Efficacy of manual and powered toothbrushes (II). Effect on microbiological parameters


Abstract

Background/aim: The purpose of the present investigation was to determine the effect of self-performed supragingival plaque removal using either manual (Crest Complete) or power (Braun 3D Plaque Remover) toothbrushing on supra and subgingival plaque composition.

Methods: 47 periodontal maintenance subjects completed this single-blind 6 month longitudinal study. At baseline, samples of supra and separately subgingival plaque were taken from the mesial aspect of each tooth in each subject using sterile curettes and individually analyzed for their content of 18 bacterial taxa using checkerboard DNA-DNA hybridization. After random assignment to groups receiving either a manual (n=25) or power toothbrush (n=22), subjects received instruction in oral hygiene and used their assigned toothbrush 2× daily for 6 months. Clinical monitoring and microbiological sampling were repeated at 3 and 6 months. Significant differences in microbiological measures over time were sought using the Quade test and between brushing groups at each time point using the Mann-Whitney test.

Results: Mean total counts were significantly reduced for supra- and subgingival plaque samples in the manual group and subgingival samples in the powered brushing group. Actinomyces naeslundii and Actinomyces israeliiligerencseriae were the most numerous organisms detected at baseline and showed the greatest reductions in counts in both brushing groups. Streptococcus constellatusintermedius was significantly reduced in both groups, while Streptococcus mitis/oralis/sanguis was significantly reduced in the manual toothbrushing group. Mean counts of species were more markedly altered in subgingival plaque. Major reductions occurred in both groups for A. naeslundii, A. israeliiligerencseriae, Peptostreptococcus micros, Veillonella parvula, Prevotella intermedia/nigrescens, S. mitis/oralis/sanguis and S. constellatusintermedius. All taxa examined were reduced in prevalence (% of sites colonized) in the subgingival plaque samples for both brushing groups. The reductions in prevalence were greater for A. naeslundii, S. constellatusintermedius, V. parvula, A. israeliiligerencseriae, S. mitis/oralis/sanguis, P. micros, Streptococcus mutans and P. intermedia/nigrescens. Mean prevalence was decreased more for Porphyromonas gingivalis, Campylobacter rectus/showae, Treponema denticola and Bacteroides forsythus in supragingival plaque than subgingival plaque.

Conclusions: The major finding was the effect of supragingival plaque removal on the composition of the subgingival microbiota. Counts and prevalence of most taxa examined were markedly decreased in both toothbrushing groups. This reduction should translate to a decreased risk of periodontal disease initiation or recurrence. Further, the decreased prevalence of periodontal pathogens in supragingival plaque lowers potential reservoirs of these species.

Key words: periodontal disease; bacteria; plaque; DNA probes; powered toothbrushing; manual toothbrushing

Accepted for publication 29 September 2000
Toothbrushing is probably the most commonly performed oral hygiene practice in the world. The major purpose of this procedure is to lower the organisms in dental plaque that might be responsible for oral diseases/conditions including dental caries, periodontal diseases and halitosis. Given that so much effort is directed at controlling organisms by this means, it is surprising that few studies have examined the changes in plaque composition brought about by this procedure. The few published studies that are available have employed light microscopy to examine bacterial morphotypes (Murray et al. 1989), selective culture media (Murray et al. 1989) or DNA probes (Ho & Niederman 1997). Ho & Niederman (1997) found that the sum of 6 measured Gram negative species was decreased in subgingival plaque samples taken from 12 orthodontic patients who used a high frequency toothbrush. This reduction was not observed in 12 subjects who employed a manual brush. In a more comprehensive study, Murray et al. (1989) examined the effect of a rotary electric toothbrush and a manual toothbrush on subgingival plaque composition in 20 periodontal maintenance subjects. 2 subgingival plaque samples were taken from each patient at baseline, 6 and 12 months and analyzed for the % obligate anaerobes and colony-forming units of black-pigmented Bacteroides, Fusobacterium, Actinomyces, Streptococcus and Veillonella species. In addition, the % of spirochetes and motile rods was determined using darkfield microscopy. Obligate anaerobes, Fusobacterium and Actinomyces as well as the % of spirochetes and motile rods were significantly decreased in both brushing groups, while levels of Streptococcus species increased in both groups. However, there was no significant difference between groups for any of the test species.

