J Clin Periodontol 2004; 31: 470–474 doi: 10.1111/j.1600-051X.2004.00515.x
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Journal of Clinical Periodontology

Effect of two toothcleaning frequencies on periodontal status in patients with advanced periodontitis

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Sadoh DR, Watts TLP, Newton JT: Effect of two toothcleaning frequencies on periodontal status in patients with advanced periodontitis. J Clin Periodontol 2004; 31: 470–474. doi: 10.1111/j.1600-051X.2004.00515.x. © Blackwell Munksgaard, 2004.

Abstract

Objective: To compare the effect of once a day toothcleaning with once in 2 days toothcleaning in patients with advanced periodontitis.

Material and Methods: Twenty-two patients, aged 34–54 years were given intensive oral hygiene (OH) and half their mouth root planed with re-assessment 6 weeks later. The patients were randomised into either a once a day toothcleaning group or a once in 2 days toothcleaning group. The effects of the two cleaning regimens were assessed during a 6-week follow-up period. Two patients were excluded from the study. Analysis of covariance was used to test the difference between the two groups at baseline and at 6 weeks.

Results: There was a statistically significant difference between the two groups in plaque reduction ($p = 0.01$) and reduction of probing pocket depth >6 mm ($p = 0.05$) in the OH-only sites. No significant difference was found between the two cleaning regimens in the combined oral hygiene with root planing sites.

Conclusion: The present study demonstrated that in patients with advanced periodontitis, once a day toothcleaning is more effective than once in 2 days toothcleaning in otherwise untreated sites.

Key words: combined oral hygiene and root planing; oral hygiene; periodontitis; randomized controlled trial; toothcleaning frequency

Accepted for publication 4 August 2003

Dental plaque (DP) is strongly implicated in the development of gingivitis (Löe et al. 1965) and periodontitis (Lang et al. 1998). Elimination of DP results in resolution of gingival inflammation (Löe et al. 1965, Theilade et al. 1966) and reduction of the severity of periodontitis (Axelsson & Lindhe 1981).

The most effective method of DP elimination is mechanical by toothcleaning with a toothbrush (Frandsen 1986) and an interdental cleaning aid (Galgut 1991, Watts 2000). However, the appropriate frequency of toothcleaning is not known (Macgregor et al. 1997). Studies have shown a reduced caries incidence (Chesters et al. 1992) and lower DFMS (O'Mullane et al. 1997) in children who self-reported brushing twice a day with fluoride toothpaste compared with children who self-reported brushing less frequently. Löe (1971) argued that twice daily toothcleaning to maintain a healthy gingiva is scientifically unfounded and based mainly on tradition. Expert opinion on the most effective frequency of toothcleaning in the maintenance of gingival health has varied from once a day for 20 min (Ariaudo 1971), once a day with duration unspecified (Greene 1971), once every 2 days (Löe 1971), to at least once in 3 days (Arnim 1971).

Clinical studies on dental students have shown that once in 2 days toothcleaning was as effective as more frequent toothcleaning to maintain a healthy gingiva (Lang et al. 1973) and to reverse experimental gingivitis in 10 days (Bosman & Powell 1977). However, these studies did not include sites with deep pockets.

The aim of this study was therefore to determine if there were any differences in terms of plaque control, improvement of gingival health and reduction in probing pocket depth (PPD) between toothcleaning frequencies of once a day and once in 2 days in patients with advanced periodontitis.

Materials and Methods

This single blind trial was conducted at the Department of Periodontology and

Preventive Dentistry of the Guys, King's College and St Thomas' Dental Institute. Ethical committee approval was obtained and subjects gave informed consent to participate.

Subjects

Subjects were new patients attending the periodontal clinic. They were selected at a screening examination, which consisted of an oral exam and completion of a medical history questionnaire.

Subject selection was based on the criteria of general good health, age between 30 and 60 years and at least 20 standing natural teeth. Participants were required to have no removable partial denture and some proximal periodontitis including a minimum of two >6 mm true pockets and two <4 mm pockets.

