green tea in periodontitis

Catechins in green tea are more effective in anaerobic bacteria like *Porphyromonas gingivalis* and *Prevotella* spp which are the main etiological agents in periodontitis. Some in-vitro studies have shown that catechins showed their effectiveness, especially on *P. Gingivalis*, *Prevotella intermedia*, and *Prevotella nigrescens* by preventing the attachment of *P. Gingivalis* onto human buccal epithelial cells. Few studies have shown that some components such as ECG and EGCg inhibited *P. Gingivalis*-derived

collagenase activity.¹³

Catechin present in green tea is highly potent in suppressing bone resorption mediated by the inflammatory response. In both in vitro and in vivo conditions, EGCg reduced lipopolysaccharide-mediated bone resorption in animal studies. It also controls and reduces cyclooxygenase-1, RANKL, and the cytokine PGE2 in animal osteoblasts.^{11,12}

Green tea has been used as a dentifrice and a local drug delivery system in a few pilot studies which have shown beneficial effects in periodontal disease. It is also known to have anti-plaque efficacy as chlorhexidine when used for 1 week.¹²

Rubia Cordifolia

Ayurvedic medicine has employed the roots of this plant. It also contains Alizarin, an organic chemical that gives textile dyes their red color. A significant component of *R. cordifolia* i.e., mollugin, has been proven to have anti-inflammatory properties. Mollugin decreased RANKL-induced osteoclast development and bone-resorbing activity in mature osteoclasts, according to a recent study.¹³ Mollugin inhibited the different genes associated with osteoclastogenesis such as Osteoclast-associated receptor, tartrate-resistant acid phosphatase, ICAM-1, cathepsin K, DC-STAMP, and OC-STAMP and reduced the phosphorylation of signaling pathways activated in the early stages of osteoclast differentiation, including MAPK, Akt, and GSK3. Few studies have shown significant restoration of lipopolysaccharide-induced bone loss as indicated by micro-computed tomography and histological analysis of femurs. The same concept can be employed in restoring the bone in periodontitis and can be a boon to periodontics.¹⁴

Piperine

It's a type of alkaloid found in plants like *Piper nigrum* and *Piper longum*. It has been demonstrated to have anti-inflammatory and antioxidant effects. Piperine treatment of LPS-stimulated mice resulted in reduced nitrite levels and decreased TNF- α levels in an animal model.¹⁵ Piperine's ability to scavenge free radicals is supported by this research. Piperine significantly reduced the generation of interleukin-1 β , MMP-8, and MMP-13 in a rat periodontitis model, according to another study. In a dose-dependent way,

piperine prevented alveolar bone loss and repaired trabecular microstructures. According to histological staining, Piperine considerably reduced inflammation infiltration in soft tissues.¹⁶

Sumac

Sumac, also called *Rhus coriaria*, has anti-inflammatory, antibacterial, and antioxidant effects. Sumac fruit extracts demonstrate significant antioxidant activity against lipid peroxidation and free radicals in vitro, making it a well-known spice.

In an experimental rat study of ligature-induced periodontitis, serum total oxidant status (TOS) and oxidative stress index (OSI) were significantly reduced when sumac extracts were administered at a dosage of 20 mg/kg/day. The total antioxidant status of ligated rats' serum was comparable to that of non-ligated rats. Sumac extracts have the potential to reduce alveolar bone loss in rats with periodontal disease by influencing TOS and OSI levels.¹⁷

Ginkgo Biloba

Ginkgo biloba (EGb) leaf extract contains ginkgo flavone glycosides (24%), terpenoids (6%), and 5ppm ginkgolic acid. It is said to have biological effects such as free radical scavenging, lowering oxidative stress, and anti-inflammation. In one study, systemic administration of EGb (28-56 mg/kg/day) resulted in lower osteoclastic counts, less inflammation, and increased osteoblastic activity.¹⁸

