

Essential oils: some lesser known uses and properties for improved oral health

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Abstract

Much evidence has been published in this current series of articles supporting the use of essential oil (EO) mouthwashes in crucial areas of oral health including plaque and gingivitis control, interdental hygiene, oral malodour, preprocedural rinsing for infection control, implant maintenance and caries prevention. The aim of this paper in to present series on essential oils in oral health focuses on a review of some of its lesser known uses and properties. First published in *S Afr Dent J* 2004; 59: 381-4.

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Much evidence has been published in this current series of articles supporting the use of essential oil (EO) mouthwashes in crucial areas of oral health including plaque and gingivitis control, interdental hygiene, oral malodour, preprocedural rinsing for infection control, implant maintenance and caries prevention^{1,2}. The aim of this paper focuses on a review of some of its lesser known uses and properties.

Essential oils for use in home oral irrigator systems

Although essential oils mouthwashes have been shown to be effective adjuncts to mechanical oral hygiene regimens for plaque and gingivitis control, the antiseptic solution may still not reach the desired depths of the gingival pocket. However, when used as a powered irrigating solution in close contact with the periodontal pocket, antiseptics may partially reach the subgingival bacteria (with a mean penetration of 70% of the total pocket depth) and inflamed tissues that are otherwise inaccessible^{3,4}.

Ciancio et al.⁴ undertook a double-blind randomized controlled trial on 66 generally healthy patients who exhibited pre-existing dental plaque and gingivitis with pocket depths of < 5mm. All subjects were randomly assigned to an antimicrobial agent (EO Listerine Antiseptic) or a hydroalcoholic control, which was used as the solution in the powered oral irrigator. Plaque, gingivitis, bleeding and pocket depth were assessed at 3 and

6 weeks, including a microbiological analysis of the subgingival plaque. At 6 weeks, both groups showed significant decreases from baseline in plaque, but at both study points the change produced in the EO mouthwash group was 12–16% greater than that produced by the placebo rinse ($P < 0.01$). At week 3, compared with placebo, the EO mouthwash had reduced bleeding by 41.8% ($P < 0.01$). At week 6, decreases in bleeding were slightly but not significantly greater in the EO mouthwash group compared to those seen with placebo. Both rinses significantly reduced gingivitis and pocket depths compared with baseline. Microbiological data revealed that EO mouthwash irrigation markedly reduced subgingival plaque bacteria. The total bacterial count at 6 weeks increased in the placebo group but decreased in the EO mouthwash group, yielding a significant between group difference ($P < 0.05$).

The efficacy and safety of oral irrigation for plaque and gingivitis control has been well established in a number of recently published randomized controlled trials⁵⁻⁷. The evidence presented by the Giancio et al trial⁴ suggests that essential oil mouthwashes can be used as the irrigant solution in powered oral irrigators for additional oral health benefits.

Anti-fungal effects of essential oil mouthwashes

As early as 1984, DePaola et al.⁸ reported that Listerine (EO mouthwash) was effective against *C. albicans*, the organism most commonly associated with denture stomatitis. This aim of this study⁸ was to evaluate agents that reduced microbial growth on the dental prostheses of myelosuppressed cancer patients. Listerine was found to inhibit all bacteria at a 1: 4 dilution and *C. albicans* at a 1: 8 dilution. DePaola et al. (1986)⁸ undertook a

randomized controlled trial with three objectives:

- to determine the effectiveness of Listerine antiseptic mouthrinse, antifungal mouthrinses and denture soaks in retarding the accumulation of microbial growth and plaque on maxillary complete dentures and on palatal tissues,
- to identify and quantify microbial populations on maxillary dentures and denture-bearing tissues prior to and after the treatment regimens,
- to evaluate the effects of the antiseptic and antifungal rinses and denture soaks on inflammation of denture-bearing tissues.

Fifty-three subjects, between the ages of 30 and 80, who complete dentures and had mild to moderate inflammation of the palatal mucosa were enrolled into this trial. Palatal inflammation and denture stability were assessed at baseline and samples from the inflamed palate, surface of the denture and saliva were obtained. Following these baseline procedures, the dentures were cleaned.

The subjects then began a 28-day test regimen, in which they refrained from all denture hygiene measures except the rinses or soaks provided. Each patient was allocated to one of five treatment groups:

1. Listerine mouthrinse, Listerine denture soaks,
2. Listerine mouthrinse, Nystatin denture soak,
3. Nystatin mouthrinse, Listerine denture soak,
4. Nystatin mouthrinse, Nystatin denture soak,

5. Sterile water rinse, sterile denture soaks which were the controls.

Patients were given instructions on how to use the mouthrinses and denture soaks for a period of four weeks.