Patients were excluded if they had received any advice on oral hygiene (OH) or root planing in the past 6 months or had any systemic or local problems likely to prejudice their health or interfere with the results of the trial (e.g. antibiotics, pregnancy, diabetes and cardiovascular disease).

Method of measurements

Evaluation of patients was based on measurement of DP, bleeding on marginal probing (BOMP), PPD and bleeding on deep probing (BODP). One operator, who was kept ''blind'' to which group the subject was placed in, carried out all measurements and treatment.

Estimation of pocket depth, to the nearest millimetre was performed using a tapered tine, with a tip diameter of 0.5 mm mounted in a ''Borodontic'' probe handle, adjusted to a force of 0.25 N (Quayldent, Worthing, UK). The Williams markings were 0.5 mm offset (Watts 1989). Full mouth measurement was done, with exclusion of teeth not fully erupted.

The first visit

Dental plaque

Plaque was recorded as present or absent after running the probe 1 mm along the gingival margin. Disclosing agent was not used. Measurements were made at four sites: mesial, distal, buccal and lingual.

Bleeding on marginal probing

BOMP was recorded from the same site as for DP immediately after completion of DP measurement in a quadrant. Bleeding was recorded as absent or present. Patients then rinsed with water and a time interval of 5 min was allowed to elapse before measurements of PPD and bleeding from depth of pockets. This was to minimise contamination of bleeding from the depth of the pocket (BODP) by BOMP.

Probing pocket depth

Measurements of PPD were done using the same Borodontic constant force probe. During probing, the probe was directed at a slight angle to the long axis of the teeth into the pocket until resistance was met and the distance to the gingival margin was noted (Badersten et al. 1981). Measurements rounded to the nearest millimetre were obtained from six sites: mesio-buccal, mid-buccal, disto-buccal, mesio-lingual, mid-lingual and disto-lingual.

Bleeding on deep probing

Immediately the PPD measurements were completed in a quadrant the assessment of BODP was carried out for the six sites.

OH instructions

After clinical measurements, OH instruction was given including the Bass technique of toothbrushing and effective interdental cleaning using looped floss. Any inadequacies in technique were corrected until the patient was considered to be capable of carrying this out at home. Patients were given necessary OH accessories (toothbrush and floss) for use during the duration of the trial, and a purpose-designed diary to indicate and record times of toothcleaning and to encourage adherence.

Debridement of pockets

The same operator performed the instrumentation of periodontal pockets. One quadrant in each jaw was randomly chosen and thorough subgingival scaling with ultrasonic instrumentation carried out under local anaesthesia until the root surfaces felt smooth.

The 22 patients were then randomly allocated into one of two groups by a second person. Patients were asked to remove plaque once every 24 h or once every 48 h.

The second visit

This was carried out at 6 weeks after the first visit, and all patients were asked to clean their teeth before coming. Any problem during the period of study was recorded. Patients were then examined for DP, BOMP, PPD, BODP following the same protocol as for the first visit.

These measurements were entered on new charts in the absence of the charts from the first visit. All patients were then advised to brush at least once a day. The remaining two unplaned quadrants in each patient were then root planed.

Consistency of clinical examination

Every subject was assessed using the same ''Borodontic'' handle and tine. Intra-examiner reproducibility for PPD was tested in 20% of patients at approximately 10% of sites at the first visit by repeating measurements on every fifth volunteer within 1 h at non-root planed sites.

Statistical methods

Data recorded on the dental charts were transcribed onto computer records and analysed using SPSS-X (1988). All variables were examined to establish whether the data conformed to a normal distribution. The proportion of sites bleeding on probing required square root transformation and the proportion of sites probing 7 mm or more required logarithmic transformation prior to parametric analysis. Data were analysed using a paired *t*-test to evaluate differences between baseline and 6 weeks. Differences between OH regimens (daily versus every other day) were analysed by comparing the 6 weeks measurements using analysis of variance with the equivalent baseline measurements as covariates. Percentage changes in the number of sites with clinical measures between baseline and 6 weeks were not amenable to transformation and were analysed using the Wilcoxon matched-pairs signed-ranks test.

