Clinical efficacy of phase I therapy combined with a triclosan/copolymer dentifrice on generalized chronic periodontitis

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Abstract

Background/purpose: Periodontal disease is a plaque-induced infection; therefore successful periodontal therapy is dependent on anti-infective procedures. Currently, many clinicians use a combination of adjunctive chemotherapeutic agents in non-surgical periodontal therapy. The purpose of this study was to evaluate the clinical efficacy of using triclosan/copolymer toothpaste on improving the periodontal health during phase I periodontal treatment.

Materials and methods: This study was performed at the Department of Periodontics, Chung Shan Medical University Hospital. Forty participants with generalized chronic periodontitis who provided informed consent were included in the study. At the baseline examination, the pocket depth (PD), clinical attachment loss (CAL), bleeding on probing (BOP), and full-mouth plaque score (FMPS) were recorded before phase I therapy began. The subjects were assigned to 2 groups. The experimental group used a triclosan/copolymer-containing toothpaste, whereas the control group used only a standard fluoride toothpaste without antibacterial ingredients. All participants received full-mouth ultrasonic scaling and root planing with intensive oral hygiene instruction. After 6 weeks, the examinations were repeated and results recorded.

Results: There were no statistical significant differences (P > 0.05) in the baseline data collected between the experimental and control groups. After phase I therapy, the PD, CAL, BOP, and FMPS all improved in both the control and experimental groups (P < 0.05). The use of triclosan/copolymer toothpaste was found to have significantly reduced the BOP and FMPS compared to the control group (P < 0.05). In the group with PDs >6 mm, the PD and CAL also showed significant improvements versus the control group (P < 0.05).

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Conclusion: An oral hygiene regimen including triclosan/copolymer-containing toothpaste can sustain the short-term effect of phase I therapy for patients with generalized chronic periodontitis. Copyright © 2010, Association for Dental Sciences of the Republic of China. Published by Elsevier Taiwan LLC. All rights reserved.

Introduction

Periodontitis is a common inflammatory disease affecting the tissues that comprise the dental support structures: the gingiva, cementum, periodontal ligament, and alveolar bone. An oral microbial biofilm is the major factor in the pathogenesis of the disease.\(^1\) When a host is overwhelmed, the pathogenic supragingival bacteria migrate subgingivally and form a subgingival biofilm that can be highly detrimental to the surrounding periodontal structures.\(^2\)

Successful periodontal therapy is dependent on anti-infective procedures aimed at eliminating the pathogenic organisms found in dental plaque associated with the tooth surface.\(^3\)–\(^5\) Anti-infective therapy includes both mechanical and chemotherapeutic approaches. Mechanical therapy consists of both supragingival and subgingival scalings as well as root planing via the meticulous use of hand or power-driven scalers to remove plaque, endotoxin, calculus, and other local plaque-retentive factors.\(^6\) Chemotherapeutic approaches, including topical application of antiseptics,\(^7\)–\(^9\) such as chlorhexidine, triclosan, hydrogen peroxide, baking soda, and povidone iodine, can be applied professionally as an adjunct to mechanical debridement.\(^8\),\(^9\)

Chemical agents were shown to support periodontal therapy.\(^10\),\(^11\) Among different chemical products, the use of toothpaste can easily be handled and acquired. The bisphenolic, non-cationic, lipid-soluble compound, triclosan (2,4,4'-trichloro-2 hydroxydiphenylether), has potent antibacterial as well as anti-inflammatory properties. Previous studies demonstrated that Colgate Total (Colgate-Palmolive, Piscataway, NJ, USA), containing 0.3% triclosan, 2.0% copolymer, and fluoride (1100\(\times\)1450 ppm), maintains concentrations of triclosan in the plaque that exceeds the minimum inhibitory concentration values of many plaque bacteria for up to 12 h.\(^12\) In addition, the daily use of a triclosan/copolymer-containing dentifrice was found to reduce signs of gingivitis, and may also retard the progression of chronic periodontitis in susceptible subjects.\(^13\),\(^14\)

The aim of this study was to evaluate the clinical efficacy of the daily use of a triclosan/copolymer-containing toothpaste and determine if it can enhance clinical outcomes during phase I therapy for patients with generalized chronic periodontitis.

