

# A comparative study of electric toothbrushes for the effectiveness of plaque removal in relation to toothbrushing duration

## Timerstudy

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**Abstract.** The purpose of the present study was to test the plaque-removing efficacy of 4 different toothbrushes in relation to duration of toothbrushing. The brushes studied were a manual toothbrush (M), a conventional electric toothbrush – the Blend-a-Dent® (BL), the Interplak® (IP) and the Braun Plak Control® (BPC). For this study, 20 subjects were selected. The study was divided into 5 experiments which differed only in respect to the brushing time. The available time in experiment 1 through 5 was 7.5, 15, 30, 45, 90 s per quadrant respectively. Prior to each experiment, all subjects were asked to abstain from oral hygiene procedures for at least 24 h. The efficacy of toothbrushing in each experiment was studied while one investigator (MAL) brushed the teeth of the subjects. In each subject, all 4 brushes were tested. Each brush was assigned to a quadrant in a random order. No toothpaste was used throughout this study. The amount of dental plaque was evaluated before and after brushing by means of the Silness & Løe plaque index at 6 sites around each tooth investigated. The results show an increase in efficacy for all brushes varying from 7.5 s per quadrant to 90 s per quadrant (mean plaque reduction in terms of percentage 7.5 s–90 s: M=40%–75%, BL=45%–82%, BPC=51%–94%, IP=64%–92%). The IP removed significantly more plaque than the other 3 after 7.5 s of brushing. From 15 s through 90 s, the IP and BPC were equally effective. Both were, at all times, significantly more effective than the M and BL. This difference was mainly caused by a greater plaque removal from the interproximal areas, since brushing for 30 s or more with all 4 brushes removed about 90% of the plaque from the vestibular and lingual surfaces. Evaluation of the efficacy in relation to brushing time showed for all brushes that the greater part of the effect is reached after 30 s of brushing per quadrant. The brushing time appears to be an important variable in the evaluation of plaque removing effectiveness since the efficacy increases with time and differs per toothbrush.

Key words: dental plaque; oral hygiene; electric toothbrush; brushing time.

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Many studies have indicated the effectiveness of the toothbrush as the primary contributor to oral hygiene and even today mechanical tooth cleaning remains the most reliable method of controlling supragingival bacterial plaque (Suomi 1971). Failure to comply

and lack of technical skill of the patient lessen the effectiveness of conventional toothbrushing. In order to facilitate and improve the quality of tooth cleaning, a number of electric toothbrushes have been marketed. In general the design of the brushing head and the mode of ac-

tion is similar to the conventional manual toothbrush.

Recently, Braun developed a new type of electric toothbrush (D5) with a mode of action that resembles that of the rotary instruments used professionally in toothcleaning. In a previous study (Van

der Weijden et al. 1993) the efficacy of the Braun Plak Control (BRAUN D5) was evaluated in relation to the conventional electric toothbrush the BRAUN D3 and a manual brush. It was found that the new design, compared to a manual toothbrush, was more effective on the proximal tooth surfaces. Since the development of the electric toothbrush, there has been a continuing controversy relating to its effectiveness compared to a manual toothbrush. Some reports seem to indicate that electric toothbrushes are superior to manual ones in terms of removing plaque and improving gingival health (Glavind & Zeuner 1986, Killoy et al. 1989). However, several other studies conclude that conventional and electric brushes are equally effective (McKendrick et al. 1968, Crawford et al. 1975). The fact that in a number of clinical trials the brushing-time is not specified might be one of the reasons for contradictory data. From a short-term comparison study by Ritsert & Binns (1967) it appeared that if the participants are not given a specific time interval to use to brush their teeth, the brushing time ranges between 30 s and 8 min. According to Hawkins et al. (1986), the duration of toothbrushing has an almost linear effect on the plaque reduction. Based on these findings it was in the previous study (Van der Weijden et al. 1993), decided to standardize the duration of toothbrushing to two minutes, in accordance with studies by other investigators (Walsh & Glennwright 1984, Killoy et al. 1989, Baab & Johnson 1989).

Considering the fact that the duration of toothbrushing was standardized it can be discussed whether it is equitable to state that one brush is 'better' than the other. In other words, one could assume that all brushes can be equally effective if the duration of toothbrushing is *not* standardized.

The purpose of this timer study therefore was to determine the efficacy curve for 4 different toothbrushes, 3 electric brushes and a manual brush.