Forty-seven patients completed the trial. Palatal inflammation in all treatment groups was significantly reduced in area and intensity when compared to the control group. The denture stability and denture plaque scores for patients in the control group did not change significantly after 4 weeks. There were significant reductions in the total yeast counts in groups 1, and 4 but not in groups 2, 3 and 5. In denture stomatitis patients, groups 1, 3, and 4 were efficacious in reducing palatal inflammation when compared to the control group (group 5). The authors concluded that when yeast populations in denture stomatitis were controlled, there was clinical improvement in the degree and area of palatal inflammation. Furthermore, both Listerine and Nystatin were effective in reducing yeast colonization of the dentures and palate and reducing palatal inflammation.

More recently, Meiller and colleagues¹⁰ undertook an in-vitro study to compare the efficacy of Listerine Antiseptic, Tartar Control Listerine Antiseptic, Peridex mouthrinses and a 0.2% chlorhexidine digluconate solution against known pathogenic fungi. Standardized methods were used to compare the antimicrobial efficacy of the above agents versus representative fungal species. Minimum inhibitory concentration-minimum fungicidal concentrations in macrobroth dilutions, suspension kill-time, and effectiveness against an artificial biofilm-attached population were studied. All antimicrobials tested were effective against the fungal species under investigation at the

concentration available commercially. However, Listerine Antiseptic showed a greater efficacy against attached artificial biofilm populations than the other antimicrobials tested. The authors concluded that all of the mouthrinses showed promise as a means to control the pathogenic fungal species under investigation and may have applications to reduce oral colonization.

The use of essential oil mouthwashes post-surgically¹¹

Antiseptic mouthwashes may be useful following periodontal surgery in the early postoperative phase. This has been assessed in two studies. The first¹² examined plaque formation, gingival health, bleeding, wound healing and patient comfort level in postgingival surgery patients, and the second¹³ investigated the effects of EO mouthwashes on wound healing alone. Both studies involved adult patients with moderate periodontitis, who required bilateral maxillary posterior segment gingival flap surgery involving at least three adjacent teeth.

As early as week 1, each of the studies demonstrated that the EO mouthwash evoked a therapeutic effect on the clinical postsurgical parameters evaluated, which was significantly superior to the control rinse. In the Zamblon et al study¹² the difference in inhibiting plaque formation was 28.9% ($P < 0.04$).

Wound healing¹² was evaluated by colour (measured by pink, mixed or red) and oedema status (absent, mild, moderate or severe). At day 7, patients in the EO mouthwash group exhibited significantly less oedema than patients using the control rinse ($P < 0.04$), and only 20% of this group had signs of moderately inflamed gingiva compared with 40% of the control group ($P < 0.052$). Pockets depths were significantly reduced in both rinse groups

($P=0.001$). The authors of both studies^{12,13} concluded that EO mouthwashes were safe to use in surgical situations and offered healing benefits. They added that despite their relatively low pH they did not damage hard or soft tissues or interfered with the healing process.

Essential oil mouthwashes for the treatment of recurrent aphthous ulcerations

Meiller et al.¹⁴ undertook a six-month double-blind clinical study of 96 adults with the aim of evaluating the effects of a vigorous twice-daily rinsing using a commercially available antimicrobial mouthrinse (Listerine Antiseptic) and a hydroalcoholic on the incidence, duration, and severity of recurrent aphthous ulcers (RAU) in persons prone to this disorder. The authors found that the Listerine Antiseptic rinse and the hydroalcoholic rinse resulted in a statistically significant reduction in the incidence of RAU occurrences from baseline. The duration of lesions and the severity of pain in subjects with ulcers during the treatment period were also significantly reduced in the Listerine Antiseptic rinse group of patients when compared with baseline. The hydroalcoholic rinse did not show a significant effect versus baseline for either severity or duration of the lesions. The authors concluded that oral rinsing could be of clinical value in reducing the occurrence of RAU in susceptible patients, and that Listerine Antiseptic rinse may be of significant additional value in decreasing the duration and severity of RAU in affected patients.

