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Chapter

Herbs and Oral Health

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Abstract

Herbal medicine has long been used to prevent and control disease, and it can minimize the potential side effects of chemical products. However, side effects from herbs do exist. Most of the challenges with herbal medicine revolves around inadequate information about the effect of herbs in the oral cavity, the mechanism of action, and potential side effects. There are several herbs described in this chapter have anti-inflammatory, anti-bacterial, anti-viral, anti-fungal in oral micro-organisms. It includes aloe vera, ginger, clove, cinnamon, garlic, neem, miswak, turmeric, tulsi, green tea, chamomile, fenugreek, anise plant, peppermint, bloodroot, caraway, eucalyptus, phyllanthus emblica, black seed, myrrh, rosemary, sage, and thyme; some may act as an alternative management option to current treatments for oral conditions such as caries prevention, gingivitis, periodontitis, oral burn, ulcers and inflammation, after extraction, dry mouth, pain reduction, anesthesia, intracanal medications, ill-fitting dentures, peri-implant mucositis and peri-implantitis. It can be used in several forms such as mouthwashes, toothpastes, topical agents or local drug delivery devices. However, more research is needed to understand their mechanisms and potential side effects.

Keywords: bacterial plaque, herbs, oral health, gingiva, periodontal disease, caries

1. Introduction

Herbs is defined as “any plants that lack the woody tissue characteristic of shrubs or trees” [1–7]. Several herbs have shown positive effects against a variety of inflammatory medical problems, such as dysphagia, gastric ulcers, wound healing, and sore throat. It is the core component of the complementary and alternative medicine (CAM) [1–7]. It has been used to manage blood problems and eliminate waste, stimulate body and blood circulation, minimize irritation [1–7]. It has several forms such as tablets, syrups, or it can be used externally as a dressings, or topical application [1–7].

Herbs could have a potential beneficial effect in the dental field, such as with gum swelling, specifically, and in oral healthcare overall. However, few studies have scientifically reviewed these topics. In this chapter, the most common herbal supplements that can be used in dentistry (i.e., neem, ginger, clove, aloe vera, eucalyptus, garlic, miswak, turmeric, tulsi, charcoal, and cinnamon) are reviewed. Evidence-based findings will be presented to support or refute the use of these agents in oral care.

2. Most common herbs used in dentistry

2.1 Aloe Vera

Aloe vera is effective in periodontal disease conditions [1]. It is available in several forms, such as a mouthwash, toothpaste, or gel [1]. In a recent systematic review, aloe vera as a mouthwash was effective in all included studies in reducing plaque and gingival inflammation (**Table 1**, [2]). Moreover, aloe vera had no or very minimal side effects compared to other chemical mouthwashes [2]. It has a strong detoxifying agent, a neuro-sedative properties and immune booster [1, 2]. It can act as a mercury scavenger and antioxidant. It accelerated healing after surgical extraction including the third molar [1, 2].

Aloe vera toothpaste is another form that is effective on periodontal index and gingival scores and that can be used as an alternative to traditional toothpaste [3]. Aloe vera gel has inhibitory activities on some cariogenic organisms (*Streptococcus mutans*) [4], such as periodontopathic (*Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*) and an opportunistic periodontopathogen (*Bacteroides fragilis*) [4]. It can be used as intracanal medicaments against *Enterococcus faecalis* (**Table 1**, [5]). It can be used to manage antiviral infection such as herpes simplex and herpes zoster, or as an antifungal agent against *candida albicans* [3–5].

There are several other uses for aloe vera such as aid in chemical burns, dry sockets, relief of aphthous ulcers, canker sores, lichen planus, pemphigus, desquamative gingivitis, migratory glossitis, and burning mouth syndrome [1–5]. It can help in reducing the information related to ill-fitting dentures [1–5]. It can also be used in peri-implant mucositis and peri-implantitis [1–5].

2.2 Ginger

Ginger, which is scientifically named *Zingiber officinale roscoe*, can be used as a pain killer and is as effective as ibuprofen [6]. It can be used as an alternative for ibuprofen [6]. Combined with non-surgical periodontal therapy in chronic periodontitis cases among the type 2 diabetes population, ginger can help [7]. The reducing colony forming unit (CFUs/uL) of *S. mutans* is comparable to other oral rinses, such as chlorhexidine, and is also effective against *Lactobacillus* (**Table 1**).