The data examining the effects of toothbrushing on either supra or subgingival plaque composition are sparse considering the wide use and clinical benefits of this procedure. Thus, the purpose of the present investigation was to determine the effect of self-performed supragingival plaque removal using either manual or power toothbrushing on supra and subgingival plaque composition. The clinical changes in these subjects were described in a companion paper (Haffajee et al. 2001).

Material and Methods

Subject population, clinical monitoring and oral hygiene procedures

The inclusion and exclusion criteria for the 48 subjects who completed this study as well as clinical monitoring and instruction in home care procedures were described by Haffajee et al. (2001). In brief, the subjects were randomly assigned to use either a manual Crest Complete toothbrush, (Procter & Gamble, Cincinnati, OH) or a Braun Oral B 3D Plaque Remover (Braun GmbH, Kronberg, Germany). Subjects used the assigned brush twice daily for the 6 months of the study as well as Crest regular toothpaste (Procter & Gamble, Cincinnati, OH). Clinical and microbiological monitoring were performed at baseline, 3 and 6 months. The microbiological samples for the final visit of 1 subject were unavailable, therefore this subject’s data were omitted from the analyses in the present manuscript. Thus, a total of 25 subjects were evaluated in the manual brushing group and 22 subjects in the power brushing group. Table 1 presents baseline clinical data of subjects in the 2 groups and indicates that there were no statistically significant differences in clinical parameters between brushing groups.

Microbiological monitoring

Supra and subgingival plaque samples were obtained from up to 28 teeth in each subject and analyzed by checkerboard DNA-DNA hybridization (Socransky et al. 1994). Supragingival plaque was sampled from the mesial-buccal aspect of each tooth using sterile Gracey curettes. Each sample was placed into individual tubes containing 0.15 ml TE (10 mM Tris-HCl, 1 mM EDTA, pH 7.6). After removal of the supragingival plaque sample and any remaining supragingival plaque, subgingival plaque samples were taken from the same sites (i.e., the mesiobuccal aspect of each tooth) using sterile Gracey curettes and placed into individual tubes containing 0.15 ml TE. 0.15 ml of 0.5 M NaOH were added to each sample and the tubes were boiled for 5 min. The samples were neutralized using 0.8 ml 5 M ammonium acetate. The released DNA was placed into the extended slots of a Minislot (Immunetics, Cambridge, MA) and then concentrated onto a Boehringer Mannheim nylon membrane by vacuum and fixed to the membrane by exposure to ultraviolet light.

Enumeration of organisms using DNA probes

A specially constructed Immunetics Minislot device permitted the deposition of up to 60 plaque samples and controls

Table 1. Mean (±SEM) baseline clinical parameters for subjects in the manual and power brushing groups

<table>
<thead>
<tr>
<th></th>
<th>Manual</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>25</td>
<td>22</td>
</tr>
<tr>
<td>age (years)</td>
<td>47±2</td>
<td>49±2</td>
</tr>
<tr>
<td>no. missing teeth</td>
<td>2.88±0.47</td>
<td>2.77±0.57</td>
</tr>
<tr>
<td>% males</td>
<td>58</td>
<td>59</td>
</tr>
<tr>
<td>mean plaque index</td>
<td>1.23±0.09</td>
<td>1.51±0.13</td>
</tr>
<tr>
<td>mean gingival index</td>
<td>0.86±0.07</td>
<td>0.92±0.08</td>
</tr>
<tr>
<td>% sites with bleeding on probing</td>
<td>23±2</td>
<td>25±3</td>
</tr>
<tr>
<td>mean pocket depth (mm)</td>
<td>2.91±0.07</td>
<td>2.97±0.08</td>
</tr>
<tr>
<td>mean attachment level (mm)</td>
<td>3.00±0.18</td>
<td>3.17±0.20</td>
</tr>
</tbody>
</table>