## Material and Methods

For this study, 20 subjects, dental students and junior staff of the department of periodontology, were selected. They were screened on having at least 24 teeth and the absence of a probing pocket depth of 5 mm or more. Since only the amount of supragingival plaque removal was studied, the subjects were not screened for their general health status

because no invasive methods were to be used.

The study consisted of a single oral prophylaxis followed by 5 experiments. These experiments differed solely in respect to the duration of toothbrushing.

Prior to each experiment all subjects were asked to abstain from oral hygiene procedures for at least 24 h. One examiner (AN) then evaluated the amount of dental plaque by means of the Silness & Løe plaque index (1964). 6 surfaces of each tooth were scored: the buccal and lingual surfaces and the mesial and distal surfaces examined from both the buccal and lingual aspect. This implicates that the index system was slightly modified and the weight upon the interproximal surfaces was increased. Subsequently, in the absence of this examiner, the subject's mouth was brushed by a 2nd examiner (MAL). The brushes studied were a manual toothbrush (M), a conventional electric toothbrush – the Blend-a-Dent® (BL), the Interplak® (IP) and the new designed Braun® Plak Control (BPC). In each subject, all 4 brushes were tested. Each brush was assigned to a quadrant in a random order. The same quadrant was used for each brush throughout this study because of the individual variations in arch anatomy. The form of the arch, the height of the alveolar process (occlusal-apically), and anatomic surface variations should be considered in this respect.

The available time for the brushing procedure differed per experiment. The available time in experiment 1 to 5 was 7.5, 15, 30, 45, 90 s per quadrant respectively, which implies that for a whole mouth between 30 s and 6 min were used. With the help of a stopwatch a sign was given to the second examiner (MAL) when to change brushing from surface, quadrant and brush. No toothpaste was used throughout this study. After finishing the brushing procedure the first examiner (AN) re-evaluated the amount of dental plaque remaining after the professional toothbrushing.

All examinations were performed by the same examiner (AN) under the same conditions. At the time of examinations the examiner was unaware of the brush type used in the different quadrants. Records of earlier examinations were not available to the examiner at the time of re-examination.

## Data analysis

The mean plaque index was calculated for each quadrant in all individuals. First the baseline data for the 4 brushes in each of the 4 quadrants were compared using a Kendall's  $W$ -test.

The difference between 'before' and 'after' brushing scores was used as the variable of response for comparison of the toothbrushes and calculated as a % of the baseline plaque score. Scores were given to the overall plaque index per quadrant (6 surfaces per tooth) and for 7 regions of the mouth: vestibular, lingual, interproximal-vestibular, interproximal-lingual, front, premolars and molars. The front section consisted of the lateral incisor and the canine, the premolar section of the 2 bicuspids and the molar section of the 1st and 2nd molar. For statistical analysis the SPSS/PC+ statistical package for IBM PC was used. The efficacy of each brush in time was tested using the 'Analysis of Variance'. Comparison of the 4 brushes was carried out using the 'Student Newman Keuls' multiple range test. For all additional analysis a Student  $t$ -test was used. Values of  $p < 0.05$  were accepted as statistically significant.

## Results

The mean baseline plaque scores per quadrant varied in this study from 1.29 to 1.43 (Table 1). No statistically significant differences were found for these baseline indices between the 4 quadrants within each experiment.

The mean plaque reduction in terms of percentage is presented in Table 2. For all 4 brush types, the efficacy increases with time, whereas the major part of the effect is reached at 30 s brushing time per quadrant. Up to this time period the effectiveness increases significantly within each of the time intervals as was set in this study.

At 7.5 s, brushing time per quadrant the Interplak removes more plaque than the other three brushes. From 15 s and on, both the Interplak and Braun Plak Control remove approximately the same amount of plaque and are both better than the manual brush and the conventional electric toothbrush. At 90 s per quadrant the Interplak and Braun Plak Control remove 92% and 94%, respectively. In comparison the manual brush removes on average 75% of the

