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MJ Kim
H Noh
HY Oh

Efficiency of professional tooth brushing before ultrasonic scaling

Authors' affiliations:
MJ Kim, Boa Dental Clinic, Seoul, Republic of Korea
H Noh, Department of Dental Hygiene, Wonju College of Medicine, Yonsei University, Wonju-si, Kangwon-do, Republic of Korea
HY Oh, Department of Dental Hygiene, Suwon Sceince College, Hwaseong-si, Gyeonggi-do, Republic of Korea

Correspondence to:
Hiejin Noh
Department of Dental Hygiene
Wonju College of Medicine
Yonsei University 20 Ilsan-ro
Wonju-si, Kangwon-do 220-701
Republic of Korea
Tel.: 82-33-741-0394
Fax: 82-33-735-0391
E-mail: nohh14@yonsei.ac.kr

Abstract: *Objectives:* This study aimed to examine the effect of dental plaque biofilm removal with a toothbrush, an interdental brush and dental floss by a dental hygienist prior to ultrasonic scaling on treatment times and client satisfaction. *Methods:* This study was conducted among adults who received scaling after agreeing to participate in this study at a dental clinic in Seoul, Korea, from July to September 2012. Thirty-seven subjects received modified scaling (*M*-scaling) which is ultrasonic scaling after plaque control with a toothbrush and dental floss by a dental hygienist, and 37 subjects received routine ultrasonic scaling (*R*-scaling). Univariate and multivariate analyses and chi-squared and *t*-tests were conducted using SAS. This study was approved by the Kangwon Institutional Review Board. *Results:* Significant differences were found between the outcomes of *M*- and *R*-scaling for both the ultrasonic scaling time (*M*-scaling, 7.41 ± 6.18 min; *R*-scaling, 23.22 ± 6.92 min) and the total tooth cleaning time (*M*-scaling, 15.92 ± 7.70 min; *R*-scaling, 23.22 ± 6.92 min) ($P < 0.001$). Subject satisfaction with the scaling process was not significantly different between *M*-scaling (4.54 ± 0.80) and *R*-scaling (4.84 ± 0.44). *Conclusions:* These findings indicated that removing the dental plaque biofilm with a toothbrush and dental floss by a hygienist before scaling with an ultrasonic device was more effective in reducing the working time of the dental hygienist.

Key words: dental hygienist; tooth brushing; ultrasonic scaling

Introduction

According to the Fourth Korea National Health and Nutrition Examination Survey (KNHANES), 37.2% of Korean males in their 40s and 49.2% of Korean males in their 50s were found to have contracted a periodontal disease (1). Regular dental check-ups and routine scaling (*R*-scaling) are recommended to prevent periodontal diseases and to maintain oral health (2). However, dental treatment generates different types of anxiety among dental patients. Korean adult males are reluctant to receive scaling, particularly because of hypersensitivity, noise and discomfort in the mouth from the water coolant, among other reasons (3, 4).

Tooth hypersensitivity, which commonly occurs during the ultrasonic scaling procedure, may result from tooth problems, including the exposure of root or dentin. Hypersensitivity may also occur because of an excessive number of scaling procedures and the operation of the ultrasonic scaler on the tooth surface with improper tip angulations (5). Using an ultrasonic scaler reduces treatment times by allowing a shorter amount of time to remove the dental plaque biofilm and dental calculus compared with using manual periodontal instruments. Moreover, this scaler

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relieves clinician fatigue and easily reduces subgingival microflora (5). However, an ultrasonic scaler causes patient discomfort because of pain, vibration, noise and a large volume of water coolant; excessive operation of the instrument may also prove to be detrimental to periodontal health by roughening the root surface (5, 6).

Although *R*-scaling is a cost-effective method of preventing periodontal diseases and dental caries, various burdens of scaling impede patients from undergoing scaling (3, 7). The usage rate of periodontal scaling among dental patients is particularly low in Korea. Thus, various measures must be devised to reduce patient burden by incorporating easier and safer scaling procedures (3, 4).

The authors of this study believed that dental plaque biofilm removal using a toothbrush, an interdental brush and dental floss prior to scaling would be more efficient by reducing the unnecessary operation of ultrasonic devices, patient discomfort, clinician fatigue and treatment times, thereby leading to the satisfaction of both clients and clinicians. This study aimed to examine the effect of dental plaque biofilm removal by professional brushing prior to ultrasonic scaling on treatment times and client satisfaction.

