Efficacy of Interdental Plaque Control Aids in Periodontal Maintenance Patients: A Comparative Study

Cassiano Kuchenbecker Rösing[a]/Fernando Antonio Rangel Lopes Daudt[a]/
Fabio Eduardo Festugatto[a]/Rui Vicente Oppermann[a]

Purpose: To compare the interdental plaque removal capacity of dental floss, a cylindrical and a conical interdental brushes.

Material and Methods: Fifty individuals were selected from those attending a maintenance programme for periodontally treated patients. Upon written agreement, the Silness and Löe Plaque Index (Pl.I) was registered in nine interdental spaces in three quadrants. The patients were then instructed on the use of each device and performed the cleaning until they felt it was satisfactory using one instrument for each quadrant. The same calibrated examiner registered Pl.I again, unaware of the instruments used in each quadrant. Mean values were calculated and compared by One Way ANOVA + Bonferroni and paired sample t test (α=.05). Frequency distribution of scores 0+1 and 2+3 was also calculated and compared by Mc Nemar.

Results: The mean Pl.I at start was 1.71 for dental floss, 1.69 for the conical and 1.66 for the cylindric interdental brushes. All three instruments reduced plaque significantly. Thus, the final mean Pl.I was 1.02, 0.46 and 0.42 for floss, conical and cylindric brushes, respectively. The final values observed for the interdental brushes were significantly smaller than those observed for floss. The same result was observed for the frequencies of 0+1 and 2+3 criteria of the Pl.I.

Conclusion: It may be concluded that, for individuals in periodontal maintenance care, interdental toothbrushes, regardless of their shape (conical or cylindric) are more efficacious in interdental supragingival plaque removal than dental floss.

Key words: dental floss, efficacy, interdental brush, supragingival plaque control

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Regular plaque control is important for dental health, both in relation to dental caries and periodontal disease. It is also necessary for the long-term success of periodontal treatment (Garmyn et al, 1998; Axelsson et al, 2004).

Periodontitis is more prevalent and severe in interproximal surfaces as compared to free surfaces (Albandar, 2002; Susin et al, 2004). This has been linked to difficulties in plaque control in these areas. Consequently, it is important for periodontal therapy that patients have good standards of plaque control, including these surfaces.

Flossing is the most used interdental cleaning device (Warren and Chater, 1986; Kinane et al, 1992). However, it requires dexterity and might be difficult in areas with previous periodontal breakdown. Interdental brushes were designed in order to better achieve difficult-to-reach interproximal areas, facilitating supragingival plaque control (Gjermo and Flötra, 1970).

Additionally, the maintenance phase is critical for stability of the results of periodontal therapy, requiring compliance from the patient with plaque control (Serino et al, 2001). Thus, testing the potential of the different interdental cleaning devices is of great interest. Studies comparing these interdental devices in periodontal maintenance patients are scarce.

[a] *Department of Periodontology, Federal University of Rio Grande do Sul, Porto Alegre, Brazil*

Reprint requests: *Cassiano Kuchenbecker Rösing, Rua Dr. Valle, 433/701, 90560-010 – Porto Alegre – RS, Brazil. Tel: 55 51 33165318. Fax: 55 51 33384221. E-mail: ckrosing@hotmail.com*

The aim of the present study was to compare the efficacy in supragingival plaque removal of two interdental brushes and dental floss in a group of periodontal maintenance patients.

MATERIAL AND METHODS

Test panel

The participants of this randomised controlled single-blind efficacy trial were recruited among patients attending the periodontal maintenance clinic in the Federal University of Rio Grande do Sul, Porto Alegre, Brazil. Their age ranged from 20-73 (mean = 44 years, 33 females and 17 males). Fifty patients were included in the trial. Mean time after systematic periodontal treatment was 31.24 months.

Inclusion criteria

To be included in the study, volunteers presented at least nine interdental spaces in which interdental brushes would fit, had no handicap that could interfere with interdental plaque control and agreed to participate in the trial, signing the informed consent form. The Ethical Committee of the Federal University Rio Grande do Sul approved this study protocol.

Testing interdental cleaning aids

The tested brushes were a conical and a cylindrical Johnson & Johnson interdental brushes and the Johnson & Johnson waxed dental floss.

Clinical examinations

A split-mouth design was chosen in this study. Plaque was assessed according to the Silness and Löe Plaque Index (Pl.I) (Silness and Löe, 1964) and scored before and immediately after usage of the test cleaning aids, by a blinded examiner.

The scores for the Plaque Index were: 0- no plaque present; 1- no visible plaque present after drying the tooth surface, but present after scratching with the probe; 2 – visible plaque present, covering up to 1/3 of the tooth surface; 3 – abundant amount of visible plaque on the tooth surface.

Reproducibility of the outcome variable was assessed prior to the study by double scoring of six maintenance patients not enrolled in the study, but with similar clinical characteristics. Agreement on the visible plaque level was 92.7%, which was considered optimal reproducibility.

