



Commiphora Myrrh in Management of Periodontal Diseases: Review Article

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Abstract

Background and objectives: The herbal extracts in management of oral and other body diseases were increased in last decades due to potential benefits as antibacterial, anti-inflammatory and antioxidant properties. *Commiphora myrrh* (*C. myrrh*) has been used for treating different diseases including chronic inflammatory conditions as periodontal diseases. This review aims to provide updated information on the clinical effects of *C. myrrh* products in treatment of periodontal diseases. The collected data of these review article obtained from several electronic data bases (PubMed, Scopus, Google Scholar, and others), the review based on the antibacterial, anti-inflammatory, and clinical effectiveness of *C. myrrh* in treating of periodontal diseases then discussion for these knowledges.

Conclusions: The current review suggested that *C. myrrh* extracts is an effective to improve oral hygiene. It demonstrated clinical effectiveness in reduction of dental plaque and gingival inflammation and used as an adjunct to mechanical plaque control and professional therapies of periodontitis patients. Furthermore, well designed studies are required to establish the efficacy of *C. myrrh* in controlling of subgingival biofilm and reducing the proinflammatory cytokines.

Keywords: *Commiphora myrrh*; Gingivitis; Periodontitis; Periodontal Therapy

Abbreviations

C myrrh: *Commiphora Myrrh*; *P. Gingivalis*: *Porphyromonas Gingivalis*; *T. Denticola*: *Treponema Denticola*; *T. Forsythia*: *Tannerella Forsythia*; *A. actinomycetemcomitans*: *Aggregatibacter Actinomycetemcomitans*; *E. Faecalis*: *Enterococcus Faecalis*; *F. Nucleatum*: *Fusobacterium Nucleatum*; PgE2: Prostaglandin E2; MS: Myrrh Solution; SN: Silver Nanoparticles; CHX: Chlorhexidine; MWs: Mouthwashes; MO: Myrrh Oil; SRP; Scaling and Root Planning

Introduction

Periodontal diseases comprise a group of diseases which induced by several infectious microorganisms in organized community (dental plaque biofilm) which attack the periodontium leading to inflammatory and clinical changes: gingival inflammation, bleeding, pocket formation and clinical attachment level of junctional epithelium, and alveolar bone loss [1]. The main categories of periodontal diseases are gingivitis and periodontitis which precipitated by supra and subgingival periodontal pathogens by their toxins and virulence factors especially the gram negative anerobic periodontal pathogens [2]. A group of red complex pathogens of

plaque biofilm are typically associated with periodontal diseases. Increased bacterial load of *Porphyromonas gingivalis* (*P. gingivalis*), *Treponema denticola* (*T. denticola*) and *Tannerella forsythia* (*T. forsythia*) have been recorded in generalized periodontitis stage III or IV. However, *Aggregatibacter actinomycetemcomitans* (*A. actinomycetemcomitans*) is commonly associated with molar incisor periodontitis stage IV [3].

The current therapeutic modalities of periodontal diseases are depended on control of the supragingival and subgingival plaque biofilm by using of local and systemic natural and chemical antimicrobial products, and host modulation drugs to enhance the anti-inflammatory host immune response [3]. Several natural and herbals products in many forms were used in traditional medicine for several hundreds of years such as clove oil, propolis, green tea, aloe vera, cranberry, salvia, calendula, curcumin, salvadora persica (Miswak) and commiphora myrrh/myrrah, due to their treating efficacies of numerous oral diseases [4,5].

Commiphora myrrh (*C. myrrh*) is a small tree develop commonly in middle east region (Saudi Arabia, Oman, Somalia, Sudan, north-

ern Kenya, and Ethiopia), likewise known as *Commiphora molmol*, *Balsamdendron myrrha* (Figure 1 and 2). The myrrh is yellowish resinous fluid released from the phloem of the tree. Moreover, the name Myrrh was derived from the Arabic word (murr), meaning bitter [6,7].

Therapeutic application of Myrrh has a wide range in management of numerous oral and body diseases, referred to its pharmacological activities (e.g., antibacterial, antifungal, anti-inflammatory, antioxidant, analgesic, antiparasitic) [6-8]. Myrrh is produced in several forms: essential oils, tincture, gargles, and mouthwashes. It's useful in treating sore throats or other oral mucosal or gingival irritations and enhance wound healing [9-11].

The searching literature displayed few studies were evaluating the positive effectiveness of *C. myrrh* as a drug for treating the oral and periodontal diseases. The purpose of the current review article to spotlight on antibacterial, anti-inflammatory, and beneficial clinical applications of *C. myrrh*.



Figure 1: *Commiphora myrrh* tree [17].



Figure 2: Oleo-gum resin of *Commiphora myrrh* [26].