Table 1. Mean plaque index at baseline and end-trial

Exp		M		BL		BPC		IP	
		base	end	base	end	base	end	base	end
I	mean	1.35	0.83	1.31	0.75	1.30	0.66	1.30	0.49
	SD	0.34	0.35	0.29	0.31	0.28	0.34	0.30	0.23
II	mean	1.30	0.63	1.31	0.53	1.32	0.37	1.31	0.35
	SD	0.35	0.32	0.37	0.24	0.31	0.24	0.33	0.21
III	mean	1.37	0.48	1.35	0.38	1.34	0.21	1.34	0.23
	SD	0.33	0.29	0.31	0.23	0.32	0.18	0.32	0.18
IV	mean	1.43	0.38	1.32	0.33	1.36	0.19	1.36	0.16
	SD	0.27	0.19	0.32	0.21	0.29	0.21	0.33	0.15
V	mean	1.43	0.37	1.36	0.26	1.36	0.09	1.40	0.11
	SD	0.26	0.20	0.28	0.19	0.21	0.08	0.27	0.11

Exp: experiment; M: manual, BL: blend-a-dent, BPC: Braun Plak Control, IP: Interplak. I=7.5 s; II=15 s; III=30 s; IV=45 s; V=90 s; SD=standard deviation.

Table 2. Mean plaque reduction in terms of %. Comparison in time

	7.5 s	15 s	30 s	45 s	90 s
manual	40.02	53.91	66.60	74.14	75.07
Blend-a-dent	44.86	60.07	72.93	76.06	81.87
Braun Plak Control	51.43	72.62	84.81	87.24	93.78
Interplak	63.50	74.30	83.37	89.00	92.18

plaque using the same amount of the time. Approximately the same level of plaque removal is reached after 15 s by both the Interplak and Braun Plak Control, 74% and 73% respectively. The Blend-A-Dent removes 82% of the plaque after 90 s of brushing. At 30 s, brushing time per quadrant the Braun Plak Control removes significantly more plaque than the Blend-A-Dent at 45 s (BPC-BL:  $p=0.23$ ) and more than the manual at 45 and 90 s (45 s; BPC-M:  $p=0.002/90$  s; BPC-M:  $p=0.003$ ).

In Figs. 1-3, the results of the anterior and posterior teeth are presented. The tendency is for all 4 brushes that the front teeth are on average cleaned better than the molar teeth. Furthermore, there is an overall improvement in efficacy as the brushing time increases from 7.5 to 90 s per quadrant. Considering the 90% level of plaque reduction only the Interplak and Braun Plak Control reach this level in all 3 analyzed sections. In particular, the manual brush seems to have difficulty in cleaning the molars since after 90 s only 69% of the plaque is removed. Comparison of the Interplak to the Braun Plak Control shows that both brushes remove approximately the same amount of plaque in the three regions. Only at 7.5 s Interplak removes more plaque in the premolar and front region (Figs. 1-3).

The data was furthermore analyzed by dividing the plaque indices of 6 tooth-surfaces into 4 major areas, the vestibular surface, interproximal-vestibular surfaces, interproximal-lingual surfaces and the lingual surface (Table 3).

No significant differences between baseline scores per area were found. Commencing with the manual toothbrush it is evident that after 90 s the

vestibular and lingual surfaces are almost free of plaque. In contrast, the interproximal areas are not as clean. Here the plaque is removed to a level which is reached on the vestibular and lingual surfaces after just 7.5 s brushing. The Blend-A-Dent is more or less as effective as the manual toothbrush although it tends to be more effective than the manual on the lingual surfaces. Both the Interplak and the Braun Plak Control are significantly more effective on the proximal surfaces, while the Braun Plak Control at 90 s removes more plaque than the Interplak from the proximal-lingual surfaces ( $p=0.001$ ).

Table 4 shows the plaque removing efficacy of the four different brushes at the distal surface of the second molar. The Braun Plak Control is compared to the other three brushes. The results show that the Braun Plak Control tends to remove more plaque from the distal surface than the manual brush (significant differences at 30 s and 90 s per quadrant).

## Discussion

This study was designed to test the effect of duration of toothbrushing on plaque reduction for different types of toothbrushes. The design consisted of 24 h plaque accumulation after which the subjects were professionally brushed. This experimental design was developed