Materials and methods

Subjects

The study included both male and female adults who required scaling. The subjects were recruited from July 2012 to September 2012 from the clients who visited the dental clinic, had no history of scaling within the last 6 months and had more than 20 natural teeth. The study only included those patients who were diagnosed to receive scaling by a calibrated dentist because of calculus for periodontal health and preventing potential periodontal diseases. A total of 100 patients satisfied our inclusion criteria, and 74 subjects agreed to participate in the research programme. None of the subjects had any systemic or oral diseases falling under the contraindications of ultrasonic scaling. In addition, we selected those subjects who were able to undergo scaling without local or general anaesthesia.

Questionnaire

The questionnaire was composed of six questions covering demographic items such as gender, age, job, smoking, systemic disease and medication. It included a five-point Likert scale to establish the scaling satisfaction.

Clinicians and clinical setting

All subjects received tooth cleaning and scaling by a calibrated dental hygienist with 10 years of clinical experience to minimize any errors that might be incurred by different clinicians. The dental examination was also performed by a calibrated dentist. A dental clinic located in Seoul was chosen by simple random sampling as the clinical setting, and the subjects were limited to adult patients visiting the dental clinic.

Oral examination

Each dental examination was performed in the unit chair of the dental clinic by the dentist, and a survey was conducted by distributing questionnaires about each patient's medical and oral history. The subject's periodontal health and oral hygiene statuses were assessed by the oral debris index (S-debris index) and the calculus index (S-calculus index) from the simplified oral hygiene index (8). The number of natural teeth (including artificial crowns), clinical attachment level (CAL) and periodontal index (PI) (9) was also determined. A disclosing solution (Oral-B, *2* tone disclosing solution) was used to measure the S-debris index and S-calculus index and to investigate the remaining dental plaque biofilm and calculus on the tooth surface after the scaling.

Scaling

The *R*-scaling group and modified scaling (*M*-scaling) group were selected with randomization method. The *R*-scaling in this study was defined as complete removal of dental plaque biofilm, calculus and stain accumulated on the supra and subgingival tooth surface with ultrasonic scaler. *M*-scaling was defined as complete removal of dental plaque biofilm with a toothbrush, an interdental brush and dental floss prior to complete removal of dental calculus and stain accumulated on the supra and subgingival tooth surface with an ultrasonic scaler. Thirty-seven patients were randomly selected in the control group to undergo *R*-scaling using an ultrasonic device to remove all dental plaque biofilm and calculus. Meanwhile, 37 patients were randomly selected in the experimental group to undergo *M*-scaling to remove all dental plaque biofilm using a toothbrush, an interdental brush and dental floss after revealing the biofilm with the disclosing solution prior to ultrasonic scaling. We used a piezoelectric ultrasonic device (EMS S.A., Muchen, Switzerland) with tips A and P for both *R*- and *M*-scaling. The toothpick method was used to remove the dental plaque biofilm with a B-10M GC Ruscello brush (GC Fuji, Oyama, Japan), and an interdental brush of short s, ss and sss sizes (Lion Corporation, Tokyo, Japan) and dental floss (Oral-B Super Floss, Cincinnati, Ohio, USA) were used for *M*-scaling to remove the dental plaque biofilm. After the scaling, we applied the disclosing solution to the tooth surfaces to evaluate the remaining deposits. If necessary, we removed all residual deposits.

Institutional Review Board approval and questionnaires

The study was performed after receiving approval from the Kangwon Institutional Review Board (File No. 2012-03-006). The patients provided voluntary informed consent. After each scaling procedure, the subjects were placed in a different area and asked to complete the questionnaire related to scaling.