Ginger may be a promising anti-cariogenic against *Streptococcus mutans* and *Streptococcus sobrinus* [7]. It contains phenolic compounds such as gingerol and shogaol, hydrocarbons, and oleoresins. These compounds have been investigated and shown to be effective anti-inflammatory, anti-bacterial, and antioxidant agents in oral microorganisms, which can help in disease prevention [8]. Moreover, ginger can help to reduce costs and side effects, and can introduce a safe inhibitory agent compared to conventional mouthwash [9]. It can be used also as an intracanal dressing, and in cases with recurrent aphthous stomatitis and denture stomatitis [6–8]. However, it can lead to gastrointestinal irritation, heartburn, or diarrhea [6–8]. It can interfere with warfarin and inhibit platelet aggregation [6–8].

2.3 Clove

The principal phenolic components of clove, which is known scientifically as *Syzygium aromaticum* (*S. aromaticum*), are volatile oil, eugenol, and eugenyl acetate. It has some physical properties that have an adverse effect on surface roughness and

| Herbs | Main dental use | Main oral targeted organism |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aloe vera | Periodontal index, gingival scores, inhibitory activities on some organisms, intracanal Medicaments, oral medicine, after extraction, ill fitting denture, around implants complications. | <i>Streptococcus mutans</i> , <i>Aggregatibacter actinomycetemcomitans</i> , <i>Porphyromonas gingivalis</i> , <i>Bacteroides fragilis</i> , <i>Enterococcus faecalis</i> |
| Ginger | Pain killer, anti-inflammatory, anti-bacterial, intracanal dressing, recurrent aphthous stomatitis and denture stomatitis | <i>Streptococcus mutans</i> , <i>Streptococcus sobrinus</i> , <i>Lactobacillus</i> |
| Clove | Inhibit the decalcification and promote the remineralization, topical agent, anti-bacterial | <i>S. mutans</i> , <i>Porphyromonas gingivalis</i> , <i>Prevotella intermedia</i> , <i>Candida albicans</i> , <i>Herpes Simplex virus 1 and 2</i> |
| Cinnamon | Endodontic irrigate solution, antimicrobial properties against cariogenic bacteria and fungicidal activity . | <i>E. faecalis</i> , <i>Candida tropicalis</i> and <i>Candida glabrata</i> |
| Garlic | Inhibition of the growth of the periodontal pathogens, Endodontic irrigate solution. | <i>Aggregatibacter actinomycetemcomitans</i> , <i>P. gingivalis</i> , <i>Fusobacterium nucleatum</i> , <i>Streptococcus mutans</i> and <i>Lactobacillus acidophilus</i> |
| Neem | Endodontic irrigation solution, antiviral, antibacterial, antisclerotic and antiinflammatory properties. A local drug delivery system, inhibition of oral epithelial cell carcinoma. | <i>E. faecalis</i> , <i>P. gingivalis</i> , <i>S. mutans</i> , <i>S. faecalis</i> , <i>S. salivarius</i> , <i>S. mitis</i> , and <i>S. sanguis</i> |
| Miswak | Reduction of plaque, bacterial oral germs, prevent cavities, halitosis. Dentifrice, chronic periodontitis, mouthwash, remineralization effects, anti-cariogenic, whitening properties, and orthodontic chain preservation. | <i>Porphyromonas gingivalis</i> and <i>Herpes simplex virus-1</i> . |
| Turmeric | Antibacterial, antitumor, antioxidant, anti-inflammatory and analgesic properties. Mouth rinse, erythematous halo, ulcer size, and pain, oral submucous fibrosis | <i>Aggregatibacter actinomycetemcomitans</i> , <i>Porphyromonas gingivalis</i> , and <i>Tannerella forsythia</i> . |
| Tulsi | Antimicrobial agents. Toothpaste or mouthwash | <i>A. actinomycetemcomitans</i> , <i>P. gingivalis</i> and <i>P. intermedia</i> |
| Green tea | Antibacterial properties. Minimize bone loss in periodontal disease cases, mouth rinse, local drug delivery, and chewing gum. | <i>Streptococcus mutans</i> , <i>Streptococcus sobrin</i> , <i>P. gingivalis</i> and <i>P. melaninogenicus</i> . |
| Chamomile | Anti-inflammatory property, mouth rinse for gingivitis and periodontal disease, management of burning mouth syndrome, irrigant solution. | <i>Porphyromonas gingivalis</i> |
| Fenugreek | Gingival index, plaque index, bleeding on probing, pocket depth, and clinical attachment levels. | |
| Anise plant | Antibacterial properties, mouth rinse, increase healing process | <i>E. corrodens</i> and <i>Prevotella spp.</i> |
| Peppermint | Toothpaste or mouth rinse, antibiofilm properties. Topical analgesic and reduces pain. Treatment of gingivitis, periodontitis, oral mucosa of viral, bacterial, fungal and protozoal etiology. Decrease the treatment time, faster tissue regeneration, faster relieved pain and swelling, and improved the patients' quality of life. Mouthwash. | <i>Streptococcus mutans</i> |