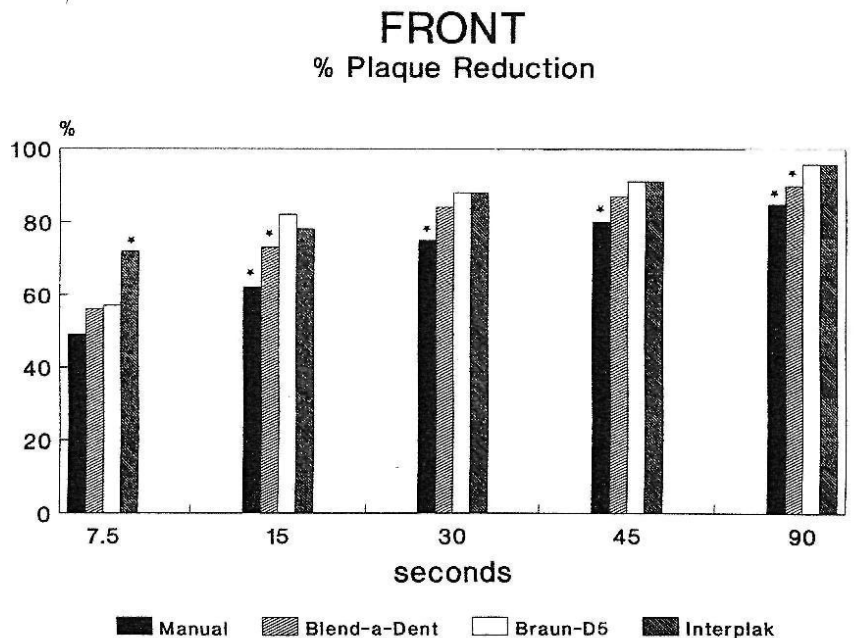


Fig. 1. Plaque reduction in terms of % at the lateral incisor and canine. 5 brushing times are indicated 7.5, 15, 30, 45 and 90 s per quadrant.

\* Statistically significant as compared to the Braun Plak Control (D5).

## PREMOLARS % Plaque Reduction

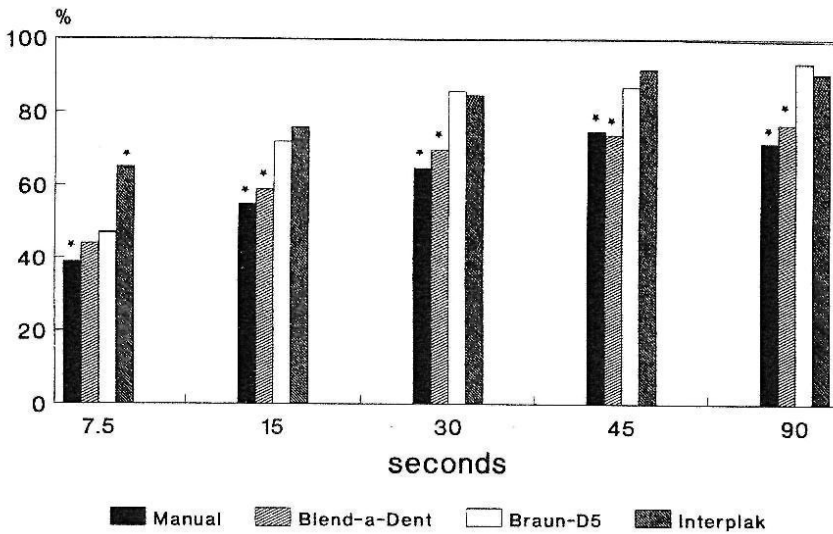


Fig. 2. Plaque reduction in terms of % at the 2 bicuspids. 5 brushing times are indicated 7.5, 15, 30, 45 and 90 s per quadrant.

\* Statistically significant as compared to the Braun Plak Control (D5).

to minimize the effects of other variables which would affect plaque removal, including type of dentifrice, frequency of toothbrushing, technique of toothbrushing, use of other oral hygiene aids, dexterity and motivation differences.

Reviewing the literature concerning studies that investigated the average amount of time spent on brushing reveals the following important data. The least time spent on brushing was observed in a study carried out on uninstructed English school children. In the age group of 13 years, approximately 33 s were spent on brushing (MacGregor & Rugg-Gunn 1985). About 1/3 of the other studies report an average brushing time of less than 56 s (Kleber et al. 1981, MacGregor et al. 1986, Rugg-Gunn & MacGregor 1978, Rugg-Gunn et al. 1978, Douglas 1961) whereas 2/3 report a brushing time of more or equal to 56 s and less than 70 s (Robinson 1946, Dahl & Davis 1954, Dahl & Muhler 1955, Wade 1971, MacGregor & Rugg-Gunn 1979, Emling et al. 1981, Saxer et al. 1983, MacGregor & Rugg-Gunn 1984). One study reported an average of 90 s (Ayer 1965). This investigation was carried out using dental students. All these studies seem to indicate, as has also been concluded by Emling et al. (1981), that the overall average brushing time is about 60 s. For the ease of the discussion, brushing times will be referred to as *num-*

*ber of seconds per quadrant*. The average toothbrushing duration is approximately 60 s per whole mouth and therefore 15 s per quadrant. At 15 s, none of the 4 brushes in this study had achieved their optimal level of plaque removal. Both the Interplak and Braun Plak Control performed best at this brushing time. The major part of the effect was reached

at 30 s which is more than double the average reported brushing time. In all 4 brushes, the efficacy increased up to 90 s.