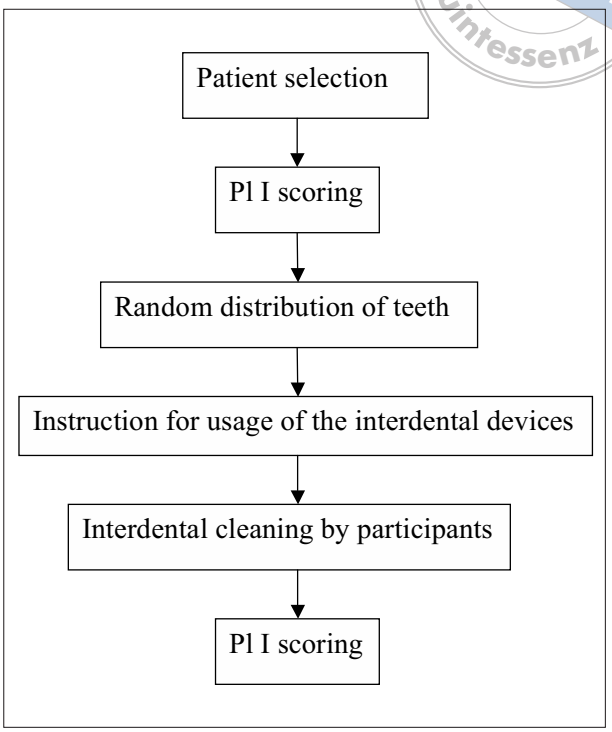

Fig 1 Experimental design.

Study design

At the start, Pl.I was assessed in all nine interdental spaces (three for each test device) selected for the study. In each individual, either interdental spaces from anterior or from posterior areas were included. No mixing of anterior-posterior sites was allowed. A total of 300 surfaces was scored in the study. Following this, by means of a draw, the interdental spaces were randomly assigned to each one of the three tested regimes. Then, in random order, each volunteer received instruction on the usage of the interdental cleaning device by a periodontist. Each instruction lasted approximately one minute, and the usage took place immediately after its correspondent instruction. No more than one minute was taken by the volunteers with each interdental cleaning device. After the three test devices were used, another scoring of Pl.I was performed. Fig 1 illustrates the experimental design.

Table 1 Mean Plaque Index (±s.d) and 95% Confidence Intervals on interdental surfaces before and after usage of the devices

EXPERIMENTAL GROUPS	BEFORE Mean ± s.d.	BEFORE 95% CI	AFTER Mean ± s.d.	AFTER 95% CI	STATISTICS (paired sample t test)
DENTAL FLOSS	1.71 ± 0.25A	1.64-1.78	1.02 ± 0.27A*	0.94-1.10	p<0.05
CONICAL INTERDENTAL BRUSH	1.69 ± 0.41A	1.57-1.08	0.46 ± 0.20B	0.40-0.52	p<0.05
CYLINDRIC INTERDENTAL BRUSH	1.66 ± 0.27A	1.58-1.74	0.42 ± 0.15B	0.38-0.46	p<0.05
STATISTICS (One-way ANOVA)	p>0.05		p<0.05		

* Means followed by different capital letters in the column indicate statistically significant differences (One-way ANOVA, + Bonferroni).

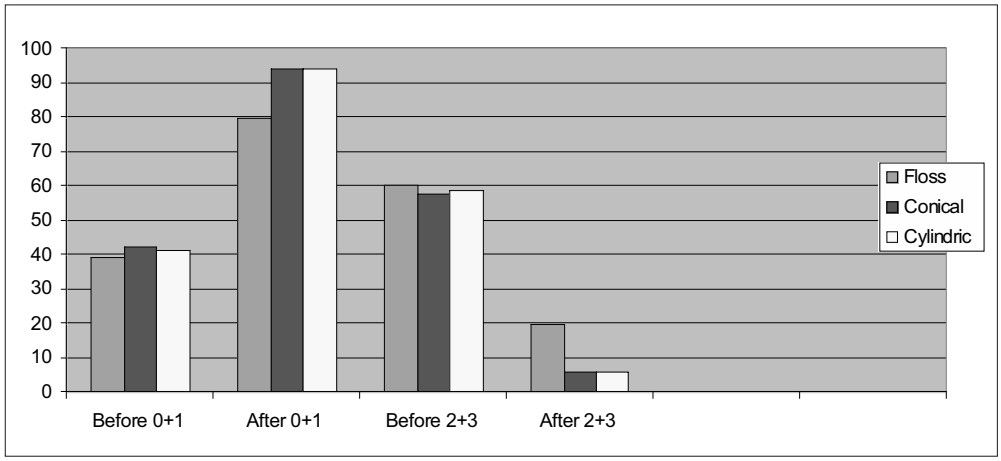

Fig 2 Frequency distribution of scores 0+1 and 2+3 of the PI.I on interdental surfaces before and after usage of the devices.

Statistically significant differences observed between floss and the interdental brushes (McNemar, p<.05).

Statistics

The mean PI.I for interdental surfaces was calculated for each interdental cleaning aid in the two study moments (before and after). Differences between groups were tested, after checking for normality, by One-way ANOVA, followed by Bonferroni as appropriate. Within group alterations in plaque index between the two study points were tested by paired-sample t test. Frequency distribution of scores 0+1 and 2+3 were also calculated for each interdental cleaning aid and tested by Mc Nemar. The chosen α-level was 0.05.