Materials and methods

Patient selection

This study was performed in the Department of Periodontics, Chung Shan Medical University Hospital. In total, 40 adult patients (21 males and 19 females) with generalized chronic periodontitis\(^15\) were recruited after informed consent was obtained. The inclusion and exclusion criteria are described here.

Inclusion criteria included no use of any triclosan-containing products over the past month, such as a mouth rinse, toothpaste, or chewing gum; more than 20 teeth remaining in the mouth; and more than 30% of the teeth with >5 mm of clinical attachment loss (CAL); and this was the first time to receive comprehensive periodontal treatment.

Exclusion criteria included having taken an antibiotic drug in the past 3 months; needing prophylaxis during the periodontal treatment; use of any other antiseptic products or chlorhexidine-containing mouth rinse; being pregnant; and suffering from another chronic medical disease/condition.

Experimental procedures

The experimental procedure is illustrated in Fig. 1. The participants received information about periodontal treatment and instructions for performing efficient oral hygiene. A baseline examination was performed recording pocket depth (PD), CAL, bleeding on probing (BOP)\(^16\), and a full-mouth plaque score (FMPS).\(^17\) A periodontal probe (Goldman-Fox/Williams Probe, Hu-Friedys, Chicago, IL, USA) was used to measure the PD and CAL to the nearest millimeter at the mesiobuccal, mid-buccal, distobuccal, mesiolingual, mid-lingual, and distolingual sides of each tooth. All assessments were performed by a single experienced periodontist.

Following the initial examination, all 40 subjects were assigned to 2 groups. Thirty subjects in the experimental group were given a dentifrice containing 0.3% triclosan, 2% copolymer, and 0.243% sodium fluoride (Colgate Total), while the other 10 participants in the control group were supplied with a fluoride-containing dentifrice (Hawley & Hazel Chemical Company, Taipei, Taiwan). Participants...
were instructed to brush their teeth carefully twice a day, in the morning and before sleep, for 3 min each time with the toothpaste provided. Subjects were not allowed to use any other dentifrice or mouth rinse, and to enhance compliance, an oversupply of products was provided.

Patients received phase I treatment, including thorough supra- and sub-gingival dental plaque and calculus debridement. The treatment was performed and completed by an experienced periodontist, and then participants were evaluated, and baseline measurements were recorded. All measurements were repeated every 2 weeks with a final evaluation at 6 weeks post-treatment.

A further analysis was performed for the PD and CAL according to the initial PDs and sites were divided into 3 categories: (i) shallow pockets with PDs of <4 mm, (ii) moderate pockets with 4 mm ≤ PD ≤ 6 mm, and (iii) deep pockets with PDs of >6 mm.

Statistical analysis

The intra-examiner variability test demonstrated that the reproducibility of the measurements of PD and CAL within ±1 mm was 96%. Differences over time within groups for the clinical results were analyzed by the non-parametric Wilcoxon’s signed-ranks test. Comparisons between the control and test groups were performed with the Wilcoxon rank-sum test. The level of significance was set to P < 0.05. All statistical analyses were carried out with the aid of statistical software (SPSS vers. 12.0, Chicago, IL, USA).

Results

As shown in Table 1, there were no remarkable differences in demographic parameters between the experimental and control groups (P > 0.05). No remarkable differences in the periodontal status were noted between the experimental and control groups at the baseline (P > 0.05). However, there were no statistical significances between the 2 groups in the PD and CAL post-treatment measurements (P > 0.05).

The PD and CAL measurements were further analyzed for the 3 different categories of initial PD. As shown in Fig. 2, the use of triclosan/copolymer toothpaste was found to have significantly reduced the PD in the deep-pocket subgroup (PD > 6 mm) compared to the control group (P < 0.05). However, there were no significant differences in pocket reduction among the shallow-pocket subgroup (PD < 4 mm), moderate-pocket subgroup (4 mm ≤ PD ≤ 6 mm), or control group (P > 0.05).

A similar pattern was found for CAL measurements. Only in the deep pocket subgroup, the CAL showed a significant reduction compared with the control group (P < 0.05) (Fig. 3).

