Essential oils: a Chemotherapeutic Option in Periodontics

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Abstract

Periodontal diseases are a group of pathologies that affect the tissues that support teeth. The efficient control of daily oral biofilm can prevent these diseases. Most individuals have difficulty in developing good oral hygiene habits and use only mechanical elements. This has led to the development of chemical adjuvants so that patients can maximize biofilm control. Essential oils (EOs) are effective and more efficient at controlling supragingival plaque and inflammation compared to a placebo and to cetylpyridinium chloride. Nevertheless, EOs were similar in their antiinflammatory effectiveness and less efficient in plaque control than chlorhexidine, causing fewer adverse effects. Current evidence suggests that chlorhexidine remains the first choice for short-term oral health care and that essential oils are best indicated for long-term treatments.

Keywords: Periodontal diseases, Chemotherapy

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Introduction

Periodontal diseases are a group of pathologies that affect the tissues that support teeth. Gingival diseases involve only the gingival margin, but if the attached gingiva is also involved, the condition is called Periodontitis. Clinical attachment loss, pathological pockets and bone resorption are typical signs of periodontal disease. Lack of treatment may lead to tooth loss (1). Periodontal disease has high prevalence among adults and lower social classes (2-5) and is currently one of the main public health concerns (6).

It includes pathologies with different clinical manifestations, as similar diagnosis may include furcal involvement, gingival recession, tooth mobility, mucogingival complications, etc. These diseases differ in their etiology, natural history and response to therapy, but their pathogenesis shows similar events, which can be modified by genetic factors and/or risk factors (7).

Dental biofilm and its byproducts are considered precipitating factors of periodontal disease. The link between dental biofilm and the prevalence and severity of these pathologies has been well established (8). Longitudinal studies have shown that these conditions can be successfully treated by removing bacterial deposits, removing tartar and teaching oral hygiene practices (9, 10).

Gingivitis can be prevented by controlling oral biofilm daily, frequently and effectively (11). Therefore, treating and eliminating gingivitis would be the most efficient way to prevent periodontitis. However, several studies show how difficult it is to help people develop good oral hygiene habits using only mechanical elements (12-15). Hence the need to supplement dental plaque removal using mechanical elements with chemical (chemotherapeutic) adjuvants (15, 16).

Ideally, the goal of periodontal therapy is to reduce the number of periodontopathogenic species that cause periodontal disease and to keep their numbers low. Therefore, the infection is treated by reducing the microbial load and/or by modifying the subgingival habitat (17).

Currently available chemotherapeutic colutory formulations include: Triclosan/ Copolymer, Cetylpyridinium Chloride (CPC), Chlorhexidine (CHX) Digluconate, or a fixed combination of essential oils as active ingredients.

Nature of essential oils

Essential oils (EOs) are organic compounds made up of various constituents obtained from plants for specific purposes. The formula includes four active ingredients: Eucalyptol 0.092%, Menthol 0.042%, Methyl Salicylate 0.060%, Thymol 0.064% (18).

Action mechanisms

EOs have proven to be effective at controlling inflammation and supragingival biofilm. They are also safe for patient use (19-21). They have the ability to alter the cell surface of specific microorganisms and eliminate their enzymatic activity (22). They can also inhibit the endotoxins of Gramnegative pathogens (23). In vitro and in vivo studies have shown how EOs can penetrate the dental biofilm and have a bactericidal effect (24, 25).

Anti-inflammatory and antiplaque action

Phenolic compounds show anti-inflammatory action and inhibit prostaglandin synthesis, act as scavengers of oxygen free-radicals, thus affecting leukocyte activity. Studies conducted on animal cells show that phenolic compounds commonly used in these chemical formulations (thymol, menthol, eucalyptol) inhibited neutrophil chemotaxis and superoxide generation in neutrophils (concentration-dependent), and they also led to the elimination or scavenging of freeradicals

and the inhibition of prostaglandins. These aromatic compounds have a free phenolic hydroxyl group which accounts for the anti-inflammatory action described above (26, 27).

Essential oils versus placebo

An alcohol-based mouthwash with EOs has been used as a chemotherapeutic agent, showing relevant clinical reductions of supragingival plaque and inflammation both in short (28) and long (29) term studies.