| Herbs | Main dental use | Main oral targeted organism |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bloodroot | Periodontal disease, toothpaste or other oral hygiene products. | <i>P. gingivalis</i> . |
| Carawa | Mouth wash in gingivitis or periodontal disease. Flavor component in toothpaste and mouthwash products. | <i>Fusobacterium nucleatum</i> , early and late bacterial colonizers . |
| Eucalyptus | Anti-bacterial, antibiotics and oral infections prevention, dissolve root canal sealer | <i>A. actinomycetemcomitans</i> and <i>P. gingivalis</i> , <i>Streptococcus mutans</i> , <i>Lactobacillus acidophilus</i> |
| Phyllanthus emblica | Antimicrobial, antioxidant, anti-resorptive and anti-inflammatory activity. Locally delivered gel | Group of bacteria |
| Black seed | Suppresses pro-inflammatory cytokines, anti-bacterial, and decrease oral halitosis. | <i>Porphyromonas gingivalis</i> , <i>A. actinomycetemcomitans</i> and <i>Prevotella intermedia</i> , <i>S. mutans</i> , <i>Enterobacter cloacae</i> , <i>Streptococcus oralis</i> , <i>Streptococcus anginosus</i> , <i>Staphylococcus epidermidis</i> . |
| Myrrh | Antimicrobial properties, immune enhancer. Topical or a mouth wash, manage pharyngitis, tonsillitis, gum swelling, aphthous ulcers, intramucosal wounds, gingivitis and ulcers. Anti-inflammatory activity such as IL-1 β , IL-6, and TNF- α . | <i>Streptococcus mutans</i> , <i>Lactobacillus spp</i> , <i>Porphyromonas gingivalis</i> , <i>A. actinomycetemcomitans</i> , <i>Treponema denticola</i> , and <i>Tannerella forsythia</i> |
| Rosemary | Antioxidant, antibacterial, antifungal, anticancer. | <i>Staphylococcus aureus</i> , <i>Staphylococcus albus</i> , <i>Vibrio cholerae</i> and <i>Escherichia coli</i> |
| Sage | Mouthwash or gargle, sore throat, gingivitis, antibacterial, antifungal. | <i>Streptococcus mutans</i> , <i>Lactobacillus rhammosus</i> , <i>Actinomyces viscosus</i> , <i>Candida albicans</i> |
| Thyme | Spasmodic, whooping cough, oral herpes, chronic candidiasis and halitosis. | <i>S. aureus</i> , <i>E. coli</i> , <i>C. albicans</i> <i>Streptococcus mutans</i> |

Table 1.
The most common herbs used in dentistry and the dental application.

hardness, as well as transverse strength [10–13]. A high dose of clove oil can cause serious problems, such as sore throat, vomiting, toxicity, damage to the kidney and liver, epilepsy, and difficulty breathing. In small doses, it can inhibit decalcification and promotes remineralization (Table 1, [14]). It can be used as a topical agent, as a benzocaine before needle insertion, and has similar pain scores [15]. The crude extract of *S. aromaticum* (clove) has shown inhibitory activity against periodontal oral pathogens, including *S. mutans* (Table 1, [16]).