Psidium Guajava

Because guava is high in Vitamin C, it has excellent antioxidant properties (Ascorbic acid). It also contains quercetin, carotenoids, and polyphenols, which help to boost its antioxidant activity. Guava leaf extracts and stem essential oil can scavenge hydrogen peroxide, and superoxide anion, and inhibit the formation of hydroxyl radicals. The root bark decoction is recommended as a mouthwash, and the leaves decoction is an effective gargle for bleeding gums.¹⁹

Lythrum salicaria

Potent antioxidant properties; aqueous extracts inhibited ROS production from stimulated neutrophils

which were isolated and cultured from humans.¹⁹

Ascophyllum nodosum

A polyphenol-rich extract from *A. nodosum* demonstrated significant anti-lipid peroxidation activity and antioxidant activity by scavenging superoxide anion, hydroxyl, and peroxy radicals.²⁰

Avocado oil, green tea extract, Aloe vera, green tea, coenzyme Q10 (6% GingiNat)

Mouthwash containing micro-encapsulated natural extracts has shown significant efficiency on the plaque, gingivitis, and halitosis due to its antioxidant and immuno-regulatory properties.¹⁹

Acacia arabica

Pradeep et al. showed that a gel and powder formulation derived from *Acacia arabica* demonstrated a significant improvement in plaque and gingival scores when compared to 1% chlorhexidine in gingivitis patients.²¹

Cymbopogon citratus

Lemongrass, as it is commonly known, is a herbal medicine known for its antiseptic, anti-emetic, anti-rheumatic, analgesic, antispasmodic, and antipyretic properties. It is especially effective against strains of *Actinomyces lundii* and *Porphyromonas gingivalis*, which are known to be resistant to a variety of modern therapies. A recent study with 0.25 percent lemongrass mouthwash demonstrated a significant reduction in gingival and plaque index in study subjects.²²

Coriandrum sativum

It is a member of the Umbelliferae family and was an important component of ancient Iranian medicinal practices used to treat flatulence. In one recent Iranian study, *Coriandrum Sativum* was combined with *Quercus brant ii* in the form of an oral gel. Both *Coriandrum sativum* and *Quercus Brantii* contained tannins, which could reduce bacterial activity in the periodontium and were thus used in the clinical study as a combination.²³

Aloe barbadensis

Miller, also known as Aloe vera, has long been used to treat skin ailments. A recent clinical study found that intra-pocket placement of aloe vera gel improved clinical factors such as plaque index, probing pocket depth, and clinical attachment in type 2 diabetes mellitus patients.²⁴

Drynaria fortunei

The herb, *Drynaria fortunei*, is referred to in China as GuSuiBu, literally meaning “mend broken bones.”

The major advantages of *Drynaria* include:

- Inhibiting osteoclast function: *Drynaria* has been shown to support healthy osteoclast function without entirely halting it, as bisphosphonate drugs do.
- Stimulating osteoblast function: *Drynaria* has been shown in multiple studies to stimulate osteoblasts to produce more healthy bone tissue.
- Osteogenesis (Mesenchymal stem cells): *Drynaria* stimulates osteogenesis and provides bone with new bone cells.

A study done in the dental department of a research hospital in China used an electron microscope to reveal that naringin, one of the active ingredients in *Drynaria*, actively stimulates protein synthesis and metabolism of human periodontal ligament cells.²⁵

Morinda citrifolia (noni) fruit extract

Morinda citrifolia (noni) has been accounted as a crucial herb for its significant medicinal implications and has recently been added as a plant of interest in the field of dentistry.