Comparing the Interplak to the Braun Plak Control, it can be stated that both brushes are equally effective given 15 s. A shorter brushing time appears to be irrelevant since no serious brushing can be carried out. The fact that the Interplak is more effective at 7.5 s is most probably caused by the size of the brush-head. The size of the brushhead of the Interplak is approximately 2 × as large as the Braun Plak Control. Given only 3.25 s per side of a quadrant the Braun Plak Control in most instances did not have enough time to reach and clean all teeth of the quadrant. This supposition is confirmed by the results from the analysis on the three region basis (Fig. 1–3). In all instances, the brushing procedure was started at the last molar and from there the brush was slowly moved to the front teeth. Both the Interplak and Braun Plak Control were equally effective at 7.5 s brushing on the molar teeth whereas the Interplak was more effective than the Braun Plak Control in the premolar region and front region. However the small brush-head of the Braun Plak Control seems to have its advantage on the 'hard to reach' surfaces such as the interproximal-lingual surfaces and distal surface of the second molar (Tables 3b, 4).

Another aspect of the analysis on the 4 surfaces basis is that all 4 brushes

## MOLARS % Plaque Reduction

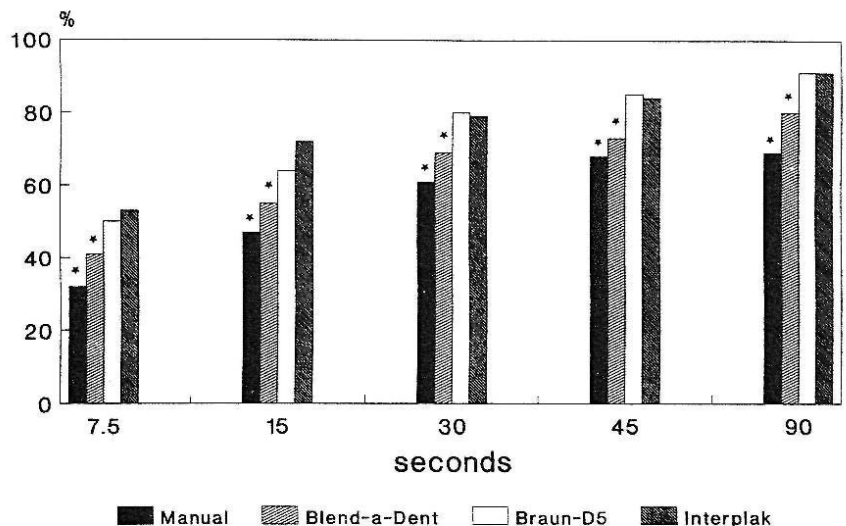


Fig. 3. Plaque reduction in terms of % at the 1st and 2nd molar. 5 brushing times are indicated 7.5, 15, 30, 45 and 90 s per quadrant.

\* Statistically significant as compared to the Braun Plak Control (D5).

Table 3. Mean plaque reduction in terms of % per area in time; the vestibular, lingual, interproximal-vestibular, interproximal-lingual surfaces

s	% plaque reduction									
	vestibular					lingual				
	7.5	15	30	45	90	7.5	15	30	45	90
M	63	82	87	97	98	62	78	84	93	92
BL	54	76	92	93	95	68	88	92	85	97
BPC	71	91	99	99	99	77	95	99	98	99
IP	78	91	96	97	100	84	80	89	93	98

s	% plaque reduction									
	interprox-vestibular					interprox-lingual				
	7.5	15	30	45	90	7.5	15	30	45	90
M	27	41	56	63	65	39	48	62	69	71
BL	35	49	64	67	73	46	56	70	77	82
BPC	40	62	76	79	88	50	69	84	88	97
IP	56	70	79	86	91	59	69	80	89	88

M: manual; BL: Blend-a-dent; BPC: Braun Plak Control; IP: Interplak.