RESULTS

All included subjects completed the study. No adverse events were recorded. The mean plaque score for each group before and after the use of the devices is shown in Table 1. Statistically significant differences were observed for all groups when the scores after usage were compared to the start (paired-sample t test, p<0.05). No statistically significant differences were observed between groups at start neither by analysis of means, nor by the analysis of the different categories of the index. However, the interdental brushes yielded lower

mean plaque values (0.46 ± 0.20 and 0.42 ± 0.15 for conical and cylindric, respectively) as compared to dental floss (1.02 ± 0.27) (One-way ANOVA+Bonferroni). Fig 2 demonstrates percentages of scores 0+1 and 2+3 for the test devices before and after interdental cleaning. It can be observed that both interdental brushes displayed higher frequencies of scores 0+1 of the PI.I as compared to flossing (McNemar, $p<0.05$) However, flossing was also able to enhance the frequency of scores 0 + 1 (79.89% versus 94.19% and 94.23%).

DISCUSSION

This study evaluated the efficacy of three interdental plaque control devices in periodontal maintenance patients. The ability to remove plaque was higher for the interdental brushes as compared to dental floss.

A randomised controlled efficacy trial was designed with a split-mouth design. This type of study is considered the gold standard for testing the hypothesis of no difference between the three instruments. Randomisation was warranted in order to avoid tendencies in terms of the choice of each area to be cleaned. Hence, the examiner was calibrated, with good standards of reproducibility, and was not aware of what kind of instrument was used, warranting blindness in the evaluation. We also used the split-mouth design to avoid differences in terms of manual ability, which could interfere in the results. These principles are considered important in efficacy trials (Hujoel and Deroven, 1992).

The population of this study comprised periodontal maintenance patients, which are a target population in terms of interdental cleaning. First, because there is strong evidence that periodontal disease is more prevalent and severe in interproximal surfaces as compared to buccal-lingual surfaces (Albandar, 2002; Susin et al, 2004). This makes interdental plaque control even more critical in terms of longevity of periodontal treatment outcomes. Secondly, periodontal patients experience loss of attachment/bone. Hence, the interdental spaces tend to be larger when compared to patients without periodontal breakdown. When large interdental spaces are present, flossing might become more difficult (Gjermo and Flötra, 1970). Patients in this study used dental floss and interdental brushes routinely. Thus, they had the ability to use both aids.

Several studies have been conducted to assess the importance of good standards of oral hygiene in the achievement and maintenance of results after dental treatments. It has been demonstrated that low levels of dental plaque are associated with higher standards of oral health (Serino et al, 2001; Axelsson et al, 2004). Rosling et al (2001) have demonstrated recently that adequately maintained periodontal patients loose fewer teeth. This is the core of the maintenance phase, especially in patients with moderate/advanced periodontal breakdown.

Few studies compared interdental brushes and dental floss, but emphasis on periodontal maintenance patients has not been dedicated, especially with experimental designs according to modern paradigms. Kiger et al (1991) showed a slightly higher reduction of gingivitis in a cross-over study when interdental brushes were compared to flossing.

In the present trial, we studied patients that were well informed about periodontitis and the impact of plaque removal, and who were already attending a maintenance periodontal clinic. They are the target population for the use of the interdental cleaning devices we tested and can benefit from different cleaning aids.

As with most plaque control efficacy studies, the outcome we measured was PI.I. This is an index that was created giving special attention to the dental area close to the gingival margin, which is extremely important in terms of clinical significance for periodontal patients. Additionally, we dichotomised this index to have an idea of the visible plaque component of the index (2+3), which is considered clinically relevant, since the scores are most frequently not associated with inflammation (Amato et al, 1986).

Our results showed that the plaque reduction was more evident when the conical and the cylindric interdental brushes were used as compared to dental floss. However, no differences were observed between the tested brushes, indicating that, regardless of the design, the interdental brushes are superior to dental floss in interdental plaque control. One possible explanation for this finding is that flossing requires higher ability from the user. Also, taking into consideration the participants of this study (with previous experience of periodontal breakdown), we can suppose that it is easier to use the brushes as compared to floss. These differences were observed in the mean values, which is frequently used as the outcome of efficacy of plaque control (Kiger et al, 1991), but also in the frequency distribution of visible/non-visible plaque (Amato et al, 1986). A very important clinical finding was demonstrated in our study: virtually all surfaces cleaned with interdental brushes were free from visible plaque. From these findings arises a recommendation of using this device whenever space is available. However, systematic research on this specific topic is scarce. The

majority of studies dealing with interdental cleaning is dedicated to flossing and/or dentifrices (Kocher, et al, 2000; Halla-Junior, Oppermann, 2004).

CONCLUSION

In conclusion, for individuals under periodontal maintenance care, interdental toothbrushes, regardless of their shape (conical or cylindric), are more efficacious in interdental supragingival plaque removal than dental floss.

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