Trial of Experimental Toothpastes Regarding Quality for Cleaning Dentures

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The aim of this study was to evaluate the efficacy of experimental toothpastes for removing denture biofilm by means of a randomized crossover trial. Thirty volunteers brushed their dentures using a brush and four pastes: (1) Corega refreshing mint (control), (2) 0.2% chloramine T, (3) 1.0% chloramine T, and (4) 0.01% fluorosurfactant. Each paste was used for 7 days, and participants were randomized to use them according to one of four sequences. Biofilm was disclosed (neutral red) after each period, photographed, and quantified by means of a software program. All experimental toothpastes were similar to the control in terms of posttreatment biofilm coverage. *Int J Prosthodont 2012;25:157–159.*

Specific pastes for denture hygiene minimize babrasion of the acrylic resin but may cost more than conventional toothpastes.¹ Ideally, these pastes should be inexpensive and present adequate antimicrobial action. Chloramine T reduces denture biofilm microorganisms,² and fluorosurfactants are able to provide improved emulsifying and detergency capabilities.³ Thus, this study aimed to evaluate the effectiveness of experimental toothpastes for denture hygiene regarding biofilm removal by means of a randomized, crossover trial.

Materials and Methods

Participants consisted of adult edentulous patients of the Ribeirão Preto Dental School, University of São Paulo, Ribeirão Preto, Brazil, who had been wearing maxillary complete dentures for more than 3 years. Dentures were to be made of acrylic resin and present no cracks or relining.

If one considers a standard deviation of differences of \pm 5.3% and a minimally important difference of 3.0%,⁴ a sample of 30 participants was necessary to detect such differences ($\alpha = .05$, $\beta = .15$). However, a number 20% higher than the estimated size was included (n = 36) to avoid low power from withdrawals and losses.

Patients were requested to brush their dentures using a brush (Denture, Condor) and one of the pastes three times a day and to immerse them in water overnight. Pastes were dispensed in white tubes without identification. A proprietary, denture-specific toothpaste (Corega refreshing mint, GlaxoSmithKline) was tested as the control (D1). Experimental toothpastes included 0.2% chloramine T (Trihydral, Perland Pharmacos) (D2), 1.0% chloramine T (D3), and 0.01% fluorosurfactant (Zonyl R, DuPont do Brasil) (D4). All volunteers used the four pastes for a period of 7 days each.

Before and after use of each paste, the internal surfaces of the dentures were disclosed (1% neutral red solution) and photographed. Photographs were transferred to a computer, and the total surface area and areas corresponding to the biofilm were

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Fig 1 Flowchart of participant involvement throughout the entire study period.

| Covered by Biofilm | | | | | | | |
|---|----------|-------|----------|-------|--------------------|--|--|
| Source of variation | SS | df | MS | F | Р | | |
| Intraindividu | al* | | · | · | | | |
| Treatment | 63.02 | 2.45 | 25.71 | 0.86 | .449 | | |
| $\overset{\rm Treatment}{\times \rm initial}$ | 54.77 | 2.45 | 22.34 | 0.74 | .504 | | |
| Residual | 2,058.80 | 68.64 | 29.99 | | | | |
| Covariate | | | | | | | |
| Initial | 1,285.82 | 1.00 | 1,285.82 | 16.48 | <.001 ⁺ | | |

28.00

1,285.82

78.04

Generalized Linear Model for the Area

| *Greenhouse-Geisser correction. |
|---|
| [†] Significant effect, P < .05. |

1,285.82

2.185.12

Table 1

Residual



Fig 2 Biofilm coverage for each group after treatment. ° = outlier.

measured using a software program (Image Tool 3.0, UTHSCSA). Biofilm percentage was calculated using the ratio between the biofilm area and total surface area of the internal denture base multiplied by 100.

The influence of the toothpastes on the outcome was assessed by means of a generalized linear model using the Mauchly test of sphericity correction. The association between baseline and posttreatment results was assessed by means of a scatter plot and the Spearman correlation coefficient ($\alpha = .05$).

Results

Forty patients were assessed for eligibility in the present study. Four excluded participants were not wearing maxillary complete dentures, whereas others were lost because of the death of a relative (n = 1) or health problems (n = 5) (Fig 1).

The experimental toothpastes seemed to be similar to D1 (Table 1, Fig 2). At the end of each 1-week interval, all toothpastes resulted in similar biofilm coverage

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Fig 3 Scatterplot of the initial biofilm values versus values obtained after using a toothpaste containing 0.2% chloramine T (D2).

(P = .449). Posttreatment results were associated with baseline values (P < .001), although there was no interaction between the treatments and covariate (P = .504); weak to moderate correlation was found between them (Table 2).

Participants with the worst hygiene at baseline tended to end up with less favorable results after the experimental protocol (Fig 3). This tendency was confirmed by the moderate correlation between posttreatment and baseline values (Table 2).

Discussion

The results showed that the chlorine-releasing activity of D2 and D3 was not sufficient to remove biofilm deposits significantly. At comparable concentrations, sodium hypochlorite is capable of removing biofilm deposits.⁵ However, the present findings do not mean that the tested concentrations of chloramine T are inactive against oral microbiota. Panzeri et al² found a higher antimicrobial effect for a toothpaste containing 1.0% chloramine T when compared with another product similar to D4.

The use of a fluorosurfactant did not change the results. A possible reason for this finding is that the mechanical action of brushing is the main factor responsible for biofilm removal.⁴ Thus, the changes produced by a different detergent were not significant.

It seems that the improvement achieved by hygiene instructions was the same for all participants irrespective of the toothpaste used or initial denture biofilm values. Of course, the lack of interaction between toothpastes and baseline values considered only one outcome. Different results might arise if other variables are considered.

| Table 2 | Spearman Correlation Coefficients for |
|------------|---|
| Baseline ' | Values and Those Observed After Treatment |

| _ | Toothpaste | | | | | |
|-------------|------------|-------|------|-------|--|--|
| _ | D1 | D2 | D3 | D4 | | |
| Coefficient | 0.43 | 0.59 | 0.31 | 0.55 | | |
| Р | .019* | .001* | .100 | .002* | | |

*Significant value, P < .05.

Conclusion

The three experimental toothpastes presented the same effectiveness in terms of biofilm removal.

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