Table 4. Mean reduction in terms of %; at the distal surface of the second molar

	7.5 s	15 s	30 s	45 s	90 s
BPC	30%	58%	82%	82%	91%
manual	25%—	42%—	57%**	71%—	65%**
Blend-a-dent	33%—	58%—	74%—	75%—	83%—
Interplak	36%—	58%—	73%—	88%—	84%—

Statistical significance indicated; per brushing time compared to the Braun Plak Control.

—: not significant; \*\*  $p < 0.01$ .

reached the 90% level on the free surfaces. This data shows that the interproximal areas were not cleaned as effectively as the vestibular and lingual surfaces. This finding is in accordance with Gjerme & Flötra (1970) and Bergenholtz et al. (1984) who reported that toothbrushing alone is insufficient to clean adequately interdentally. At 30 s, all 4 brushes removed about 90% of the plaque from the vestibular and lingual surfaces. Therefore, from these findings, it can be concluded that if one wishes to improve the efficacy of a toothbrush this has to come from an improvement in interproximal cleaning. In this study, the superiority of the Interplak and Braun Plak Control to the Manual toothbrush was mainly the effect of increased efficacy on the proximal surfaces.

It should be emphasized that this test group consisted of young individuals. In most instances within this group the interproximal areas are filled with gingival papillae. Plaque removal from the embrasures is therefore easier than the situation whereby opened interproximal areas are present.

In comparing the Braun Plak Control to other brushes, the 30-s time period (2 min/whole mouth) as chosen in our pre-

vious study, is probably the most suitable. The same holds true for the other three brushes included in this study. However, increase in toothbrushing duration will give an increase in efficacy up to 90 s (6 min/whole mouth) which was the maximum time used in our study. As suggested by other authors (Honkall, Hawkins) duration has a strong effect on plaque removal. Therefore, given the fact that the average whole mouth brushing time is approximately 1 min and the major part of the effect of brushing is reached after approximately 2 min, duration of toothbrushing should be emphasized during dental health education.

In the introduction, the assumption was made that all brushes can be equally effective if given enough time. The results of this study show that this holds true for the vestibular and lingual surfaces. After 90 s, each of the 4 different brushes had removed almost all plaque from these surfaces (Table 3b). The major problem in plaque removal seems to be the interproximal surfaces. Therefore in a toothbrush comparison study the plaque index used should adequately record plaque in the interdental area. The Silness and Loe index, especially when it is recorded on 6 toothsurfaces is highly suitable for this purpose, in which case

the interdental aspect of a tooth makes up 2/3 of the end score of the index. Plaque area indices such as the Quigley & Hein index (1962) are less suitable since these indices are weighted in favor of the vestibular and lingual aspect.

The results of this study indicate that both the Braun Plak Control and Interplak seem to have the ability to remove significantly more plaque than the Manual toothbrush when 6 min or less are spent on toothbrushing. Furthermore the duration of toothbrushing in a comparative study is an important variable. The efficacy increases with time and differs per toothbrush.

## Zusammenfassung

*Vergleich zwischen elektrischen Zahnbürsten; Effektivität der Plaqueentfernung in Bezug auf die Dauer des Zähneputzens. Eine Zeitmessstudie*