Results

The demographic data on the subject population are represented in Table 1. Twenty-two subjects were recruited for

Table 1. Demographic data of patients according to age, gender distribution and smoking status

	Once daily toothcleaning		Once in 2 days toothcleaning	
	Age in years ± SD (range)			
	47.4 ± 5.0 (36–54)		44.0 ± 5.1 (38–54)	
	Gender			
	males (2)	females (8)	males (4)	females (6)
Non-smokers	1	4	0	3
Smokers	0	3	2	1
Ex-smokers	1	1	2	2

SD, standard deviation.

Table 2. Clinical parameters in oral hygiene (OH)-only sites

% sites with	Once a day toothcleaning		Once in 2 days toothcleaning		Between groups p^*
	baseline	6 weeks	baseline	6 weeks	
Plaque	54.5 (10.2)	27.4 (11.7)	58.5 (19.8)	40.9 (19.2)	0.011
p^{**}	<0.001		<0.001		
BOMP	40.0 (22.0)	15.0 (12.3)	57.8 (35.3)	39.9 (33.1)	0.070
p^{**}	0.002		0.001		
PPD <4 mm	47.8 (14.6)	55.4 (13.2)	41.5 (13.2)	48.6 (18.8)	0.695
p^{**}	0.007		0.002		
PPD 4–6 mm	36.0 (12.4)	34.3 (11.7)	37.8 (15.1)	35.1 (15.9)	0.77
p^{**}	0.49		0.70		
PPD >6 mm	15.8 (11.7)	9.1 (7.8)	20.3 (17.2)	14.8 (11.9)	0.050
p^{**}	0.005		0.016		
BODP	68.1 (17.2)	50.8 (10.9)	72.9 (19.3)	62.6 (21.2)	0.179
p^{**}	0.005		0.016		
Mean					
PPD	4.2 (0.85)	3.7 (0.70)	4.4 (1.14)	4.0 (0.97)	0.34
p^{**}	<0.001		<0.001		
Recession	1.3 (0.73)	1.6 (0.67)	1.05 (0.66)	1.40 (0.59)	0.87
p^{**}	0.001		<0.001		

Mean (standard deviation) percentage of sites with plaque, bleeding on marginal probing (BOMP), bleeding from the depth of the pocket (BODP), pocket probing depth (PPD) <4, 4–6, >6 mm, and mean PPD and recession.

*p-Value from analysis of covariance (between-group comparison) on 6 weeks data.

**p-Value from paired t-test of baseline data with 6 weeks data.

the study; however, two subjects failed to attend for the second visit and were withdrawn from the study. Analysis was based on the remaining 20 patients. The once a day toothcleaning group and the once in 2 days toothcleaning group do not differ significantly at baseline with respect to age, gender and smoking parameters.

The clinical data obtained in the OH-only sites are presented in Table 2, and data obtained in the combined oral hygiene with root planing (COHRP) sites are in Table 3.

The percentage of sites with plaque, BOMP and BODP was generally high at baseline in both toothcleaning groups. Results showed that once a day toothcleaning and once in 2 days toothcleaning were effective in the improvement of all clinical parameters studied irrespective of whether OH was used alone or combined with root planing.

Between-group analysis showed that in the OH-only sites, once a day toothcleaning was significantly more effective in plaque reduction compared with once in 2 days toothcleaning ($p = 0.011$). Once a day toothcleaning was also statistically significantly more effective in the reduction of sites with PPD >6 mm compared with the once in 2 days toothcleaning group. No statistically significant difference was noted between the two groups in terms of the bleeding parameters and the changes in sites <4 and 4–6 mm deep.

In the COHRP sites (Table 3) no statistically significant difference was noted in any of the clinical parameters between the two cleaning regimens at 6 weeks.

Reproducibility of PPD measurements

The reproducibility of PPD was evaluated from duplicate measurements, 1 h apart. Approximately 21 sites were reprobed in 10% of the patients, giving a total of 84 sites. The PPD were reproduced within 1 mm with 96% reliability (68.4% of sites were exact and 27.6% showed a difference of 1 mm).