M.citrifolia acts on human periodontal ligament cells by enhancing the differentiation and proliferation of these cells and also by osteoblastic differentiation of bone marrow-derived mesenchymal stem cells (BMSCs).²⁶

Punica granatum

Pomegranate juice contains anthocyanins, glucose, ascorbic acid, ellagic acid, gallic acid, caffeic acid, catechin, epigallocatechin, quercetin, rutin, iron, and amino acids possessing anti-atherosclerotic, anti-

hypertensive, anti-aging and potent anti-oxidative properties.²⁷

The major ingredient puniic acid is an excellent anti-inflammatory compound with the property to suppress prostaglandin production. The cold-pressed pomegranate seed oil has inhibited both cyclooxygenase and lipoxygenase enzymes in vitro. The anti-inflammatory effect of pomegranate could be due to its immuno-regulatory action on macrophages and T and B-lymphocytes. Other Ellagic acids inhibited NF- κ B activation through a mechanism independent of I κ -B (inhibitor of nuclear factor kappa B phosphorylation).²⁸

Conclusion

Herbal medicines have been shown to have a wide range of biological properties, including antimicrobial, antioxidant, and anti-inflammatory properties. These herbs' natural phytochemicals help suppress alveolar bone loss, a prominent feature of periodontitis. Hence, the use of bone knitting herbs can benefit a clinician and a patient without side effects and resistance while helping in building the

lost bone in periodontally diseased areas. Further research on various herbs which can help in bone formation should be studied and implemented in the daily oral health of the patient.

Declarations

Conflicts of interest and financial disclosures

The author declares that he has no conflict percent and there was no external source of funding for the research in question.

Ethical approval

The study was approved by the University ethics committee and was conducted in accordance with the Declaration of the World Medical Association.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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ՈՍԿՐԳՆԱԲՈՂ ԽՈՏԱԲՈՒՅՍԵՐԻ ԴԵՐԸ ՊԱՐՕԴՈՆՏԻՏԻ ԲՈՒԺՈՒՄԱՆ ՄԵՉ

Բոյապատի Ռամանարայանա,¹ Բհավյասրի Գադամ,² Ռամա Բրահմամ Լանկա,³
Մանասի Չիննադուրայ Մուդալիյար⁴

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Ամփոփում

Պարոդոնտիտը քրոնիկ բորբոքային հիվանդություն է, որն ախտահարում է ատամների կրող կառուցվածքները՝ հանգեցնելով լնդերի արյունահոսության, փափուկ հյուսվածքների կորստի, թուլացած ատամների կորստի: Պարոդոնտալ հիվանդությունները բազմագործոն բնույթ ունեն, և ավանդական բուժումները, ինչպիսիք են ատամնափառի վերահսկման մեթոդները, հակամանրէային դեղամիջոցների օգտագործումը և տարբեր վիրաբուժական մոտեցումները, ցույց են տվել սահմանափակ արդյունավետություն դրանց բուժման համար: Հետևաբար, այլընտրանքային բուժումների որոնումը կենտրոնացած է եղել, որոնց թվում բուսական արտադրանքները կարևորություն են ձեռք բերել իրենց բնորոշ հակաօքսիդանտ, հակաբորբոքային, հակակոլագենազային, օստեոբլաստների խթանման և օստեոկլաստների արգելակման հատկությունների շնորհիվ, որոնք օգնում են ոսկորների ձևավորմանը: Այս ակնարկը կենտրոնանում է խոտաբույսերի տարբեր տեսակների վրա, որոնք օգտագործվում են պարոդոնտալ հիվանդությունների բուժման համար:

РОЛЬ КОСТНОВЯЗЫВАЮЩИХ ТРАВ В ЛЕЧЕНИИ ПАРОДОНТИТА

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Абстракт

Пародонтит — хроническое воспалительное заболевание, поражающее опорные структуры зубов,

приводящее к кровоточивости десен, потере мягких тканей, подвижности зубов и потере зуба. Заболевания пародонта являются многофакторными по своей природе, традиционные методы лечения, такие как методы контроля зубного налета, использование противомикробных препаратов и различные хирургические подходы, продемонстрировали ограниченную эффективность в их лечении. Следовательно, был сосредоточен поиск альтернативных методов лечения, среди которых растительные продукты приобрели важное значение благодаря присущим им антиоксидантным, противовоспалительным, антиколлагеназным свойствам, стимуляции остеобластов и ингибированию остеокластов, что помогает в формировании кости. В настоящем обзоре основное внимание уделяется различным видам трав, которые используются при лечении заболеваний пародонта.