Table 2. Microbial taxa evaluated in supra and subgingival plaque samples

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Actinobacillus actinomycetemcomitans</td>
<td>Prevotella intermedia/gingivens</td>
</tr>
<tr>
<td>Actinomyces israelii/gerencseriae</td>
<td>Selenomonas noxia</td>
</tr>
<tr>
<td>Actinomyces naeslundii</td>
<td>Streptococcus constellatus/intermedius</td>
</tr>
<tr>
<td>Bacteroides forsythus</td>
<td>Streptococcus gordonii</td>
</tr>
<tr>
<td>Campylobacter rectus/showae</td>
<td>Streptococcus mutans</td>
</tr>
<tr>
<td>Campylobacter gingivalis/lochraceal/sputigena</td>
<td>Streptococcus sobrinus</td>
</tr>
<tr>
<td>Fusobacterium nucleatum</td>
<td>Treponema denticola</td>
</tr>
<tr>
<td>Peptostreptococcus micros</td>
<td>Veillonella parvula</td>
</tr>
<tr>
<td>Porphyromonas gingivalis</td>
<td></td>
</tr>
</tbody>
</table>
in individual ‘lanes’ on a single 15×15 cm nylon membrane. The membranes with the fixed DNA were placed in a Miniblotter 45, with the ‘lanes’ of DNA at 90° to the channels of the device. 2 30×20 ‘checkerboard’ patterns were produced. Each channel was used as a hybridizing chamber for separate DNA probes. Signals were detected by fluorescence using AttoPhos and a Storm FluorImager (Molecular Dynamics, CA). 2 lanes in each run had standards at 10⁵ and 10⁶ cells of each species. The sensitivity of the assay for bacterial species was optimized to be able to detect 10⁴ cells of a given species. The 18 taxa that were evaluated are listed in Table 2 and include those thought to be periodontal pathogens such as *Bacteroides forsythus*, *Porphyromonas gingivalis*, *Treponema denticola*, and *Actinobacillus actinomycetemcomitans* as well as species thought to be host compatible or beneficial including members of the genera *Actinomyces*, *Capnocytophaga*, *Streptococcus*, and *Veillonella*. Also included in the panel of organisms were selected species associated with dental caries such as *Streptococcus mutans*. Certain related species were combined and used as a single probe (Table 2).

Digoxigenin-labelled, whole genomic DNA probes were prepared using a random primer technique (Feinberg and Vogelstein, 1983). The membranes were prehybridized at 42°C for 1 h in 50% formamide, 5×SSC, 1% casein (Sigma), 5×Denhardt’s reagent, 25 mM Na phosphate (pH 6.5) and 0.5 mg/ml yeast RNA. Each membrane was placed into the ‘Miniblotter 45’ with the membrane turned at 90° to its original orientation. The probes and hybridization buffer were placed in individual lanes of the Miniblotter and the whole apparatus placed in a sealed plastic bag. Membranes were hybridized overnight at 42°C in a hybridizing solution containing 45% formamide, 5×SSC, 1×Denhardt’s reagent, 20 mM Na phosphate (pH 6.5) and 0.2 mg/ml yeast RNA, 20 ng/ml of labelled probe, 10% dextran sulfate and 1% casein. Membranes were washed at low stringency to remove loosely bound probe and then at high stringency (68°C, 1×SSC, 0.1% SDS, 20 min, twice) in a Disk Wisk apparatus (Schleicher and Schuell). To detect hybrids, membranes were blocked and then incubated with a 1:20,000 dilution of anti-digoxigenin antibody conjugated with alkaline phosphatase using the modification described by Engler-Blum et al. (1993). After washing, the membranes were incubated in AttoPhos overnight at room temperature and signals detected using the Storm FluorImager (Molecular Dynamics, CA). 2 lanes in each run had standards at different concentrations.

---

**Fig. 1.** Bar charts of the mean total DNA probe counts (×10⁵, ±SEM) for supra and subgingival plaque samples at baseline, 3 and 6 months in subjects using either the manual (n=25) or power toothbrush (n=22). The bars indicate the means and the whiskers the SEM. The total counts were computed at each site, averaged within a subject for each time point for supra and subgingival plaque separately. Significance of differences over time was sought using the Quade test. Significance of differences between groups at each time point was tested using the Mann-Whitney test. There were no significant differences between groups at any time point.