Other potential dental uses include antibacterial activity against *Porphyromonas gingivalis* and *Prevotella intermedia* [13]. It minimize several cytokines and factors such as IL-6, COX-2 and TNF- α . It has antifungal activity against *Candida albicans* [10–16], and antiviral activity against *Herpes Simplex virus 1 and 2* [10–16]. It can be used as mouthwashes, toothpastes, topical agents and local drug delivery devices [10–16]. Clove and its components are generally considered as “safe”. However, it has been demonstrated as a cytotoxic agent towards fibroblasts and endothelial cells in vitro studies [10–16]. Moreover, hepatotoxicity, generalized seizures and disseminated intravascular coagulopathy has been reported as severe side effects [10–16]. Other potential side effects include skin irritation, ulcer formation, contact dermatitis, tissue necrosis, and delayed healing [10–16].

2.4 Cinnamon

Cinnamon is commonly referred to *Cinnamomum Zeylanicum* or *Cinnamomum cassia*. It can be used as an endodontic irrigant to minimize the *E. faecalis*, which is comparable to 3% of sodium hypochlorite [17]. Cinnamon has good antimicrobial properties against cariogenic bacteria such as *S. mutans* and *Lactobacillus casei* [18], as well as fungicidal activity against *Candida tropicalis* and *Candida glabrata* (**Table 1**, [18]).

Chewing gum containing cinnamon may help in the management of halitosis cases by minimizing volatile sulfur compounds inside the oral cavity [19]. The toothpaste that contained *Cinnamomum zeylanicum* showed anti-bacterial activity against periodontal pathogens (**Table 1**, [20]). It can be used in the dental unit water lines, which minimized bacterial count [21].

There are potential side effects such as tooth discoloration with high exposure to cinnamon [17–21], allergic reaction such as swelling, inflammation, burning, soreness of the mouth and lips [17–21].

2.5 Garlic

Several in vitro studies found that the inhibition of the growth of the periodontal pathogens can happen with the aqueous extract, allicin [22], and diallyl sulfide of garlic [23]. The targeted pathogens are *Aggregatibacter actinomycetemcomitans*, *P. gingivalis*, and *Fusobacterium nucleatum* (**Table 1**, [24]).

When used as an irrigant, it is an effective, safe, and natural product, and is comparable to sodium hypochlorite after using it for a period of 12 months following root canals of primary molars [25]. The maximum zone of inhibition against cariogenic bacteria, such as *Streptococcus mutans* and *Lactobacillus acidophilus*, was in hard neck garlic extract, followed by chlorhexidine mouthwash [26]. The methanolic component of garlic had no anti-bacterial effects on *S. aureus* and *P. aeruginosa* [27].

Unpleasant breath or body odor is the most common side effects of garlic use [22–27]. Other side effects include heartburn, burning in a mouth or throat [22–27]. Patients need medical advice before garlic use if he/she is taking the following medications: acetaminophen; birth control pills; or warfarin [22–27].

2.6 Neem

Neem is scientifically known as *Azadirachta indica* and can be used as an endodontic irrigation solution to minimize the *E. faecalis*, which is comparable to 3% of sodium hypochlorite [17]. It has antiviral, anti-bacterial (*S. mutans*, *S. faecalis*, *S. salivarius*, *S. mitis*, and *S. sanguis*), anti-sclerotic, and anti-inflammatory properties. A local drug delivery system using 10% neem oil chip statistically reduced *P. gingivalis* and all clinical parameters in periodontal-diseased patients (**Table 1**, [28]).

The highly pure neem leaf extract has proven potential inhibition of oral epithelial cell carcinoma through downregulation of intra tumor pro inflammatory pathways [29]. However, it was less effective in plaque scores reduction among orthodontic patients compared to *Salvadora persica* miswak-based mouthwash [30]. It has Anticandidal activity against *C. albicans*, and it inhibits *S. mutans* and *E. faecalis* which cause root canal failure in endodontic procedure [17, 28–30].