Discussion

Chronic periodontitis is the most common oral disease found in adults and the leading cause of loss of dentition. It is associated with the accumulation of plaque and calculus and generally has a slow to moderate rate of disease progression, but periods of more-rapid destruction may be observed. The disease can also be described by its severity as slight, moderate, or severe based on the amount of CAL. Phase I therapy without surgery might not be effective for deep pockets. Therefore, chemotherapeutic agents, such as triclosan/copolymer, with its antimicrobial and anti-inflammatory effects may be used as an adjunctive agent to control moderate or severe chronic periodontitis.

The focus of any attempt to prevent and control periodontal disease is the maintenance of an effective level of plaque control. In this study, subjects using the triclosan/copolymer dentifrice showed a significantly reduced level of dental plaque compared to those of the control group. Similar results were found in previous long-term studies demonstrating the efficacy of the use of triclosan/copolymer dentifrices in inhibiting plaque formation. It was shown that the range of percentage plaque reductions for a triclosan/copolymer toothpaste versus a fluoride control was 0–59%. Those studies suggested that the use of

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**Table 2 Clinical measurements in the experimental and control groups at the baseline and the 6-wk reevaluation.**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Reevaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pocket depth (mm)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triclosan/copolymer</td>
<td>3.68 ± 0.83</td>
<td>2.97 ± 0.55*</td>
</tr>
<tr>
<td>Control</td>
<td>3.66 ± 0.58</td>
<td>2.92 ± 0.56*</td>
</tr>
<tr>
<td><strong>Clinical attachment loss (mm)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triclosan/copolymer</td>
<td>4.93 ± 1.07</td>
<td>3.63 ± 1.10*</td>
</tr>
<tr>
<td>Control</td>
<td>4.94 ± 0.89</td>
<td>3.81 ± 1.03*</td>
</tr>
<tr>
<td><strong>Bleeding on probing (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triclosan/copolymer</td>
<td>68.1 ± 25.06</td>
<td>31.37 ± 19.43*</td>
</tr>
<tr>
<td>Control</td>
<td>58.2 ± 24.45</td>
<td>41 ± 22.4*</td>
</tr>
<tr>
<td><strong>Full-mouth plaque score (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triclosan/copolymer</td>
<td>70.4 ± 18.79</td>
<td>38.08 ± 18.69*</td>
</tr>
<tr>
<td>Control</td>
<td>61.7 ± 11.40</td>
<td>48.1 ± 13.54*</td>
</tr>
</tbody>
</table>

* Statistically significantly differed from the baseline (P < 0.05).

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**Table 1 Patient demographics including age, gender, the initial pocket depth (PD), clinical attachment loss (CAL), bleeding on probing (BOP), and full-mouth plaque score (FMPS).**

<table>
<thead>
<tr>
<th></th>
<th>Triclosan/copolymer</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Age (years)</td>
<td>53.23 ± 11.9</td>
<td>60 ± 15.75</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>50%/50%</td>
<td>60%/40%</td>
</tr>
<tr>
<td>Initial PD (mm)</td>
<td>3.68 ± 0.83</td>
<td>3.66 ± 0.58</td>
</tr>
<tr>
<td>Initial CAL (mm)</td>
<td>4.93 ± 1.07</td>
<td>4.94 ± 0.89</td>
</tr>
<tr>
<td>Initial BOP (%)</td>
<td>68.1 ± 25.06</td>
<td>58.2 ± 24.45</td>
</tr>
<tr>
<td>Initial FMPS (%)</td>
<td>70.4 ± 18.79</td>
<td>61.7 ± 11.40</td>
</tr>
</tbody>
</table>

There were no significant differences in demographics between the experimental and control groups (P > 0.05).
a triclosan/copolymer dentifrice in conjunction with self-performed oral hygiene procedures may have a profound effect on dental plaque formation in the general population as well as in populations with chronic periodontitis.