Mit der vorliegenden Studie wurde beabsichtigt, die Wirksamkeit der Plaqueentfernung in Bezug auf die Zeitdauer des Zähneputzens bei der Anwendung 4 verschiedener Zahnbürsten zu testen. Es wurden eine manuelle Zahnbürste (M), eine konventionelle Blend-a-Dent Zahnbürste\* (BL), die Interplak\* (IP) und die Braun Plak\* (BPC) Bürste getestet. 20 Probanden wurden für diese Studie ausgewählt. Sie bestand aus 5 Versuchen, die sich nur durch die Zeitdauer des Zähneputzens unterschieden. Die zur Verfügung stehende Zeit für den Versuch 1 war 7.5, 15, 30, 45, 90 Sekunden pro Quadrant in angegebener Reihenfolge. Sämtliche Probanden wurden gebeten, vor jedem Versuch ihre oralen Hygienemaßnahmen mindestens 24 Stunden lang einzustellen. Bei jedem Versuch wurde die Effizienz des Zähneputzens dadurch untersucht, daß ein Untersuchender (MAL) die Zähne der Probanden putzte. Bei jedem Probanden wurden alle 4 Bürsten erprobt. Jede Bürste wurde einem Quadranten nach dem Zufallsprinzip zugeordnet. Zahnpaste wurde in dieser Studie nicht angewandt. Vor und nach dem Zähneputzen wurde die dentale Plaquemenge bei jedem untersuchten Zahn an 6 Stellen nach dem Plaqueindex von Silness & Loe bewertet. Die Ergebnisse zeigen bei allen Zahnbürsten eine, von der Dauer des Zähneputzens (von 7.5 Sek. bis zu 90 Sek. pro Quadrant) abhängige, Verbesserung der Plaqueentfernung (mittlere prozentuale Plaqueentfernung von 7.5 Sek.–90 Sek.: M = 40%–75%, BL = 45%–82%, BPC = 51%–94%, IP = 64%–92%). Die IP hatte nach 7.5 Sek. langem Bürsten signifikant mehr Plaque entfernt als die 3 anderen Zahnbürsten. Von 15 Sek. bis zu 90 Sek. erreichten IP und BPC gleiche Effizienz bei der Plaqueentfernung. Beide waren immer signifikant wirksamer als M und BL. Hauptsächlich wurde dieser Unterschied durch bessere Plaqueentfernung in den approximalen Regionen verursacht, da 30 Sekunden oder längeres Zähneputzen bei allen 4 Zahnbürsten etwa

90% Plaqueentfernung an lingualen und vestibulären Zahnflächen erreichte. Die Auswertung der Plaqueentfernungseffizienz in Bezug auf die Zahnputzzeit zeigte, daß bei allen getesteten Zahnbürsten der hauptsächliche Effekt nach 30 Sek. langem Bürsten pro Quadrant erreicht wird. Die Zeitdauer des Zähneputzens scheint für die Auswertung der Plaqueentfernungseffizienz eine bedeutende Variable zu sein, da sich der Wirkungsgrad mit der Zeitdauer erhöht und je nach Zahnbürste unterschiedlich est.

## Résumé

*Etude comparative de l'efficacité de brosses électriques à enlever la plaque dentaire vis-à-vis de la durée du brossage*

Le but de la présente étude a été de tester l'efficacité de quatre brosses à dents à éliminer la plaque dentaire en relation avec la durée du brossage. Les brosses étudiées étaient une brosse manuelle (M), une brosse à dents électrique conventionnelle: Blend-a-Dent® (BL), l'Interplaque® (IP) et la Braun Plak Control® (BPC). 20 sujets ont été sélectionnés pour cette étude qui a été divisée en cinq expériences variant seulement en ce qui concerne le temps de brossage: 7.5, 15, 30, 45 et 90 s par quadrant. Avant chaque expérience, les sujets n'avaient pu se brosser les dents pendant au moins vingt-quatre heures. L'efficacité du brossage dentaire de chaque expérience a été étudiée lorsqu'un praticien (MAL) brossait les dents des sujets. Chez chaque sujet, les quatre brosses ont été testées d'une manière randomisée dans un quadrant. Aucun dentifrice n'a été utilisé. La quantité de plaque dentaire a été évaluée autour de chaque dent étudiée avant et après le brossage à l'aide de l'Indice de Plaque de Silness et Løe au niveau de six sites. Les résultats ont montré une augmentation de l'efficacité pour toutes les brosses variant de 7.5 s par quadrant à 90 s par quadrant. La réduction moyenne de plaque de 7.5 s à 90 s étaient les suivantes: M=40 à 75%, BL=45 à 82%, BPC=51 à 94% et IP=64 à 92%. La IP enlevait significativement plus de plaque que les trois autres brosses après 7.5 s de nettoyage. Pour les périodes de 15 à 90 s, les IP et BPC avaient une efficacité semblable. Les 2 étaient à tout moment plus efficaces que les M et BL. Cette différence était essentiellement due à une élimination de plaque plus importante au niveau des surfaces interproximales puisque se brosser pendant 30 s ou plus avec les quatre types de brosses à dents enlevait environ 90% de la plaque des surfaces vestibulaires et linguales. L'évaluation de l'efficacité en relation avec le temps de brossage a montré que pour toutes les brosses, la plus grande part de l'efficacité était déjà atteinte après 30 s de brossage par quadrant. Le temps de brossage est donc une variable importante dans l'évaluation de l'enlèvement de la plaque dentaire puisque l'efficacité augmente avec le temps et est différente d'une brosse à l'autre.

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