Statistical analysis

Univariate analyses were used to summarize the general characteristics and oral health status of the subjects according to the tooth cleaning methods used by the dental hygienist. The number of natural teeth was identified by percentile, and the results were matched with 28 at the 50th and 75th percentiles. Subsequently, the number of teeth was analysed by dividing into groups ranging from 22 to 27, 28 and 29 to 32. Moderate periodontitis of <4 mm CAL was used as the standard, and the PI was categorized into 0%, <0–30%≤ and 30%< according to the sites exposed to periodontal disease by more than one occurrence of gingivitis based on the American Academy of Periodontology classification (10). The S-debris index was assessed by a 3-point scale ranging from 0 to 1.0, 1.1 to 2.0 and 2.1 to 3.0 points. The S-calculus index was assessed by a 3-point scale ranging from 0 to 0.09, 0.1 to 1.0 and 1.1 to 2.0 points. Only one subject fell under the category of the 1.1–2.0 S-calculus index in the *M*-scaling group and was, therefore, unsuitable for the statistical analysis (Tables 3 and 4).

The total cleaning time of the *R*-scaling remained unchanged because the calculus and dental plaque biofilm were all removed using an ultrasonic device. By contrast, the plaque control times of the toothbrush, an interdental brush and dental floss use were added to the time taken for ultrasonic scaling in the *M*-scaling procedure. We conducted a frequency test to present the subjects' general characteristics and oral health status, and chi-squared test was utilized to differentiate *R*- and *M*-scaling groups' characters. To evaluate the scaling time needed depending on each subject's oral health status, the mean and standard deviation of the ultrasonic scaling time and total scaling time needed for the *R*- and *M*-scaling were displayed. The subjects' satisfaction was analysed with the *t*-test by the total tooth cleaning time and scaling method based on the oral health status of the subjects. Differences at $P < 0.05$ were considered to be statistically significant, and SPSS version 20 was used for the data analysis.

Results

General characteristics of the subjects

This study involved a total of 74 subjects, with 37 subjects in each of the *R*- and *M*-scaling groups. The percentages of male and female participant were 40.54% and 59.45%, respectively, in the *R*-scaling group and 56.76% and 43.24%, respectively, in the *M*-scaling group. The age distribution was highest in the 30- to 39-year-old age group, followed by the over 50, 20–29 and 30–39 age groups in both the routine and *M*-scaling groups (Table 1).

Scaling methods by the oral health status of subjects

All subjects had 22 or more natural teeth. The subjects with more than 28 natural teeth accounted for 48.65% of all subjects in the *R*-scaling group. The subjects with 22–27 natural teeth accounted for 43.24% of all subjects in the *M*-scaling group. Moreover, 43.24% of the subjects who underwent *R*-scaling did not have sites with clinical attachment loss >4 mm. However, 18.92% of the subjects fell under this category in the *M*-scaling group. Subjects with <30% of the sites with a PI ≥ 1 accounted for the greatest percentage of all cases, with 45.95% in the *R*-scaling group and 59.46% in the *M*-scaling group. The simplified debris index was 0 in 64.86% of the subjects in the *R*-scaling group and ranged from 0.1 to 1.0 in 45.95% of the subjects in the *M*-scaling group. While subjects with points higher than 1.1 on the S-calculus index accounted for 8.11% in the *R*-scaling group, the same accounted for 2.70% in the *M*-scaling group, respectively. In addition, 83.78% of the subjects in the *R*-scaling group and 56.76% of the subjects in the *M*-scaling group were non-smokers. Hence, among various variables, only smoking was significantly different between *R*- and *M*-scaling groups ($P < 0.05$) (Table 2).

Table 1. **Per cent distribution of subjects by general characteristics, *n* (%)**

Variables	Range	*R*-scaling	*M*-scaling	Total
Sex	Male	15 (40.54)	21 (56.76)	36 (48.65)
	Female	22 (59.46)	16 (43.24)	38 (51.35)
Age (year)	20–29	9 (24.32)	6 (16.22)	15 (20.27)
	30–39	13 (35.14)	16 (43.24)	29 (39.19)
	40–49	5 (13.51)	5 (13.51)	10 (13.51)
	50≤	10 (27.03)	10 (27.03)	20 (27.03)
Total		37 (50.00)	37 (50.00)	74 (100)