**Fig. 2.** Plots of the mean values for total DNA probe counts for supra and subgingival plaque at baseline and 6 months in each subject in both brushing groups. The upper panels provide data for supragingival plaque while the lower panels present data for subgingival plaque. The left panels represent subjects in the manual group and the right panels subjects in the power group. The open circles represent the mean values at baseline and the black circles represent the mean values for the same subject at 6 months. The black circles in the shaded area represent a decrease from baseline values, while the black circles in the unshaded area represent an increase from baseline values.
Fig. 3. Bar charts of the mean counts ($\times 10^5$, ±SEM) of selected taxa in supragingival plaque samples at baseline, 3 and 6 months in subjects using either the manual ($n=25$) or power brush ($n=22$). The bars indicate the means and the whiskers the SEM. Counts for each taxa at each site were averaged within a subject for each time point for supragingival plaque samples. The species were ordered according to baseline values in the manual brushing group. Significance of differences over time was sought using the Quade test. Significance of differences between groups at each time point was tested using the Mann Whitney test. V. parvula was significantly higher ($p<0.05$) in the power brushing group at visits 2 and 3 than in the manual brushing group (dashed lines).

Fig. 4. Microbial profiles of the mean counts ($\times 10^5$) of 18 microbial taxa in supragingival plaque samples taken at baseline, 3 and 6 months from subjects in the 2 brushing groups. The profiles represent the mean counts derived by averaging the counts of each species within a subject and then across subjects in the same group for each time point. The species were ordered according to baseline values in the manual brushing group. Testing of significance of differences was performed as described in Fig. 3.

Signals were converted to absolute counts by comparison with standards on the membrane. A total of 7098 plaque samples were evaluated, 1183 supra and 1183 subgingival samples at each of 3 time points. This translated to an average of 25.17 supra and 25.17 subgingival samples per subject at each visit.

Data analysis
Microbiological data available for each subject were the counts of each of the 18 test taxa from up to 28 supragingival and, separately, up to 28 subgingival plaque samples per subject at baseline, 3, and 6 months. In order to compare the counts of each of the bacterial species, the data were expressed as counts $\times 10^5$ at each site, averaged within a subject and then averaged across subjects at each time point for supra and subgingival counts separately for each brushing group. Changes in supragingival and subgingival plaque composition over time were evaluated using the Quade test (Conover 1980). Significance of differences between time points for each species were sought using the Mann Whitney test. The change in % of sites colonized from baseline to 6 months was determined by subtracting the baseline values from the 6 month values at each site for supra and subgingival plaque separately, averaging within each subject and then averaging across subjects in the 2 brushing groups. Significance of differences for mean changes between brushing groups was determined using the Mann-Whitney test.

Full-mouth microbial profiles were constructed for total counts and selected microbial taxa, at baseline and 6 months, by averaging the data for each sample site location across subjects in the 2 brushing groups separately.

Results
Fig. 1 presents the mean total DNA probe counts (±SEM) for both supra and subgingival plaque samples at baseline, 3 and 6 months in the 2 toothbrushing groups. There was a significant decrease in total counts for supra and subgingival plaque samples in the subjects using the manual brush and a significant decrease in subgingival counts for the power brushing group. The majority of subjects in both groups showed a decrease in total counts from baseline to 6 months (Fig. 2).

Mean counts ($\times 10^5$) of the test taxa in supragingival plaque samples at baseline, 3 and 6 months for subjects using either manual or power toothbrushing are presented in Fig. 3. Actinomyces naeslundii and Actinomyces israelii/gerencseriae were the most numerous organisms detected at baseline and showed the greatest reductions in counts (Fig. 3). Streptococcus constellatus/intermedius was significantly reduced in the manual toothbrushing group ($p<0.05$) and power group ($p<0.01$). In addition, Streptococcus mitis/oralis/sanguis was significantly reduced ($p<0.01$) in the manual toothbrushing group. The microbial profiles presented in Fig. 4 reinforce the notion of a major decrease in Actinomyces counts and a lesser change for other taxa examined. Veillonella parvula was significantly higher in the power brushing group at the 3 and 6 month visits. This was the only significant difference between brushing groups.

The mean counts of the species in subgingival plaque were more markedly altered in both brushing groups com-
Microbiological effects of toothbrushing

Fig. 5. Bar charts of the mean counts ($\times 10^5$, ±SEM) of selected taxa in subgingival plaque samples at baseline, 3 and 6 months in subjects using either the manual ($n=25$) or power brush ($n=22$). The bars indicate the means and the whiskers the SEM. Counts for each taxa at each site were averaged within a subject for each time point for subgingival plaque samples. Significance of differences over time was sought using the Quade test. Significance of differences between groups at each time point was tested using the Mann Whitney test. Significance of differences occurred in both groups for most subjects for any taxa at 3 and 6 months.

