Short-term effects of scaling and root planing with or without adjunctive use of an essential-oil-based mouthwash in the treatment of periodontal inflammation in smokers

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Abstract: Objective: The aim of the present short-term follow-up study was to assess the effects of scaling and root planing (SRP) with or without adjunctive use of an essential-oil-based mouthwash in the treatment of periodontal inflammation in smokers. Methods: In total, 120 individuals were divided into 2 groups. In Group-1, 60 smokers with periodontal inflammation received SRP alone; and in Group-2, 60 smokers with periodontal inflammation received adjunct essential-oil mouthwash therapy. Periodontal parameters (plaque index [PI], bleeding-on-probing [BOP], and probing pocket depth [PD] ≥ 4 mm) were assessed at baseline and after 90 days of treatment. Results: There was no significant difference in periodontal parameters (PI, BOP, and PD ≥ 4 mm) among participants in Group-1 and -2. Participants in both groups showed significant reductions in PI (P < 0.01), BOP (P < 0.01), and PD ≥ 4 mm (P < 0.01) at follow-up compared to baseline. At 90 days of follow-up, PI (P < 0.05), BOP (P < 0.05), and PD ≥ 4 mm (P < 0.05) were significantly higher in Group-1 compared to Group-2. Conclusions: SRP with adjunct essential-oil mouthwash therapy is more effective in the treatment of periodontal inflammation in smokers as compared to when SRP is performed alone.

Keywords: essential oil, oral rinse, periodontal, scaling and root planing, smoking

Introduction

Smoking is associated with an increased expression of receptor of advanced glycation end products (RAGE) in gingival tissues [1]. In addition, it has been reported that nornicotine upregulates the expression of RAGE in the gingiva of smokers that sparks a proinflammatory effect by stimulating the secretion of cytokines and reactive oxygen species which directly cause destruction of the periodontal apparatus [2]. Smoking is also associated with catecholamines release resulting in vasoconstriction and decreased tissue perfusion [3]. These mechanisms have been associated with an impaired healing after periodontal treatment in smoking patients [4, 5].

One of the main objectives of scaling and root planing (SRP) is the removal of dental plaque and calculus deposits, which harbor periodontopathogenic microorganisms such as Aggregatibacter actinomycetemcomitans, Prevotella intermedia, and Porphyromonas gingivalis (P. gingivalis) [6, 7]. It has been reported that sub-
EO-based oral rinse, SRP, and chronic periodontitis

Gingival SRP may result in resolution of inflammation to some extent [1]; however, with deep probing depths, a mucoperiosteal flap surgery may be necessary to achieve a greater reduction in probing pocket depth (PPD) and gain in clinical attachment level [2, 3]. Risk factors for periodontal inflammatory conditions include smoking, stress, and immunodeficiency [4–7]. Although chlorhexidine is a well-known antiseptic for antiplaque action and has been used as an adjunct in conventional SRP for the treatment of periodontal inflammatory conditions; its side-effects including extensive tooth staining, taste alteration, and calculus deposition limit patient compliance for its long-term use [7]. However, essential-oil mouthwashes have been shown to be useful in reducing periodontopathogenic microbes and in controlling plaque and gingivitis [8]. In a randomized placebo-controlled study, Cavalca Cortelli et al. [9] investigated the clinical and microbiological long-term effects of an essential-oil-containing mouthwash as the active agent utilized in the treatment of periodontal inflammation. The results showed significantly more reductions of gingival index, PI, and PD in patients treated with SRP with adjunct essential-oil-based mouthwash used as compared to controls [9]. Moreover, the essential-oils group revealed significant reduction on occurrence of P. gingivalis in saliva comparing baseline values [9]. However, to the best of our knowledge from indexed literature, the role of essential-oil-based mouthwash as an adjunct to SRP has not been investigated in smokers. In the present clinical study, it was hypothesized that EO-based oral rinse when used as an adjunct to SRP is more effective in the treatment of CP in smokers as compared to when SRP is performed alone. The aim of the present short-term follow-up study was to assess the effects of SRP with or without adjunctive use of an essential-oil-based mouthwash in the treatment of periodontal inflammation in smokers.