Essential oils as disinfectants for dental unit waterlines Meiller and colleagues¹⁵ investigated the overnight treatment of dental unit waterlines with Listerine Antiseptic in which recurrence was investigated by evaluating effluent and biofilm specimens by plate

culture. The presence or absence of biofilm within the dental unit waterlines was evaluated, pre- and post-treatment, by scanning electron microscopy. Baseline evaluations of dental unit waterlines determined the effluent and biofilm to harbor an average of $1 \times 10(5)$ CFU per ml and $1 \times 10(4)$ CFU per cm^2 , respectively, prior to treatment. In terms of the results, the overnight, 18-hour treatment with Listerine Antiseptic rendered effluent and biofilm samples free of recoverable bacteria in all cases immediately following treatment. Viable bacteria in the effluent of treated dental unit waterlines recurred to near pre-treatment levels by Day 7. The minimum inhibitory concentrations for each of the recovered isolates did not change following overnight treatment. Repeated overnight treatments at the beginning of a one-week study were effective in inhibiting recurrence of viable bacteria in the biofilm and effluent indefinitely, but still failed to completely remove the biofilm matrix. New tubing treated prior to use and then daily with LA did not develop a detectable biofilm by scanning electron microscopy during the study. One-month long follow-up clinical trials have demonstrated that a maintenance solution of a 1:50 concentration of Listerine Antiseptic mouthrinse and sterile distilled water in self-contained dental units with new tubing is effective for prolonged periods in maintaining the effluent within the American Dental Association's recommendation for the year 2000 of < 200 CFU per ml. According to the authors of this study, the clinical significance of their findings was that a solution to the problem of dental unit waterline contamination may be currently available. Since antimicrobial Listerine Antiseptic was safe for patient use, it may be one of the most viable options suggested to date.

Antiviral properties of essential oils

Baqui et al.¹⁶ evaluated and compared the in-vitro antiviral effectiveness of essential oil-containing mouthrinses and chlorhexidine mouthrinses on 2 different enveloped viruses, human immunodeficiency virus (HIV-1) and Herpes simplex virus (HSV-1) McIntyre strain which were treated with two commercially available forms of Listerine and chlorhexidine for 30 sec. The antiviral effect was estimated by inhibition of the syncytia formation or the cytopathic effect for HIV-1 on MT-2 cells and by inhibition of the plaque formation for HSV-1 on Vero cell monolayers. Both Listerine and chlorhexidine completely inhibited both HIV-189.6 and HSV-1 McIntyre strain. The antiviral effects of Listerine and chlorhexidine were similar and provided evidence that these products could be used clinically to reduce viral contamination during the delivery of dental care.

Anticalculus efficacy of essential oil mouthwashes

Charles et al.¹⁷ undertook a controlled clinical study to determine the efficacy of an essential oil antiseptic mouthrinse containing zinc chloride (Tartar Control Listerine) in inhibiting the development of supragingival dental calculus. This was a multi-center trial, which consisted of two phases. Phase 1 consisted of an eight-week pretrial period designed to identify a population with a suitable rate of calculus formation.

After providing informed consent at the start of phase 1, healthy men and women aged 18 to 75 years, each with a minimum of 16 natural teeth (including the six mandibular anterior teeth) received an oral soft- and hard-tissue examination and a thorough dental prophylaxis to remove dental plaque,

stain and calculus. Subjects began brushing twice daily for 60 seconds with a regular (non-tartar-control) toothpaste. After eight weeks, subjects received an oral examination and their calculus levels were scored using the Volpe-Manhold Index, or VMI. Subjects with a VMI score >7.0 and <30 were qualified to participate in phase 2. Qualified subjects were stratified by calculus scores and randomly assigned to a group using one of three treatment regimens:

- A tartar-control dentifrice with an antiseptic rinse (the positive control group);
- A regular dentifrice with an antiseptic rinse (the negative control group);
- A tartar-control mouthrinse (Tartar Control Listerine) with a regular dentifrice (the experimental group).

At the start of phase 2, qualified subjects received a baseline oral soft- and hard-tissue examination and a thorough dental prophylaxis to remove all calculus. Subjects began a 16-week program of brushing twice daily for 60 seconds with their assigned dentifrice, then rinsing for 30 seconds with 20 milliliters of their assigned mouthrinse. All clinical test products dispensed were coded and identical in appearance. Timers were provided to help the subjects comply with the brushing and rinsing time instructions. All clinical examinations were repeated after 16 weeks. The researchers assessed subjects' calculus levels using the Volpe-Manhold Index, or VMI, after 16 weeks.

Using analysis of covariance, the authors found that both the experimental group (which used a tartar-control rinse containing zinc chloride) and the positive control group (which used a tartar-control dentifrice containing pyrophosphate)

demonstrated statistically significantly lower VMI scores ($P = 0.001$) than the negative control group (which used a regular dentifrice and an antiseptic rinse). Both anticalculus agents provided a clinically relevant 21 percent reduction in calculus formation. The authors concluded that tartar-control mouthrinse (Tartar Control Listerine) containing zinc chloride was shown to provide demonstrable anticalculus benefit and to be a viable vehicle for delivery of a calculus-control agent.