Fig. 6. Microbial profiles of the mean counts ($\times 10^5$) of 18 microbial taxa in subgingival plaque samples taken at baseline, 3 and 6 months from subjects in the 2 brushing groups. The profiles represent the mean counts derived by averaging the counts of each species within a subject and then across subjects in the same group for each time point. The species were ordered according to baseline values in the manual brushing group. Testing of significance of differences was performed as described in Fig. 3.

pared with the changes observed in supragingival plaque (Fig. 5). Major reductions occurred in both groups for A. naeslundii, A. israelii/gerencseriae, Peptostreptococcus micros, V. parvula, Prevotella intermedia/nigrigens, S. mitis/oralis/sanguis and S. constellatus/intermedius. The microbial profiles in Fig. 6 reinforce the greater relative reduction in subgingival counts between baseline and 6 month data for many of the taxa tested. V. parvula and S. constellatus/intermedius were significantly higher in the power brushing group at the baseline visit. There were no other significant differences between brushing groups at baseline or for any taxa at 3 and 6 months.

Fig. 7 presents the mean change in the % of sites colonized at levels $>10^4$ by each taxon in supra and subgingival plaque samples in the power and manual toothbrushing groups. All taxa were reduced in prevalence in the subgingival plaque samples for both brushing groups. Only A. actinomyctetomcomitans increased in prevalence in the supragingival samples in both brushing groups. The reductions in prevalence were, in general, greater in the subgingival samples, particularly for A. naeslundii, S. constellatus/intermedius, V. parvula, A. israelii/gerencseriae, S. mitis/oralis/sanguis, P. micros, S. mutans and P. intermedia/nigrigens. Mean prevalence was decreased more for P. gingivalis, Campylobacter rectus/showae, T. denticola and B. forsythus in supragingival plaque than subgingival plaque. Nonetheless, the prevalence of the “red complex” species, B. forsythus, P. gingo- 

givalis and T. denticola was markedly decreased for most subjects in subgingival plaque (Fig. 8).

Both brushing techniques decreased mean total DNA probe counts at all site locations sampled (Fig. 9). Reductions did not differ significantly in different regions of the oral cavity. Prevalence of individual species at levels $>10^4$ was also reduced at virtually all sites locations sampled. For example, the prevalence of S. constellatus/intermedius was reduced markedly in both arches for both brushing groups (Fig. 10). Others species also showed reductions in counts and prevalence at virtually all sampled sites throughout the oral cavity whether subjects used manual or power brushing (data not shown).

Discussion

The present investigation evaluated the effect of manual and power toothbrushing on the composition of supragingival plaque. As such it provides one of the more comprehensive examinations, to date, of the microbial changes brought about by well-performed toothbrushing.

The major effect of manual and power toothbrushing was to reduce total and individual counts of bacterial taxa in both supra and subgingival plaque. The significant decrease in total counts that was observed supra and subgingivally was accompanied by a significant decrease in counts of the Actinomyces species. A. naeslundii and A. israelii/gerencseriae were significantly reduced in supra and subgingival plaque samples in the 2 brushing groups. This decrease was not surprising given the dominant role of the Actinomyces in these 2 plaque environments. Thus, any procedure reducing plaque is likely to dramatically affect the Actinomyces. What was a little surprising was the greater decrease subgingivally in counts of these species compared with the supragingival decrease. Other species which were reduced significantly in supragingival plaque in-
Fig. 7. Bar charts of the change in the mean % of sites colonized (±SEM) from baseline to 6 months of the test taxa in supra and subgingival plaque samples in subjects using either the manual or power brush. The bars indicate the mean change in prevalence and the whiskers the SEM. The % of sites colonized by each taxon at levels \( > 10^4 \) in each subject was determined for baseline and 6 months and the difference computed. Mean differences were then averaged across subjects in the 2 brushing groups. Significance of differences between brushing groups was tested using the Mann-Whitney test. There were no significant differences between groups for any of the test taxa in either supra or subgingival plaque samples.