Antibacterial activity of commiphora myrrh

Commiphora myrrh tree produces the aromatic oleo-gum-resin, named as myrrh. This oleo-gum-resin of *C. myrrh* is considered one of the most documented natural antimicrobial agents [5]. Al-Marby, *et al.* (2016) evaluated the antimicrobial activity of *C. myrrh* methanol extracts on, *Staphylococcus carnosus*, *Escherichia coli*. The results confirmed that *C. myrrh* (100 mg/ml) had most antibacterial activity with inhibition zones ranged between 12 and 15 mm and minimum inhibitory concentrations of 2.5 mg/mL for both microorganisms [12]. Regarding to oral pathogens, the suppression effect of Myrrh tincture (100 mg/ml) on some periodontal pathogens (*P. gingivalis*, *Prevotella intermedia*) was studied by Beak, *et al.* (2013). They concluded that the *C. myrrh* extract can suppress the oral harmful bacteria and prevent periodontal diseases [13].

Synergistic antibacterial activity of *C. myrrh* ethanolic extracts with antibiotics on most virulent periodontal pathogens (*P. gingivalis*, *T. forsythia*, *T. denticola* and *A. actinomycetemcomita*). They concluded that significant antibacterial activity when *C. myrrh* extract was combined with antibiotics against all the investigated bacteria [14]. Also, *C. myrrh* oil reported to decrease the gram negative of dental plaque bacteria at early stage [15].

Antimicrobial efficacy of the extract of *C. myrrh* compared to sodium hypochlorite as a root canal irrigants against *Enterococcus faecalis* (*E. faecalis*) and *Fusobacterium nucleatum* (*F. nucleatum*) was investigated by Al-Madi, *et al.* (2019). They suggested that ethanolic extract of *C. Myrrh* has significant antibacterial activity toward to both *E. faecalis* and *F. nucleatum* [16].

Recently, AL-Harhi, *et al.* (2021) investigated the antibacterial activity of Myrrh mixed with silver nanoparticles against *P. gingivalis* compared to myrrh and silver nanoparticles alone. They reported that myrrh solution mixed with silver nanoparticles (MSN) presented greater anti-microbial activity against *P. gingivalis* compared to myrrh solution (MS) and silver nanoparticles (SN) after incubation at 48 hrs rather than after 24 hrs [17].

The previous studies indicated that *C. myrrh* in different forms had significant antibacterial effects against multiple oral and periodontal pathogenic microorganism may play a role in decreasing the inflammatory process of different oral and periodontal diseases.

Anti-inflammatory activity of commiphora myrrh

The inflammation is processed by presence of inflammatory agents that regulates the inflammatory response including pro-inflammatory cytokines, growth factors and inflammatory mediators such as prostaglandin E2 (PgE2). Numerous investigations demonstrated that myrrh has anti-inflammatory properties by suppressing pro-inflammatory signaling pathways and enhancing anti-inflammatory mediators [7,18,19]. In some animal experimental

studies on rats, Myrrh induce activation/maturation and differentiation of both (myeloid and lymphoid) cell types of WBCs during wound healing of induced gastric and skin injuries [20], it has significant anti-inflammatory, analgesic and anti-hyperlipidemic effectiveness and decrease body weight gain and improves the profile blood lipids [19], and has beneficial value in the induced ulcerative colitis in rats by downregulating the expression of inflammatory mediators and enhancing endogenous antioxidative processes [21]. Furthermore, Shin, *et al.* (2019) recorded that the *C. myrrh* suppresses histamine and IL31 expression in stimulated cultured mast cells [22].

The etiopathogenesis of chronic inflammatory periodontal diseases (gingivitis and periodontitis) is mainly directed through bacterial virulence factors and host inflammatory immune system response [23]. An *in vitro* study on the anti-inflammatory effects of myrrh oil (MO) on human epithelial and gingival fibroblast cells. The results recorded that long term exposure with MO significantly reduces the synthesis of IL-1 β - stimulated interleukin-6 (IL-6) and IL-8, decreasing of the inflammatory response of fibroblasts from the gingival fibroblasts, but not like epithelial cells [24]. Also, MO inhibited IL-1 β -stimulated PGE2 production by fibroblasts except epithelial cells [25].

Regarding previous scientific knowledge, *C. myrrh* is established a significant natural anti-inflammatory agent in downregulating several inflammatory mediators and the role in controlling of chronic inflammatory periodontal diseases is expected.

Clinical effectiveness of commiphora myrrh in periodontal diseases

Herbal medicine and using of medicinal plants in several body diseases were used for several last centuries. The effectiveness of herbal natural products in management of oral and periodontal diseases were discussed in many reviews and original research trails [4,6,12,26].