2.7 Miswak

Salvadora persicahas have potential benefits in reduction of plaque, bacterial oral germs, cavity prevention, and halitosis [31]. It contains high amounts of calcium, chloride, phosphate, and thiocyanate, which, as a consequence, can affect saliva and oral health [32]. When used in the dentifrice, it can lead to significant reduction in plaque index scores compared to conventional dentifrice [33]. The miswak raw extract is effective against *Porphyromonas gingivalis* and *herpes simplex virus-1* in chronic periodontitis patients (**Table 1**, [34]).

The mouthwash form has been investigated as an effective method for plaque reduction [35]. It can also be used as a chewing gum, mouthwash, and chewing stick [31–35]. It has remineralization effects following dental caries. Miswak can accelerate the wound healing after oral/periodontal surgery or extraction. It has potential anti-cariogenic, whitening properties and orthodontic chain preservation [35].

2.8 Turmeric

Curcumin (Turmeric) has shown anti-bacterial, anti-tumor, antioxidant, anti-inflammatory, and analgesic properties [36]. It can be used as a topical application, mouthwash, subgingival irrigant or local drug delivery system to treat periodontal diseases, with equivalent or even higher efficacy compared with chlorhexidine in periodontopathic bacteria reduction such as *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, and *Tannerella forsythia* (**Table 1**, [36]).

The extract gel can be used as a treatment for erythematous areas, ulcers, and pain [37]. It can help in cases with oral submucous fibrosis, leukoplakia, lichen planus and it gave better results compared with the systemic form alone, or antioxidants (**Table 1**). It has anticancer activity as well [36, 37].

Although it considered safe, it may cause gastric irritation, nausea, diarrhea, allergic reaction, and interfering with blood-clot formation [36, 37].

2.9 Tulsi

Tulsi is released in several metabolites found in these plants, which have antimicrobial agents. It can be used in toothpaste or mouthwash [38]. It is similar to chlorhexidine in its antimicrobial property, and as an alternative in patients who cannot use chlorhexidine [39]. Tulsi extracts have antimicrobial activity against *A. actinomycetemcomitans*, *P. gingivalis*, and *P. intermedia*, with different inhibition zones (**Table 1**, [40]).

2.10 Green tea

Green tea and its principal compound (*flavonoid epigallocatechin-3-gallate*) are responsible for protective effects against several diseases and has anti-bacterial properties [41]. They can minimize bone loss in osteoporosis and periodontal disease cases by inducing apoptotic cell death of osteoclasts and osteoclasts-like cells (**Table 1**, [41]).

Green tea extract rich in epigallocatechin gallate minimizes alveolar bone loss in rats with periodontal disease [42]. It can be used in different forms, such as mouthwash, local drug delivery, and chewing gum. It has catechins that is anti-bacterial against *Streptococcus mutans*, *Streptococcus sobrin*, *P. gingivalis*, and *P. melaninogenicus* (**Table 1**, [42]).

2.11 Chamomile

Chamomile, known as *Matricaria recutita*, contains volatile oils, flavonoids, apigenin, luteolin, and quercetin [43]. It has an anti-inflammatory property that is as effective as a mouthwash for gingivitis and periodontal disease. There was a zone of inhibition when tested against *P. gingivalis* (**Table 1**, [44]). However, eucalyptus oil was the most effective, followed by tea tree oil, chamomile oil, and turmeric oil [45]. It can be used in management of burning mouth syndrome cases and as an irrigate solution (**Table 1**, [46]). It can be used topically in the treatment of eczema [43–46]. In fact, a randomized clinical trial found it to be equivalent to hydrocortisone cream [43–46]. However, it can cause allergic reactions which included bronchial constriction and skin reactions [43]. It is controversial to use with a pregnant women since it caused a newborn death in a single case report.

2.12 Fenugreek

There was a significant reduction in several parameters, such as gingival index, plaque index, bleeding on probing, pocket depth, and clinical attachment levels, when fenugreek was used clinically (**Table 1**, [47]). It has antibacterial activity against *S. mutans*, biofilm formation and acid production [47]. It was able to increase the salivary pH up to 7.83 and decreased the demineralization of the tooth's outer surface [47]. Fenugreek is considered unsafe to use during pregnancy, breastfeeding and for children. Do not use this product without medical advice if you are pregnant [47]. It can interact with blood sugar levels and cause hypoglycemia), or cause bleeding/blood clotting disorders [47].