Fig. 8. Plots of the mean values of the % of sites colonized by the “red complex” species, B. forsythus, P. gingivalis and T. denticola in subgingival plaque samples at baseline and 6 months in each subject in both brushing groups. The upper panels provide data for the manual group while the lower panels present data for power brushing group. The open circles represent the mean values at baseline and the black circles represent the mean values for the same subject at 6 months. The black circles in the shaded area represent a decrease from baseline values, while the black circles in the unshaded area represent an increase from baseline values.

Included members of the genus Streptococcus such as S. constellatus/lintermedius in both brushing groups and S. mitis/loralis/sanguis in the manual toothbrushing group. Subgingivally, additional taxa were also significantly reduced including V. parvula and P. micros in both brushing groups and P. intermedia/lignrescens in the power brushing group.

The decrease in counts was accompanied by a decrease in the prevalence of several taxa. Once again, the decrease in prevalence was more marked in the subgingival plaque where all of the test taxa were decreased in both brushing groups, many of them significantly (Fig. 7). Subgingivally, 17 of 18 taxa were decreased at 6 months, although the decreases were less pronounced for most taxa examined than those seen in the subgingival samples. Interestingly, the largest reductions in prevalence subgingivally were seen for members of the genera Actinomyces, Streptococcus and P. micros, while species such as P. gingivalis, C. rectus/showae, T. denticola and B. forsythus showed the biggest decreases supragingivally. This latter finding of a greater effect on periodontal pathogens in the supragingival environment may suggest that this is a somewhat less favorable habitat for these species.

Of clinical benefit, was the decrease in “red complex” species in prevalence subgingivally for the majority of subjects (Fig. 8).

In the present study, total counts and counts of individual taxa were decreased at 3 months and further reduced at 6 months. Murray et al. (1989) using rotary or manual brushing and Ximenez-Fyvie et al. (2000) using repeated professional removal of supragingival plaque showed that further reductions in counts could be observed in the period from 6 to 12 months. In the present study, reductions in Fusobacterium nucleatum in subgingival plaque were less apparent at 6 months than reductions for other taxa. In the study of Murray et al. (1989) reductions in F. nucleatum were minimal at 6 months but much more marked at 12 months suggesting that it might take added time to affect some segments of the microbiota. This was encouraging from a clinical standpoint and suggests that studies of 12 months or longer might be valuable in defining the shifts that oral hygiene procedures bring about.

In accord with the findings of Murray et al. (1989) there were few significant differences between manual and power brushing groups in terms of effects on the plaque microbiota. In retrospect, the experimental design of the present study was inadvertently biased against detecting such differences. The greatest differences in clinical parameters between manual and power brushing groups were found at lingual surfaces with minimal differences at mesiobuccal sites (Haffajee et al. 2001). Thus, microbial samples were taken at sites with the least clinical and microbial differences. Future studies seeking differences in microbial efficacy between manual and
power brushing might emphasize surfaces where clinical and microbial differences are likely to be the largest.

The greater effect of toothbrushing on subgingival plaque composition than supragingival plaque composition is counter-intuitive. One would expect that toothbrushing would more profoundly affect supragingival plaque, the biofilm that it directly removes. However, this was not the case. This finding suggests that supragingival plaque may regrow rather rapidly after its mechanical removal. The effect of supragingival plaque removal on subgingival plaque composition is complicated. It has been speculated that removal of supragingival plaque directly affects the contiguous subgingival biofilm ecosystem leading to a "change in habitat" (Ximenez-Fyvie et al. 2000). This change diminishes gingival inflammation and gingival fluid flow resulting in a decreased nutrient availability for the subgingival organisms. The reduction in nutrients may have a more lasting effect on the subgingival bacteria than the direct removal has on the supragingival bacteria. If these suppositions are correct, supragingival plaque receives its nutrients primarily from saliva and the diet and to a lesser extent, the subgingival environment. Subgingival plaque derives its nutrients primarily from supragingival plaque and the adjacent host tissue. Removal of supragingival plaque would diminish both sources, the supragingival plaque directly and the adjacent host tissue by decreasing inflammation and fluid flow. Supragingival plaque growth might be decreased somewhat by diminishing flow from the tissues, but dietary and saliva sources would be minimally affected.