Discussion

The purpose of this investigation was to determine if there was a difference between once a day toothcleaning and once in 2 days toothcleaning frequencies in the maintenance of periodontal health in patients with advanced periodontitis. Previous studies have suggested that once in 2 days toothcleaning was equally as effective as more frequent toothcleaning in the maintenance of previously healthy gingiva (Lang et al. 1973) and in the reversal of experimental gingivitis in 10 days (Bosman & Powell 1977). However, these studies focused on subjects without deep pockets. More plaque has been shown to form in sites with deep pockets (Lindhe et al. 1982, Goh et al. 1986) and inflammation (Goh et al. 1986, Quirynen et al. 1991) with the faster development of a more complex bacterial plaque (Saxton 1973, Brecx et al. 1980).

This is the first study to compare once a day toothcleaning against once in 2 days toothcleaning in human beings with advanced periodontitis. The results of this study show that once a day toothcleaning is more effective than once in 2 days toothcleaning in the reduction of plaque and PPD >6 mm in otherwise untreated sites.

Adherence to protocol

Direct measures of patient adherence are difficult to obtain, so self-report by subjects was relied upon. Some studies suggest that people clean teeth for cosmetic rather than health reasons (Macgregor et al. 1997), and the most common frequency of toothcleaning is

Table 3. Clinical parameters in combined oral hygiene and root planing (COHRP) sites

% sites with	Once a day toothcleaning		Once in 2 days toothcleaning		Between groups p^*
	baseline	6 weeks	baseline	6 weeks	
Plaque	54.3 (10.9)	29.9 (9.0)	63.1 (23.2)	36.2 (18.8)	0.628
p^{**}	0.001		0.002		
BOMP	41.5 (27.2)	22.0 (21.8)	52.7 (30.4)	34.2 (32.7)	0.818
p^{**}	0.032		0.020		
PPD <4 mm	48.3 (20.3)	61.4 (16.7)	45.8 (15.8)	56.1 (18.2)	0.461
p^{**}	0.007		0.001		
PPD 4–6 mm	35.0 (13.0)	27.9 (11.0)	36.3 (10.6)	31.9 (14.4)	0.494
p^{**}	0.072		0.293		
PPD >6 mm	16.7 (12.6)	10.0 (7.7)	17.9 (15.7)	11.3 (9.5)	0.696
p^{**}	0.018		0.072		
BODP	68.0 (17.5)	45.3 (14.9)	73.9 (20.2)	60.9 (20.5)	0.070
p^{**}	<0.001		0.032		
Mean					
PPD	4.2 (0.92)	3.6 (0.77)	4.2 (1.02)	3.6 (0.83)	0.95
p^{**}	<0.001		<0.001		
Recession	1.24 (0.75)	1.63 (0.54)	1.14 (0.75)	1.56 (0.69)	1.0
p^{**}	<0.001		<0.001		

Mean (standard deviation) proportion of sites with plaque, bleeding on marginal probing (BOMP), pocket probing depth (PPD) <4, 4–6, >6 mm and bleeding from the depth of the pocket (BODP), and mean PPD and recession.

$^*p$-Value from analysis of covariance (between-group comparison) on 6 weeks data.

$^{**}p$-Value from paired t-test of baseline data with 6 weeks data.

twice a day (Frandsen 1986, Macgregor et al. 1997). Thus, adherence to less frequent toothcleaning may be difficult to achieve. That is why to encourage adherence, a special diary was designed, to remind the subjects the days they were meant to clean their teeth. In any case, most patients initially had poor OH and may not have regularly cleaned their teeth before instructions. Differences in plaque score at the end of the study between the two cleaning regimens suggest that the subjects complied with the study protocol, as they stated when asked.

Clinical results

Dental plaque

Irrespective of the cleaning regimen used, there was a statistically significant reduction in DP scores at 6 weeks. In the OH-only sites, there was a further statistically significant difference between the once a day cleaning when compared with the once in 2 days cleaning regimen. This agrees with Lang et al. (1973) who demonstrated more plaque accumulation in subjects cleaning once every other day than in those cleaning more frequently.