Time difference due to each subject's oral health status and scaling method

The time needed to complete the routine and *M*-scaling was 23.22 ± 6.92 and 15.92 ± 7.70 min, respectively, which indicated a significant difference between the two scaling methods ($P < 0.05$). Significant differences were found in the time taken for the ultrasonic scaling with respect to all oral health statuses, including the number of natural teeth, clinical attachment loss, PI, simplified debris index, S-calculus index and smoking ($P < 0.05$). The total ultrasonic scaling time for the *M*-scaling group was 7.41 ± 6.18 min. The total cleaning time for the group was 15.92 ± 7.70 which included approximately 9 min required for the plaque control. Yet, it still required relatively less total cleaning time compared to the *R*-scaling group which took 23.22 ± 6.92 min ($P < 0.05$). The total cleaning time varied depending on the oral health status of the subjects, requiring less time in most of the *M*-scaling patients ($P < 0.05$). Significant time differences were not examined for >31% of the sites with >4 mm CAL, 0% of the sites with PI > 1 and non-smokers for the two different scaling techniques (Table 3).

Scaling satisfaction by the general characteristics and oral health status of subjects

The subject satisfaction with the routine and *M*-scaling protocols was evaluated based on a 5-point scale, with scores of

Table 2. **Scaling methods by the oral health status of subjects, *n* (%)**

Variables	Range	*N*	*R*-scaling	*M*-scaling	*P**
No. of natural teeth	22–27	24 (32.43)	8 (21.62)	16 (43.24)	0.110
	28	33 (44.59)	18 (48.65)	15 (40.54)	
	29–32	17 (22.97)	11 (29.73)	6 (16.22)	0.073
Clinical attachment level 4≤ (%)	0	23 (31.08)	16 (43.24)	7 (18.92)	
	>0–30≥	33 (44.59)	13 (35.14)	20 (54.05)	
	30<	18 (24.32)	8 (21.62)	10 (27.03)	
Periodontal index 1≤ (%)†	0	19 (25.68)	13 (35.14)	6 (16.22)	0.176
	>0–30≥	39 (52.70)	17 (45.95)	22 (59.46)	
	30<	16 (21.62)	7 (18.92)	9 (24.32)	
S-debris index‡	0	37 (50.00)	24 (64.86)	13 (35.14)	0.076§
	0.1–1.0	28 (37.84)	11 (29.73)	17 (45.95)	
	1.1–2.0	9 (12.16)	2 (5.41)	7 (18.92)	
S-calculus index¶	0–0.09	32 (43.24)	17 (45.95)	15 (40.54)	1.00§
	0.1–1.0	38 (51.35)	17 (45.95)	21 (56.76)	
	1.1–2.0	4 (5.41)	3 (8.11)	1 (2.70)	
Smoking	No	52 (70.27)	31 (83.78)	21 (56.76)	0.011
	Yes	22 (29.73)	6 (16.22)	16 (43.24)	
	Total	74 (100)	37 (50.00)	37 (50.00)	

*The data were analysed by chi-squared test.
†Periodontal index: score (0.1.2.4.6) for each individual is obtained by arriving at a score for mesial, distal, facial and lingual surfaces of all teeth in the mouth, adding the scores and dividing by the total number of teeth (9).
‡Oral debris index: select one tooth from each sextant with the greatest amount of debris and score (0.1.2.3) the facial and lingual surfaces using designated criteria (8).
§Results of Mantel–Haenszel chi-squared test.
¶Calculus index: select one tooth from each sextant with the greatest amount of calculus and score (0.1.2.3) the facial and lingual surfaces using designated criteria (8).

4.54 ± 0.80 and 4.84 ± 0.44 points, respectively (Table 4). Although satisfaction by different gender and age groups was all higher in the *M*-scaling group, statistically significant differences were not detected. Satisfaction with respect to each subject's oral health status also did not show significant differences in general; however, in cases with 28 natural teeth (5.00 ± 0.00) and an S-debris index of 0 ($P < 0.05$) showed significantly higher satisfaction with the *M*-scaling (4.92 ± 0.28).

Discussion

Possible effects other than removal of calculus and dental plaque biofilm were not considered in this study. We used a piezoelectric ultrasonic instrument, which requires less instrumentation time than and creates similar surface roughness as a magnetostrictive ultrasonic instrument (11, 12). Ultrasonic devices are commonly used for periodontal treatment in Korea. Operating an ultrasonic scaler is more convenient and produces less discomfort than hand instruments. Accordingly, ultrasonic scaler use reduces the required time and efforts of both the subjects and clinicians. This scaler is a remarkably effective device in periodontal treatment (5). The ultrasonic scaler effectively reduces not only the bacterial plaque in periodontal pockets by removing subgingival plaque and calculus but also completely eliminates the diseased cementum and dentine. Furthermore, the device can easily access subgingival and furcation areas and has more applicability in periodontal treatments.