2.13 Anise Plant

Anise has potent anti-bacterial properties due to the presence of anethole [43]. It has a strong effect against *Staphylococcus aureus*, as well as some gram-positive and gram-negative microorganisms. In the oral cavity, it works on anaerobic and facultative aerobic periodontal bacteria such as *E. corrodens* and *Prevotella spp* (**Table 1**, [43]). When used as a mouthwash, it was comparable to chlorhexidine in reducing bleeding on probing and increasing the healing process [43]. Anise is likely safe for most adults [43].

2.14 Peppermint

Mentha piperita can be used in a toothpaste or mouthwash, which showed anti-biofilm properties against *Streptococcus mutans* and dental plaque (**Table 1**, [48]). It can be used topically as an analgesic and to reduce pain. It can also reduce a toothache [48]. It showed antimicrobial, analgesic, anti-inflammatory, immunomodulatory, and astringent properties. It can be used in treatment of gingivitis, periodontitis, and oral mucosa of viral, bacterial, fungal, and protozoal etiology (**Table 1**). It can lead to a decrease in treatment time, faster tissue regeneration, faster relieved pain and swelling, and improved quality of life for the patients. It has also been used as a mouthwash [48]. It can be used safely in most of the cases [48]. However, it may interfere with iron absorption [48]. It can cause burning and gastrointestinal distresses in some cases. It is contraindicated in patients with chronic heartburn, severe liver damage, gallbladder inflammation or obstruction [48], and peppermint oil should be avoided in any facial application on children and infants [48].

2.15 Bloodroot

Bloodroot is an alkaloid known as *Sanguinaria canadensis*. It has been used for periodontal disease due to its ability to inhibit the growth of oral bacteria such as *P. gingivalis* (Table 1, [43]). It's available in toothpaste or as other oral hygiene products, and it is safe in long-term use. However, a recent report found that dental preparations with bloodroot may be associated with leukoplakia which is a precancerous lesion [43]. It is contraindicated in children, pregnant or lactating women [43]. The overdose can lead to stomachache, diarrhea, visual impairment, glaucoma, miscarriage, paralysis, and heart disease [43].

2.16 Caraway

The main components of *Carum carvi* are carvone and limonene. It can be used as a mouthwash in gingivitis or periodontal disease (Table 1, [43]). It can also be used as a flavor component in toothpaste and mouthwash products. It can target *Fusobacterium nucleatum* and early- and late-bacterial colonizers on tooth surfaces [43]. However, it should not be used in children under 2 years old because it may cause irritation to the skin and mucous membranes [43].

2.17 Eucalyptus

Eucalyptus is effective against *A. actinomycetemcomitans* and *P. gingivalis* (Table 1). It can be used as a promising alternative to antibiotics and oral infections prevention [49]. It can stimulate the innate cell-mediated immune response, tumor chemotherapy [50]. Eucalyptus oil has the ability to dissolve root canal sealer (Table 1, [51]). It has anti cariogenic activity against *Streptococcus mutans* and *Lactobacillus acidophilus* [49–51]. There are several potential side effects associated with the use of Eucalyptus such as: allergy, rashes, burning sensation, drowsiness, difficulty in breathing, cardiovascular collapse and multi-organ failure due to substantial ingestion of eucalyptus mouthwash [49–51].

2.18 Phyllanthus Emblica

Emblica officinalis has several properties, such as cytoprotective, antimicrobial, antioxidant, anti-resorptive, and anti-inflammatory activity. It can be used as a locally delivered gel and as an adjunct to scaling and root planning, which will reduce the periodontal inflammation in chronic periodontitis cases compared with scaling alone [52]. It can reduce all strains of yeasts stick in the buccal epithelial cells compared with normal saline solution [53]. It can be used a mouthwash to treat mouth ulcers, and aphthous [52, 53]. It is the best remedy for scurvy due to vitamin C contents and pain reliefs [52, 53]. Even though Phyllanthus has been used as traditional medicine for long term, side effects may include stomach upset and diarrhea [52, 53]. It should be avoided in children, pregnant women, breastfeeding mothers, and patients with Wilson's disease [52, 53]. It can inhibit blood clotting and should not be used plavix (clopidogrel) because it increased bleeding [52, 53].