Conclusion

The major finding of the current investigation was the effect of supragingival plaque removal on the composition of the subgingival microbiota. Counts and prevalence of most taxa examined were markedly decreased in both toothbrushing groups. This reduction should translate to a decreased risk of periodontal disease initiation or recurrence. Further, the decreased prevalence of periodontal pathogens in supragingival plaque lowers potential reservoirs of these species. It has been known for decades that supragingival plaque removal is of benefit to the periodontal patient. The present study suggests potential biological mechanisms that produce this clinical effect.

Acknowledgments

This work was supported by Braun GmbH, Kronberg, Germany.

Zusammenfassung

Effektivität von elektrischen und Handzahn­bürsten (II). Auswirkung auf die mikrobiologische Parameter

Zielsetzung: Untersuchung der Auswirkung individueller supragingivaler Plaquekontrolle mit einer elektrischen (Braun 3D Plaque Remover; 3DPR) oder einer Handzahn­bürste (Crest Complete; CC) auf die Zusammensetzung der supra- und subgingivalen Plaque.


**Résumé**

Efficacité des brosses à dents manuelles et électriques (II). Effet sur les paramètres microbiologiques

**Origine, but:** Le but de cette recherche était de comparer les effets du contrôle de la pla que supragingivale par brossage manuel (Crest Complete) ou électrique (Braun oral B 3D Plaque Remover) sur la composition de la plaque supra et sous g ingivale.

**Méthodes:** 47 sujets en maintenance ont participé à cette étude longitudinale en aveugle d’une durée de 6 mois. Initialement, des échantillons de plaque supra et aussi de plaque sous gingivale furent prélevés sur la face mésiale de chaque dent de chaque sujet avec des curettes stériles et analyses individuellement pour la présence de 18 taxons bactériens par hybridi s par hybridation ADN-ADN en damier. Après avoir été assignés au hasard dans des groupes utilisant soit une brosse manuelle (n=25), soit une brosse électrique (n=22), les sujets recevaient des instructions d’hygiène buccos-dentaire et utilisant leur brosse 2× par jour pendant 6 mois. Un examen clinique et un prélèvement microbiologique étaient réalisés à 3 et 6 mois. Des différences significatives des mesures microbiologiques dans le temps étaient recherchées par le test de Quade et entre les groupes de brosses à chaque étape par le test de Mann-Whitney.

**Résultats:** Les comptages totaux moyens étaient significativement réduits pour les échantillons de plaque supra- et sous-gingivale dans le groupe brosse manuel et pour les échantillons sous-gingivaux pour le groupe brosse électrique. *Actinomyces naeslundii* et *Actinomyces israeliigenerseriae* étaient les organismes les plus nombreux initialement et montraient les plus grandes réductions pour le comptage dans les deux groupes. *Streptococcus constellatus/intermedius* étaient significativement réduits dans les deux groupes, alors que *Streptococcus mititloralis/sanguis* n’étaient réduits que dans le groupe utilisant la brosse manuelle. Les comptages moyens des espèces étaient remarquablement plus modifiés dans la plaque sous-gingivale. Des réductions majeures survenaient dans les deux groupes pour *A. naeslundii*, *A. israeliigenerseriae*, *Peptostreptococcus micros*, *Veillonella parvula*, *Prevotella intermedia/nigrescens*, *S. mititloralis/sanguis*, *P. micros*, *Streptococcus mutans* und *P. intermedia/nigrescens*. La prévalence (%) de sites colonisés de tous les taxons examinés était réduite dans les 2 groupes, de façon plus importante pour *A. naeslundii*, *S. constellatus/intermedius*, *P. parvula*, *A. israeliigenerseriae*, *S. mititloralis/sanguis*, *P. micros*, *Streptococcus mutans* und *P. intermedia/nigrescens*. La prévalence moyenne était plus diminuée dans la plaque supragingivale pour *Porphyromonas gingivalis*, *Campylobacter rectalus showae*, *Treponema denticola* und *Bacteroides forsythus*.

**Conclusions:** L’élément le plus intéressant est l’effet du contrôle de plaque supragingivale sur la microflore sous-gingivale. Le comptage et la prévalence de la plupart des taxons examinés étaient remarquablement diminuées dans les deux groupes. Cette diminution devait se traduire en un risque réduit d’initiation ou de récurrence de la maladie parodontale. De plus, la prévalence diminuée des pathogènes parodontaux dans la plaque supragingivale réduit la possibilité de réservoir potentiels de ces espèces.