The ultrasonic scaler is a safe and convenient device when properly used on a sound tooth surface at the correct tip angulations, lateral pressure and power level (5, 6, 13). However, dental injury may be generated by inappropriate power control, instrument contact time, angulations and tip shape, tip to tooth surface angle, power level of the unit, sharpness of the cutting edge, lateral pressure on the tooth surface and other factors. In particular, utilization of a worn tip could lead to incorrect angulations which may accelerate tooth surface erosion (5, 14). Despite the effectiveness of ultrasonic scaling, the procedure may cause some discomfort, including pain, vibration, excessive noise, bad taste and high volume of water coolant (15, 16).

According to a survey Korean adults, the noise of dental instruments (27.8%) and sensitivity (50.7%) was highlighted as the most uncomfortable aspects of scaling (4). According to another survey conducted in Hong Kong, 15.3% of the respondents stated that discomfort and pain during the procedure were reasons to avoid scaling. More than 10% of the respondents worried about damage to the teeth or gums because of scaling. Moreover, 28.3% of the respondents regarded increased sensitivity after scaling as a procedural error. More than 40% of the respondents were concerned about dental injury because of poor technique or difficulty in dental scaling as the cause of teeth becoming smaller or thinner (17).

The main purpose of dental scaling is to secure a smooth tooth surface by removing bacterial plaque and calculus. Minimizing the dental scaling procedure by professional brushing before scaling will shorten the treatment time and resolve cli-

ent discomforts, such as potential dental injury and noise, allowing minimal use of ultrasonic devices.

All study subjects had 22 or more natural teeth, and approximately 67% of the subjects had more than 28 natural teeth. Only 24.32% of the subjects had more than 30% of sites with CAL >4 mm. Therefore, the subjects had retained a relatively good oral health status (Table 2). Although the oral health status of the two groups was comparatively similar as the sampling was randomized, among these variables, smoking showed significant differences. When the subjects were analysed according to the time taken to complete ultrasonic scaling, the *R*-scaling performed using an ultrasonic device averaged 23.22 ± 6.92 min, which was relatively shorter than the time reported (32.03 ± 7.79 min) in other previously conducted domestic studies (18). The time taken to complete *M*-scaling using an ultrasonic scaler was drastically reduced to 7.41 ± 6.18 min. The investigators examined the significant difference present in the time of ultrasonic scaler use between the two scaling methods ($P < 0.05$) (Table 3). The total scaling time consisting of dental plaque biofilm removal and *M*-scaling lasted for an average of 15.92 ± 7.70 min, with a time difference of approximately 8 min. *M*-scaling, removing dental plaque biofilm with a toothbrush by a dental hygienist before ultrasonic scaling shortened the total scaling time by approximately 7 min compared with *R*-scaling, removing all deposits from tooth surfaces just with an ultrasonic scaler ($P < 0.05$). Meanwhile, the difference of total cleaning time between *R*- and *M*-scaling was not significant among subjects who smoke (Table 3). Removal of dental plaque biofilm from tooth surfaces may be negatively influenced by smoking as it could cause adverse oral conditions such as gingiva recession and stain (2).

A positive outcome was achieved in terms of subject satisfaction in addition to the shortened procedure time. Based on the 5-point scale of subject satisfaction, the satisfaction with *M*-scaling was as high as 4.84 ± 0.44 points. Satisfaction score with *R*-scaling was 4.54 ± 0.80 points, which was relatively lower than that of *M*-scaling. Satisfaction with *M*-scaling was higher in most categories except for two survey items based on the oral health status: patient age and gender (Table 4).

The two different scaling procedures in the subjects were performed by a single dental hygienist with 10 years of work experience. The statistical analysis on the subject satisfaction was not significant because of the considerably high satisfaction levels in both the *R*- and *M*-scaling groups. However, performing studies on subjects with different oral health statuses by examiners with various clinical experiences is anticipated to produce different conclusions in terms of satisfaction, scaling procedure time and other aspects. Another limitation of this study was in not performing a statistical analysis of the scaling procedure time and satisfaction according to the oral and social characteristics of the subjects because the study included only those patients visiting a dental clinic located in Seoul, which has a relatively favourable oral health status.