The efficacy of *C. myrrh* mouthwash in gingivitis and plaque control in comparison to a most commercially chlorhexidine (CHX) mouthwash (MW) was assessed by Zahid and Alblawi (2018). The study exhibited that Myrrh mouthwash led to clinical improvement in plaque reduction and gingival inflammation [27]. In clinical comparative clinical study, the effect of Myrrh and Miswak mouthwashes (MWs) on plaque accumulation and gingival inflammation were compared with chlorhexidine gluconate (MW 0.2%). Plaque and gingival indices (PI and GI) were documented at baseline and after 3 weeks of scaling and root planning (SRP). The greatest improvement was within the Myrrh group between all three groups for both GI and PI. Moreover, the results of Miswak and Myrrh MWs in controlling of plaque biofilm and decreasing gingival inflammation was recorded to be comparable to that of CHX, and Myrrh has recognized to be more active than Miswak MW [10]. Consequently,

1% Myrrh MW was as good as 0.2% chlorhexidine MW in reducing gingival inflammation and scoring of bleeding on probing (BOP) [28]. Another comparative study on the efficacy of both Myrrh and CHX MWs on gingivitis and dental plaque accumulation suggests that Myrrh-based MW is an effective technique to enhance oral hygiene and periodontal health on short time with minimal adverse effects [29].

Linka, *et al.* (2021) evaluated the anti-inflammatory, anti-plaque and antimicrobial efficiency of Myrrh oil (MO) as an adjunct to SRP in the treating of gingival inflammation. The PI, GI, and microbiological analysis for affection on gram negative bacteria was passed out at baseline, 48 hrs and 1week interval. The findings suggested that the MO could be beneficial agent with SRP, and significantly decreased the gingival inflammation in 48hrs and gram-negative bacteria after 1 week [15].

Commentary, the mentioned clinical trials indicated that a significant role of *C. myrrh* in improvement of oral and periodontal health through antibacterial and anti-inflammatory and antioxidant effects.

Discussion

Dental plaque biofilm is the initiating etiological factor of periodontal diseases. The extracellular matrix of biofilm protects the periodontal pathogens and resist the host defenses and antimicrobial agents. Proper controlling of biofilm plays a key role in oral and periodontal health. Plaque control by patient and professional management (SRP). Furthermore, chemical, and natural antimicrobial products maintain periodontal health and considered the golden base in management of chronic inflammatory periodontal diseases [1,30,31].

C. myrrh most common in traditional and alternative medicine, can be used in systemic and topical application for different diseases affecting the human body, several forms of *C. myrrh* as oil, tincture, and mouthwashes [26]. The *C. myrrh* MW is the most common form used in periodontal clinical studies, and the objectives were focused on the antibacterial, antiplaque, and anti-inflammatory effects in gingivitis and periodontitis patients with or without nonsurgical periodontal therapy [26-29]. There are little clinical studies on role of *C. myrrh* in controlling the plaque biofilm and reducing gingival inflammation. Mostly, all studies suggested that the *C. myrrh* could be considerable natural product has a multiple beneficial effects and adjunctive agent during periodontal therapy [27-30].

Regarding the traditional using of *C. myrrh* in Arabic and Middle East countries especially, the using of this herb without pharmaceutical evidence based on experimental and clinical trials, may be toxic and harmful to human tissues [26,29]. Related to that, Al-Mobeeriek (2011) evaluated the clinical and histological effects of

C. myrrh compared with CHX and tetracycline containing MWs on wound healing over time of buccal wound in an animal model. They found that the myrrh suspension promotes healing of injured tissues when used in low concentration and short period of time (≤ 2 weeks), but it can have harmful effects when used in large concentration or in long period of time [32]. Based on the above, using of herbal and medicinal plants products with noncontrolled pharmaceutical manner may be harmful more than useful.

Controlling of subgingival biofilm is considered more effective to periodontal health, in one study, the gingival local application of Myrrh oil significantly decreasing the subgingival gram-negative periodontal pathogens [15]. This finding serves as a starting point for thinking about using C. myrrh extract products in gel-based drug as a sustained release local delivery drug in conjunction with professional periodontal managements. Extensive microbiological and clinical research on C. myrrh as a promising delivery system in nanoparticle technology may represent an exciting future trend in therapies of periodontal diseases.

Conclusions

In conclusion, C. myrrh was representing a natural product significantly reduce the plaque biofilm and gingival inflammation in periodontally diseased patients. The use of several product forms of C. myrrh in conjunction with SRP may promote extra benefits when compared to periodontal treatment only. Future manufacturing technologies will be supplying the dental practitioners by highly easily potent sustained released local delivery to control the subgingival biofilm and inflammation. Further microbiological, immunological, and clinical investigations are required to clarify the more beneficial effectiveness of this herbal product in different categories of periodontitis patients.

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Conflict of Interest

None declared.

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