Essential oils for the treatment of Xerostomia

Fischman et al.⁸ undertook an observer blind crossover trial to assess the irritation potential of an essential oil-containing mouthrinse (Listerine Antiseptic) in a population with objectively documented xerostomia (hyposalivation) using an exaggerated-exposure clinical model. Following a baseline oral soft tissue examination, 19 qualifying female subjects with a mean age of 61 years and a mean unstimulated baseline salivary flow of 0.06 ml/min were randomly assigned either the essential oil mouthrinse or a negative control rinse. They rinsed under supervision with 20 ml of their assigned rinse for 30 seconds and 5 minutes later a second salivary flow rate was determined. They then rinsed unsupervised with 20 ml for 30 seconds three times daily for the next 14 days, and received soft tissue examinations on days 7 and 14. After a 1-week interim period, subjects switched to the alternate rinse and the examination and rinsing regimens were repeated during the subsequent 2 weeks. The oral irritation potential of the essential oil mouthrinse was found to be minimal. Oral mucosal abnormalities attributable to the test rinses were seen in only 2 subjects, both at the 7-day examination. These subjects were both using the essential oil mouthrinse. The abnormalities consisted of an

asymptomatic "whitish slough" which was readily wiped off leaving a normal appearing, non-erythematous mucosa. In both subjects, the oral mucosa appeared normal at the 14-day examination. This study in extremely xerostomic patients provides evidence that essential oil mouthrinses can be safely recommended to such patients in view of its minimal potential for oral mucosal irritation.

Additional properties of EO mouthwashes

Fluoride containing essential oil mouthwashes have been shown to significantly increase the micro-hardness of demineralized bovine enamel in in-vitro studies by Yu et al.¹⁹. This provides additional evidence of the viability of fluoride-containing essential oil mouthwashes that could be used for caries prevention²⁰. Other lesser known properties of essential oils include the ability of essential oil mouthwashes to induce platelet aggregation²¹ by oral bacteria in-vitro and its proven antioxidant activities²² which could be useful in the treatment of some forms of periodontal diseases²².

Conclusion

This series of articles on essential oils has highlighted the remarkable variety of properties and uses of these mouthrinses. The versatility of these products will continue to grow as more evidence of their effectiveness in a wide range of clinical situations is published. Essential oil mouthwashes provide patients with a multitude of benefits in one bottle and it is this singular feature that would attract growing numbers of oral health professionals to consider the use of this product to help achieve optimal care and oral health for their patients.

摘引

在当前的这一系列文章中已经发表了许多证据支持在口腔健康的重要领域使用香精油 (EO) 漱口水, 这些领域包括: 菌斑和牙龈炎控制、牙齿间的卫生、口臭、术前清洗以进行感染控制、植入维护和龋患防止。

本文的目标在于提交有关香精油在口腔健康中的作用的系列, 重点在于对其较少为人所知的用途和性能进行审核。

首次发表于 *S Afr Dent J* 2004; 59: 381-4.

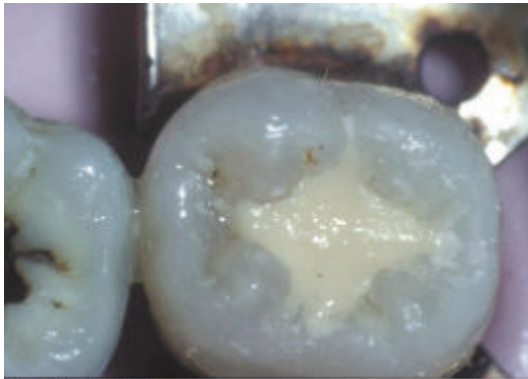
Resumen

En la presente serie de artículos se ha publicado suficiente evidencia que respalda el uso de enjuagues bucales con aceites esenciales (AE) en áreas cruciales de la salud oral, incluyendo el control de placa y gingivitis, la higiene interdental, el mal olor oral, el enjuague preprocedural para control de infecciones, el mantenimiento de implantes y la prevención de caries. El propósito de este documento en la presente serie sobre aceites esenciales en la salud oral, se centra en la revisión de algunos de sus usos y propiedades menos conocidos. Publicado primero en *S Afr Dent J* 2004; 59: 381-4.

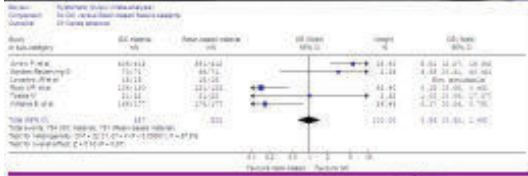
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