The discomfort and treatment time of the subjects could be markedly reduced by applying ultrasonic scaling based on the verified step of this study. Furthermore, ultrasonic scaling based on the verified step of this study can make a positive

Table 3. **Time difference by subjects' oral health status and scaling methods (mean ± SD)**

		Ultrasonic scaling time (minutes)			Total cleaning time (minutes)		
Variables	Range	*R*-scaling	*M*-scaling	*P**	*R*-scaling	*M*-scaling	*P**
No. of natural teeth	22–27	21.25 ± 6.41	6.31 ± 3.00	<0.001	21.25 ± 6.41	14.88 ± 4.33	<0.001
	28	23.17 ± 6.97	8.87 ± 9.06	<0.001	23.17 ± 6.97	18.07 ± 10.86	<0.001
	29–32	24.73 ± 7.46	6.67 ± 2.58	<0.001	24.73 ± 7.46	13.33 ± 3.83	<0.001
Clinical attachment level 4≤ (%)	0	25.25 ± 7.98	5.57 ± 3.37	<0.001	25.25 ± 7.98	13.14 ± 5.79	0.002
	>0–30≥	21.77 ± 6.25	6.20 ± 2.44	<0.001	21.77 ± 6.25	14.65 ± 2.87	<0.001
	30<	21.50 ± 5.15	11.10 ± 10.44	0.016	21.50 ± 5.15	20.40 ± 12.86	0.809
Periodontal index 1≤ (%)†	0	22.69 ± 7.69	12.33 ± 13.87	0.049	22.69 ± 7.69	21.00 ± 17.72	0.830
	<0–30≥	23.00 ± 6.34	6.27 ± 3.09	<0.001	23.00 ± 6.34	14.77 ± 3.69	<0.001
	30<	24.71 ± 7.67	6.89 ± 3.09	0.007	24.71 ± 7.67	15.33 ± 3.35	0.017
S-debris index‡	0	21.21 ± 5.42	5.69 ± 2.81	<0.001	21.21 ± 5.42	13.77 ± 3.06	<0.001
	0.1–1.0	25.00 ± 7.06	8.29 ± 8.69	<0.001	25.00 ± 7.06	16.82 ± 10.74	<0.001
	1.1–2.0	37.50 ± 3.54	8.43 ± 1.27	<0.001	37.50 ± 3.54	17.71 ± 3.64	<0.001
S-calculus index§	0–0.09	20.58 ± 5.98	5.67 ± 3.02	<0.001	20.59 ± 5.98	13.47 ± 4.10	<0.001
	0.1–1.0	23.47 ± 5.46	7.10 ± 2.61	<0.001	23.47 ± 5.46	15.81 ± 3.74	<0.001
	1.1–2.0	36.67 ± 2.89	40.00	–	36.67 ± 2.89	55.00	–
Smoking	No	22.71 ± 6.47	6.95 ± 2.67	<0.001	22.71 ± 6.47	15.43 ± 3.65	<0.001
	Yes	25.83 ± 9.17	8.00 ± 9.02	0.005	25.83 ± 9.17	16.56 ± 11.12	0.084
	Total	23.22 ± 6.92	7.41 ± 6.18	<0.001	23.22 ± 6.92	15.92 ± 7.70	<0.001

*The data were analysed by *t*-test.
†Periodontal index: score (0.1.2.4.6) for each individual is obtained by arriving at a score for mesial, distal, facial and lingual surfaces of all teeth in the mouth, adding the scores and dividing by the total number of teeth (9).
‡Oral debris index: select one tooth from each sextant with the greatest amount of debris and score (0.1.2.3) the facial and lingual surfaces using designated criteria (8).
§Calculus index: select one tooth from each sextant with the greatest amount of calculus and score (0.1.2.3) the facial and lingual surfaces using designated criteria (8).