Materials and Methods

Study participants

The study participants were recruited from an oral healthcare center situated in Riyadh, Saudi Arabia. Baseline and follow-up periodontal examinations were performed at the same oral healthcare center.

Eligibility criteria

The following inclusion criteria were entailed: (a) patients with periodontal inflammation (that is, patients with at least 30% site with bleeding on probing (BOP)) at least 30% sites with a PD of at least 4 mm. Smokers were defined as individual who reported to have been smoking at least one cigarette daily since at least 1 year [10]. Habitual alcohol consumers, patients who were currently using or had a history of antibiotic and/or steroid intake; patients having undergone periodontal therapy within the past 6 months, pregnancy, and/or lactation; and patients with self-reported systemic diseases such as poorly controlled diabetes mellitus, renal disorders, cardiovascular diseases, and acquired immune deficiency syndrome were not sought.

Study grouping

Treatment wise, participants were randomly divided into 2 groups. Randomization was done by picking a paper from an opaque bag marked either “Group-1” or “Group-2.” In Group-1, SRP was performed as the sole therapeutic strategy for the treatment of periodontal disease, whereas, in Group-2, SRP was performed and participants were instructed to twice daily rinse with 10 mL of an essential oil based mouthwash (Listerine, Johnson & Johnson Middle East FZ-LLC) for 6 weeks. Patients in Group-2 were also instructed to rinse with the mouthwash for 60 seconds. In all patients (n = 120), SRP was performed by a single trained and calibrated operator (MA). The overall k value for the intraexaminer reliability was 0.88.

Periodontal parameters

Among patients in Group-1 and -2, periodontal parameters (plaque index [PI] [10], bleeding on probing [BOP] [11], and probing pocket depth [PPD] ≥ 4 mm) [12] were assessed at baseline and 90 days after the respective treatment.

Statistical analysis

Statistical analysis was performed using a software program (SPSS Version 18, Chicago, IL., USA). Group comparisons were assessed using one-way analysis of variance. P-values less than 0.05 were considered statistically significant.

Ethics

The study was approved by the Research Ethics Review Committee of the College of Dentistry, King Saud University, Riyadh, Saudi Arabia (NF2285). A consent form was presented to all study participants. It was mandatory for all study participants to have read and signed the consent form before being included in the present investigation.
Results

General characteristics

In total, 120 patients with CP patients were included with 60 participants in each group. Mean ages of the participants in Group-1 and -2 were 32.5 ± 3.4 years and 33.8 ± 1.8 years, respectively. In each group, there were 30 males and 30 females. The mean duration of smoking among patients in Group-1 and -2 was 10.6 ± 3.5 years and 10.5 ± 2.8 years, correspondingly. Individuals in Group-1 and -2 were smoking 9.2 ± 1.5 and 10.1 ± 0.6 cigarettes daily. These results are shown in Table I.

Periodontal parameters at baseline and follow-up among patient in Group-1 and -2

At baseline, there was no significant difference in periodontal parameters (PI, BOP, and PD ≥ 4 mm) among participants in Group-1 and -2 (Table II). Participants in both groups showed significant reductions in PI (P < 0.01), BOP (P < 0.01), and PD ≥ 4 mm (P < 0.01) at follow-up compared to baseline. At 90 days of follow-up, PI (P < 0.05), BOP (P < 0.05), and PD ≥ 4 mm (P < 0.05) were significantly higher in Group-1 compared to Group-2. These results are shown in Table II.

Discussion

The present study was based on the hypothesis that EO-based mouthwash when used as an adjunct to SRP is more effective in the treatment of periodontal inflammation as compared to when SRP is performed alone in smokers. The results showed that both treatments (SRP and SRP + essential-oil mouthwash) significantly reduced periodontal inflammation at the time of follow-up compared to their respective baseline values. However, an interesting finding was that SRP + essential-oil mouthwash use reduced periodontal inflammation to a much greater extent as compared to when SRP was used alone to treat periodontal disease in smokers. It is pertinent to mention that essential-oil-based antiseptics are a mixture of the phenol related essential oils, including thymol (0.060%), eucalyptol (0.091%), menthol (0.042%), and methyl-salicylate (0.064%) in a 26.9% hydroalcoholic vehicle [13]. Essential-oil-based mouthwashes have been reported to denature bacterial membrane protein and inhibiting bacterial enzyme action [13]. Moreover, essential-oil-based mouthwashes present anti-inflammatory and prostaglandin synthetase inhibitor activity, which can occur at concentrations lower than that needed for antibacterial activity [13]. Although the present results showed SRP + essential-oil-based mouthwash to be more effective in reducing periodontal disease, it is important to note that these oral rinses have not been proven to enhance the healing of gingival tissues after periodontal surgery. To our knowledge, there are no studies that have directly assessed the effectiveness of essential-oil-based mouthwashes as adjuncts in periodontal flap surgical interventions. Hence, additional studies are needed in this context.