2.19 Black seed

Miracle herb, or *Nigella sativa*, can reduce nitric oxide levels and inhibit pro-inflammatory cytokines such as IL-1b, IL-6, TNF- α , IFN-c, and PGE2. It can also

increase the anti-inflammatory IL-10 [54, 55]. It works against *Porphyromonas gingivalis*, *A. actinomycetemcomitans*, and *Prevotella intermedia* (**Table 1**). It also decreases oral halitosis [54–58]. The black seed were found to have a bactericidal effect surface inhibition against *S. mutans* [54–58]. It can be used as an intracanal antiseptic in root canal therapy due to its activity against *Enterobacter cloacae*, *Streptococcus oralis*, *Streptococcus anginosus*, and *Staphylococcus epidermidis* [54–58]. It has beneficial effects on oral ulcerations, oral mucositis, bone and wound healing after extraction or surgery [54–58].

2.20 Myrrh

Commiphora molm has three components: the resin, the gum, and the volatile oil. It has antimicrobial properties and immune enhancer [59–61]. It can be used as a topical or a mouth wash to manage pharyngitis, tonsillitis, gingivitis and ulcers with 2–3 times per day [59–61]. There is no known side effects with its used [62–65]. It works against caries bacteria such as *Streptococcus mutans* and *Lactobacillus spp*, and periodontal disease microbes such as *Porphyromonas gingivalis*, *A. actinomycetemcomitans*, *Treponema denticola*, and *Tannerella forsythia* (**Table 1**, [62–65]). It has anti-inflammatory activity through proinflammatory cytokines reduction such as IL-1 β , IL-6, and TNF- α [66]. It can be used in cases with gum swelling, aphthous ulcers, and intramucosal wounds [62–66]. It can lead to significant reduction in plaque and gingival inflations compared with 0.2% Chlorhexidine Gluconate mouthwash [64].

2.21 Rosemary

Rosmarinus officinalis has antioxidant activity and effective as an antibacterial and antifungal agents [43]. It can inhibit cancer development in animal studies [43]. It works against *Staphylococcus aureus*, *Staphylococcus albus*, *Vibrio cholerae* and *Escherichia coli* (**Table 1**, [43]). However, it should be avoided during pregnancy to minimize the risk of abortion [43]. It can lead to iron deficiency in some cases as well [43].

2.22 Sage

The main components of *Salvia officinalis* are alpha and beta-thujone, rosmarinic acid, camphor, tannins, flavonoids, and cineole [43]. It can be used as mouthwash or gargle several times to treat a sore throat and gingivitis [43]. It has antibacterial (*Streptococcus mutans*, *Lactobacillus rhamnosus*, and *Actinomyces viscosus*), and anti-fungal (*Candida albicans*) (**Table 1**, [43]). The long term used can increase heart rate, cause mental confusion and convulsions [43]. It should be avoided during pregnancy and cases with fever [43].

2.23 Thyme

Thymus vulgaris is one of the most commonly recommended herbs in Europe in spasmodic and whooping cough [43]. It can be used to treat oral herpes, chronic candidiasis and halitosis [43]. It targeted *S. aureus*, *E. coli* and *C. albicans* [43]. Patients with orthodontic brackets can use it as varnish to reduce *Streptococcus mutans* near the bracket (**Table 1**, [43]).

3. Conclusions

Herbal medicine can be beneficial in the dental field in dental caries, periodontal disease, candida and viral infection, oral ulcers and lesions. It has several advantages such as easy accessibility, natural products, low cost and toxicity, and faster healing time. However, it can lead to serious problems if used inappropriately. Therefore, a physician consultation is required before any dental use to avoid any potential complications or drug interaction, and a deeper investigation, preclinically and clinically, is needed before official herbal medicine use is highly recommended.

Conflict of interest

The authors declare no conflict of interest.


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