Table 4. **Scaling satisfaction by the general characteristics and oral health status of subject* (mean ± SD)**

Variables	Range	*N(%)*	*R*-scaling	*M*-scaling	*P*†
Sex	Male	36 (48.65)	4.53 ± 0.83	4.90 ± 0.30	0.118
	Female	38 (51.35)	4.55 ± 0.80	4.75 ± 0.58	0.390
Age (year)	20–29	15 (20.27)	4.67 ± 0.71	4.83 ± 0.41	0.613
	30–39	29 (39.19)	4.69 ± 0.63	4.75 ± 0.58	0.801
	40–49	10 (13.51)	4.60 ± 0.89	5.00 ± 0.00	0.374
	50≤	20 (27.03)	4.20 ± 1.03	4.90 ± 0.32	0.066
No of natural teeth	22–27	24 (32.43)	4.38 ± 0.92	4.75 ± 0.45	0.303
	28	33 (44.59)	4.56 ± 0.86	5.00 ± 0.00	0.042
	29–32	17 (22.97)	4.64 ± 0.67	4.67 ± 0.82	0.935
Clinical attachment level 4≤ (%)	0	23 (31.08)	4.88 ± 0.50	5.00 ± 0.00	0.333
	>0–30≥	33 (44.59)	4.46 ± 0.88	4.90 ± 0.31	0.105
	30<	18 (24.32)	4.00 ± 0.93	4.60 ± 0.70	0.136
Periodontal index 1≤ (%)‡	0	19 (25.68)	4.46 ± 0.88	4.83 ± 0.41	0.341
	>0–30≥	39 (52.70)	4.76 ± 0.66	4.91 ± 0.29	0.413
	30<	16 (21.62)	4.14 ± 0.90	4.67 ± 0.71	0.231
S-debris index§	0	37 (50.00)	4.54 ± 0.83	4.92 ± 0.28	0.050
	0.1–1.0	28 (37.84)	4.45 ± 0.82	4.94 ± 0.24	0.082
	1.1–2.0	9 (12.16)	5.00 ± 0.00	4.43 ± 0.79	0.103
S-calculus Index¶	0–0.09	32 (43.24)	4.71 ± 0.69	4.93 ± 0.26	0.218
	0.1–1.0	38 (51.35)	4.29 ± 0.92	4.76 ± 0.54	0.076
	1.1–2.0	4 (5.41)	5.00 ± 0.00	5.00 ± 0.00	–
Smoking	No	52 (70.27)	4.48 ± 0.85	4.86 ± 0.48	0.049
	Yes	22 (29.73)	4.83 ± 0.41	4.81 ± 0.40	0.915
	Total	74 (100)	4.54 ± 0.80	4.84 ± 0.44	0.053

*Five-Point Likert Scale.
†The data were analysed by *t*-test.
‡Periodontal index: score (0.1.2.4.6) for each individual is obtained by arriving at a score for mesial, distal, facial and lingual surfaces of all teeth in the mouth, adding the scores and dividing by the total number of teeth (9).
§Oral debris index: select one tooth from each sextant with the greatest amount of debris and score (0.1.2.3) the facial and lingual surfaces using designated criteria (8).
¶Calculus index: Select one tooth from each sextant with the greatest amount of calculus and score (0.1.2.3) the facial and lingual surfaces using designated criteria (8).

impact on oral health care by motivating people to perform self-oral hygiene care and could enhance the recognition level of the importance of tooth brushing to both dental hygienists and subjects.

Conclusion

This study was performed to devise methods to boost subject satisfaction and shorten the treatment time by changing the dental scaling procedures in a dental clinic located in Seoul. Consequently, the study was able to reduce the time of ultrasonic devise use and the total scaling time by applying a remarkably changed scaling method that does not require any new dental equipment or additional training to dental hygienists and is also cost-effective. Further studies on subjects with different oral and medical statuses are thought to be crucial for client-centred dental hygiene care.

Clinical relevance

Scientific rationale for the study

The main purpose of dental scaling is to smooth the tooth surface by removing bacterial plaque and calculus. However, using an ultrasonic device for scaling can cause patient discomfort.

Principle findings

When the subject's teeth are cleaned with a toothbrush to remove dental plaque biofilm before scaling with an ultrasonic device, the total scaling time and instrumentation frequency with the ultrasonic device can be reduced.

Practical implications

A toothbrush is a proper instrument to remove dental plaque biofilm on the tooth surface; however, clinicians rarely use it during dental practice. This study indicates the effective use of a toothbrush in the dental clinic.

Conflict of interests

The authors declare that they have no conflict of interests.

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