In a 6-month randomized controlled clinical trial, EO mouthwashes showed a reduction of up to 70% in oral biofilm and a reduction of up to 36% in gingivitis compared to a control group (5% hydroalcoholic solution) among patients with mild to moderate levels of plaque and inflammation (P<0.001) (30). Likewise, in 15-day models, EO colutories showed a reduction in oral biofilm greater than 21% (P<0.001) and a 12% greater reduction of inflammation than the control group (5% hydroalcoholic solution) on patients with mild or moderate gingival disease (P<0.001) (31).

Alcohol-free EO mouthwash: In a 15-day evolution clinical trial, the group using the test product had a mean Plaque Index (PI) lower than that of the control group, with a 23.9% reduction (P<0.001). Additionally, when the dependent variable was the Modified Gingival Index (MGI), there was a 10.4% reduction. Regarding Bleeding on Probing (BOP) Index, the secondary efficacy variable, the control group showed a 53.8% reduction in the ratio of bleeding areas (p<0.001) (32).

Alcohol-free mouthwash with EOs led to a significant reduction in dental plaque (31.6%) and gingival inflammation (24%) compared to a negative control (33) 6 months after the beginning of the trial (P<0.001).

Essential oils vs Chlorhexidine (CHX): In a recent systematic review, EOs were considered an alternative to CHX to control gingival diseases.

Colutories containing CHX were more effective regarding dental plaque values, but no significant difference was found in gingival inflammation. The most probable explanation is that the mouthwash with CHX has an antiplaque effect, while EOs have a direct anti-inflammatory effect. Chlorhexidine is significantly superior at reducing bacterial deposits when compared to EOs, which is not the case for the long-term reduction of gingival inflammation. Secondary effects (stains and tartar) were more serious in CHX users compared to EOs users (34).

Essential oils vs Cetylpyridinium Chloride (CPC): Long-term studies have shown that the group using EOs had a reduction in the plaque index which was 56.2% higher than that of the group treated with 0.05% CPC (P<0.001). Regarding the MGI, the changes showed a reduction greater than 32.4% compared to the CPC group (P<0.001) (30, 33).

An EO formulation with zinc chloride (as anti-tartar agent), sodium fluoride and acidulated phosphate (for cavity control) was compared to a negative control and a CPC-based mouthwash. After three months, the EO-based mouthwash was more effective at reducing biofilm when compared to the negative control and to the CPC. These results remained the same for six months. Both regarding dental plaque and inflammation after 3 and 6 months, the EO mouthwash was better than the negative control and CPC (18).

Essential oils and oral cancer

The link between EO-based colutories and the risk of developing oral cancer has been controversial for decades, ever since the initial remarks made by Weaver et al. (35).

Daily alcohol consumption (ethanol) has

proven to be a risk factor for oral cancer.
A number of mouthwashes contain ethanol in concentrations that range between 5% and 27%. Ethanol improves product solubility, stabilization and conservation, thus modifying its taste and increasing antiplaque properties. In a 18% – 27% concentration, ethanol improves the antibacterial action of EOs (high penetration achieved in 30 seconds) (36).
Currently it is not possible to conclude that there is a statistically significant link between the use of alcohol-based mouthwash and the risk of oral cancer. Likewise, there is no significant indication that the risk increases with daily use, as evidence is mostly retrospective.

Indications

Hass and col. (41) conducted a systematic review of the efficacy in biofilm and gingival inflammation control in patients wearing fixed orthodontic appliances. These authors concluded that after 6 months, plaque and gingivitis levels decreased up to 50% among these patients when used as adjuvants to mechanical therapy. Regarding implant therapy, the systematic use of essential oils twice a day, in a 3-month follow-up period, led to a significant reduction in the plaque and tissue inflammation percentages when compared to the placebo (hydroalcoholic solution) (42). Patients undergoing periodontal maintenance therapy would also benefit from this mouthwash as an adjuvant to mechanical therapy (34).

Conclusions

Chlorhexidine is the most effective antiplaque agent, which makes it the first therapeutic short-term option. Considering their adverse effects, mouthwashes with essential oils seem to be a reliable alternative for long-term use.

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