There are a number of limitations of the present study. It is well known that periodontal inflammatory conditions are worse in immunocompromised individuals and individuals chewing smokeless tobacco products [10, 12, 14–21] It is therefore hypothesized that the outcomes of SRP (regardless of using essential-oil-based mouthwash

Table I | General characteristics of the study population

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group-1 (SRP alone)</th>
<th>Group-2 (SRP + EO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants (n)</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Age in years (mean ± SD)</td>
<td>32.5 ± 3.4</td>
<td>33.8 ± 1.8</td>
</tr>
<tr>
<td>Gender (male:female)</td>
<td>30:30</td>
<td>29:31</td>
</tr>
<tr>
<td>Duration of smoking habit (in years)</td>
<td>10.6 ± 3.5</td>
<td>10.5 ± 2.8</td>
</tr>
<tr>
<td>Number of cigarettes smoked daily (n)</td>
<td>9.2 ± 1.5</td>
<td>10.1 ± 0.6</td>
</tr>
</tbody>
</table>

Table II | Distribution of cases antiepileptic drugs (AEDs) using and seizures during pregnancy

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Baseline</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group-1</td>
<td>Group-2</td>
</tr>
<tr>
<td></td>
<td>Group-1</td>
<td>Group-2</td>
</tr>
<tr>
<td>Plaque index</td>
<td>52.2 ± 8.2a</td>
<td>57.4 ± 3.6b</td>
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<td></td>
<td>(P &lt; 0.01)</td>
<td>(P &lt; 0.01)</td>
</tr>
<tr>
<td>Bleeding on probing</td>
<td>60.2 ± 8.1a</td>
<td>66.2 ± 2.4b</td>
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<tr>
<td></td>
<td>(P &lt; 0.01)</td>
<td>(P &lt; 0.01)</td>
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<tr>
<td>Pocket depth ≥4 mm</td>
<td>37.5 ± 5.4a</td>
<td>33.4 ± 3.1b</td>
</tr>
<tr>
<td></td>
<td>(P &lt; 0.01)</td>
<td>(P &lt; 0.01)</td>
</tr>
</tbody>
</table>

*aCompared to Group-1 at follow-up (P < 0.01)
*bCompared to Group-2 at follow-up (P < 0.01)
*cCompared to Group-2 at follow-up (P < 0.05)
as adjunct) are compromised in individuals using tobacco products and immunocompromised patients, such as those with persistent hyperglycemia. Further prospective studies are warranted to assess the effect of EO-based oral rinses when used as adjunct to SRP in the treatment of periodontal inflammation among immunocompromised patients and tobacco product users. In addition, it is also worth mentioning that the results presented in the present study were based on a short-term follow-up (one month). It is hypothesized that had these patients been followed-up for longer durations (at least 6 months), the results regarding comparisons between Group-1 and -2 would have been similar. However, additional long-term follow-up studies are required in this regard.

Within the limits of the present study, it is concluded that EO-based oral rinses when used as adjuncts to conventional SRP are useful in the treatment of periodontal inflammation in smokers as compared to when SRP is used alone. However, further studies are required to assess the long-term effect of essential-oil-based mouthwashes in the treatment of periodontal inflammatory conditions.

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**Authors’ contribution:** MA designed the study and wrote the manuscript. FA, SAH and TSA performed the clinical examinations and administered questionnaires to the participants. AA performed the statistical analysis. OK wrote the manuscript and revised it prior to submission. All authors had full access to all data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

**Conflict of interest:** The authors declared no conflict of interest.

**References**