BOP is easily detected clinically and is the best clinical indicator of gingival inflammation. In 1 meta-analysis, it was demonstrated that the gingival bleeding condition of the population using the triclosan/copolymer-containing dentifrice had decreased 49% compared to those using a standard fluoride toothpaste. Another short-term double-blinded randomized clinical trial reported that volunteers with gingivitis had a 30% decrease in the BOP in the triclosan/copolymer-containing dentifrice group. Our results are in agreement with those previous studies. Triclosan is well documented to be a significant inhibitor of inflammatory mediators, such as tumor necrosis factor-α, interleukin-1β, and prostaglandin E2. It is likely that both antibacterial and anti-inflammatory properties of triclosan may play a similar role in the sustained gingival health observed in the present trial.

Periodontal parameters, i.e., the PD and CAL, significantly improved following phase I therapy in both the experimental and control groups in the present study. There were no significant differences in the reduction in PD or the gain in CAL between the 2 groups. However, in a long-term study following non-surgical therapy, the use of a triclosan product exhibited a significantly greater reduction in the PD and improvement in CAL compared to those using the fluoride-containing dentifrice. The reason for this contradictory result is not clear. It may have been a result of (i) different specific subjects, (ii) a shorter follow-up period, or (iii) evaluation of the oral hygiene status and use of toothpaste every 2 weeks.

Pockets of varying depth may respond differently to phase I therapy. Therefore, sites are usually analyzed in 3 categories of initial probing depths: 1 to 2 weeks, 4 to 6 weeks, and >6 mm.

Table 3  Clinical efficacy at the 6-week reevaluation.

<table>
<thead>
<tr>
<th></th>
<th>Triclosan/copolymer</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in the pocket depth (mm)</td>
<td>0.70 ± 0.52</td>
<td>0.74 ± 0.36</td>
</tr>
<tr>
<td>Gain in the clinical attachment loss (mm)</td>
<td>0.56 ± 0.6</td>
<td>0.63 ± 0.46</td>
</tr>
<tr>
<td>Reduction in bleeding on probing (%)</td>
<td>36.73 ± 22.73 *</td>
<td>17.2 ± 8.9</td>
</tr>
<tr>
<td>Reduction in the full-mouth plaque score (%)</td>
<td>32.32 ± 22.85 *</td>
<td>13.6 ± 13.33*</td>
</tr>
</tbody>
</table>

* Statistically significantly different between the experimental and control groups (P < 0.05) [Participants (n = 40, 21 males and 19 females)/OHI, baseline measurements (PD, CAL, BOP, and FMPS)/Experimental group (n = 30, 15 males and 15 females)/Control group (n = 10, 6 males and 4 females)/1-2 weeks/4-6 weeks/8 weeks/Every 2 weeks, participants were reevaluated].

Figure 2  Data demonstrating the reduction in pocket depths (PDs) at the 6-week reevaluation. In the analysis of the initial PD < 4 mm and 4 mm ≤ PD ≤ 6 mm, there was no significant main effect of the dentifrice. However, the use of triclosan/copolymer toothpaste was found to have significantly reduced the PD in subjects the PDs of which were >6 mm, compared to the control group. * Indicates a statistically significant difference from the baseline (P < 0.05). # Indicates a statistically significant difference between the control group and the test group (P < 0.05).

Figure 3  Data demonstrating the reduction in clinical attachment loss at the reevaluation. In the analysis of the initial pocket depth (PD) < 4 mm and 4 mm ≤ PD ≤ 6 mm, there was no significant main effect of the dentifrice. However, the use of triclosan/copolymer toothpaste was found to have significantly reduced the PD in subjects, the pocket depths of which were >6 mm, compared to the control group. * Indicates a statistically significant difference from the baseline (P < 0.05). # Indicates a statistically significant difference between the control group and the test group (P < 0.05).
between the dentifrice and subjects with PDs of >6 mm. The use of triclosan/copolymer toothpaste was found to significantly reduce PDs in the deep-pocket subgroup (PD > 6 mm) compared to the control group. It is difficult to thoroughly debride deep-pocket sites in phase 1 therapy for additional improvements without the use of chemotherapeutic agents.

In conclusion, the findings of the present study indicate that an oral hygiene regimen including the use of a triclosan/copolymer dentifrice may sustain the adjunct effects of phase I therapy in subjects with chronic periodontitis.

References