The plaque reduction in subjects who cleaned once a day was similar in the COHRP sites and the OH-only sites. This suggests that subjects were able to keep both sites equally clean. It was interesting that there was no statistically significant difference in plaque reduction between subjects cleaning once a day and those cleaning once in 2 days in the COHRP sites (Table 3). In the OH-only sites of those who cleaned their teeth once in 2 days, there was marginally less plaque at baseline compared with the same cleaning regimen in the COHRP sites (Fig. 1). At 6 weeks, however, the OH-only sites had marginally more plaque.

The failure to show a statistically significant difference in the plaque reduction between the COHRP sites of the once a day cleaning group and the once in 2 days cleaning group may be explained in three ways.

Firstly, it may be that the numbers of subjects in this study did not have enough power to show the difference in plaque reduction. But this does not explain why a statistically significant difference was seen in the OH-only sites between the once a day cleaners and the once in 2 days cleaners.

Secondly, it may be that the subjects did not comply with the cleaning regimen in COHRP sites. However, it is unlikely that adherence was achieved in the OH-only sites but not in the COHRP sites.

Thirdly, a more complex but fascinating explanation may be related to the ability of root planing to modify tooth surfaces so as to reduce plaque accumulation. Plaque adheres to tooth surfaces by various forces; e.g., van der Waals forces and electrostatic forces. This adhesion is enhanced by short-range forces; e.g., hydrogen bonding, ion pair formation, steric interaction and bridging interaction (Quirynen & Bollen 1995). Root planing when properly carried out has a smoothing effect thereby reducing the surface free energy on tooth surfaces and helping to reduce plaque accumulation. The effect is more apparent in surfaces with more plaque (Quirynen & Bollen 1995). A similar effect may not be discernible in the COHRP sites of the once daily cleaners because there was less plaque. As a result of the additional effect of root planing on plaque reduction in the once in 2 days cleaners (Fig. 1) there was no longer a statistically significant difference between the once a day and once in 2 days cleaners in plaque reduction in the COHRP sites.

Bleeding parameters

It is generally assumed that BOMP and BODP are interchangeable especially in shallow pockets. However, in a study comparing both methods only 43.1% of shallow sites were positive for both bleeding methods (Chaves et al. 1993), and in this study the highest agreement was in deep sites (85.4%). This justifies the decision to study the effect of therapy on both BOMP and BODP. In the present study, the mean percentage BODP was always higher than the mean percentage BOMP at baseline and 6 weeks after therapy. This is in contrast to Chaves et al. (1993) study where BOMP was found to be generally higher than BODP. They also showed that BODP correlated with PPD, while BOMP correlates with plaque. In the present study, the difference between BODP and BOMP increased from approximately 15–28% at baseline to 22–36% at 6 weeks in the OH-only sites. In the COHRP sites the difference between BODP and BOMP did not change at 6 weeks compared with baseline (21–26% at baseline and 23–27% at 6 weeks). This means that OH only seems to have a greater effect on BOMP than BODP, while COHRP seems to have a similar effect on both bleeding indices.

Both cleaning regimens were effective in the reduction of the bleeding parameters measured. No statistically significant difference was found between the two groups. This is in agreement with previous studies (Lang et al. 1973, Bosman & Powell 1977).

Effect of toothcleaning frequencies on PPD

Both toothcleaning regimes were effective in the overall reduction of deep pockets and increment in shallow pockets. In addition, in the OH-only sites, once a day toothcleaning was better at reduction of PPD >6 mm when compared with once in 2 days toothcleaning ($p = 0.05$; Table 2). This difference was not reproduced between the two groups in the COHRP sites. This implies that once a day cleaning is more effective in the reduction of >6 mm pockets only in otherwise untreated sites. With regard to mean PPD, this study showed an improvement of around 0.5 mm in all groups. This is similar to findings from other studies on OH (Turner et al. 1994).

In conclusion, the present study suggests that once a day toothcleaning, in otherwise untreated sites, is significantly more effective in the reduction of plaque and proportion of sites with >6 mm PPD compared with once in 2 days toothcleaning. These differences between the two cleaning regimens were generally not shown in the COHRP sites, suggesting an additional modifying effect of root planing especially in the once in 2 days cleaning group. Thus dentists should recommend a minimum toothcleaning frequency of once a day in patients with deep pockets especially before professional treatment is commenced.

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