Journal of Dental Sciences (2014) 9, 400—406

Available online at www.sciencedirect.com

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ORIGINAL ARTICLE

Clinical and microbiological effects of quadrant versus full-mouth root planing—A randomized study

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Received 13 March 2013; Final revision received 9 June 2013
Available online 6 August 2013

KEYWORDS
periodontal therapy;
periodontitis;
polymerase chain reaction;
scaling and root planing

Abstract *Background/purpose:* Periodontitis is a destructive inflammatory disease of the tooth-supporting tissues caused mainly by Gram-negative microorganisms. Disruption and removal of the subgingival biofilm are the primary objectives of cause-related initial periodontal therapy. The aim of this study was to compare the clinical and microbiological effects after single-visit full-mouth debridement and quadrantwise therapy.
Materials and methods: Forty patients diagnosed with chronic periodontitis were randomly assigned to one of the following two treatment protocols: (1) scaling and root planing, quadrant by quadrant, at 1-week intervals and (2) full-mouth scaling and root planing performed in 2 consecutive days. Plaque index, gingival index (GI), papilla bleeding index, probing depth, and clinical attachment level were used to assess the periodontal status of the patients. Polymerase chain reaction was used to determine the presence of *Porphyromonas gingivalis*, *Tannerella forsythia*, *Prevotella intermedia*, and *Aggregatibacter actinomycetemcomitans* in subgingival plaque.
Results: Both treatment modalities resulted in significant clinical improvement, without evident difference between the two groups. Likewise, no differences were detected for selected target bacteria, except for *A. actinomycetemcomitans*, the level of which was reduced significantly in the full-mouth root planing (FMRP) group ($P = 0.007$).
Conclusion: Results of the present study indicate similar clinical outcomes following both treatment modalities. Although all four species responded more favorably to FMRP, the only

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http://dx.doi.org/10.1016/j.jds.2013.06.005

statistically significant decrease was recorded in the case of *A. actinomycetemcomitans* after therapy in this group of patients.

Introduction

Scaling and root planing is the most common and most effective treatment for periodontitis, and includes removal of supra- and subgingival microbial deposits. Numerous studies have been conducted with the aim to determine the beneficial effects of scaling and root planing on both clinical and microbiological parameters.[1–3] Moreover, many authors have demonstrated that plaque removal leads to the resolution of inflammation and can prevent further disease progression.[1,4] It has been shown that with subgingival debridement it is possible to reduce total viable bacterial counts[5] and pocket depths, as well as to improve clinical attachment levels (CALs).

The traditional modality of nonsurgical periodontal therapy includes scaling and root planing performed in a quadrant- or sextant-wise manner and is usually completed within 4–6 weeks. Nonetheless, several studies indicated that periodontopathogens could be found not only in periodontal pockets but also on the tongue, tonsils, and other oral mucous membranes.[6,7] In addition, as recently scaled and root-planed pockets have been shown to be recolonized by pathogenic bacteria from residual untreated pockets or other intraoral niches, such translocation can result in early reinoculation and recurrence of the disease.[8]

In order to minimize the possibility of bacterial recolonization, Quirynen et al[9] introduced the "one-stage full-mouth disinfection", where scaling and root planing was performed in two sessions within 24 hours, supplemented with supra- and subgingival use of chlorhexidine. Such an approach was considered to yield improved clinical and microbiological results when compared with conventional quadrant-by-quadrant scaling and root planing. Many studies using this protocol have reported significant improvements of the clinical and microbiological parameters in patients diagnosed with chronic periodontitis in comparison with traditional periodontal treatment.[10,11] Mongardini et al[12] reported that one-stage full-mouth disinfection yielded more pronounced reduction in probing depth (PD) and gain in attachment up to 8 months compared to conventional periodontal treatment.

However, more recent studies conducted to compare between quadrantwise mechanical periodontal therapy and the treatment within 24 hours failed to demonstrate significant differences in either clinical or microbiological parameters.[13–18] Evaluating the effects of different protocols over a 6-month period, Koshy et al[19] reported significant improvements in both groups of patients compared to baseline measurements. The authors concluded that, even though single-visit full-mouth mechanical debridement might have limited additional benefits over the quadrantwise therapy in the treatment of periodontitis, it could be completed in a shorter time. Accordingly, both protocols were shown to be effective for the treatment of chronic periodontitis.

Although both therapeutic protocols have unambiguously been shown to yield equally positive results, full-mouth root planing (FMRP) can offer some practical benefits to the patients, such as time saving, less absence from work, and a shorter abstinence period from some systemic therapies such as those using anticoagulants, which have been shown to decrease the systemic risk caused by the discontinuation of medication.[20] Moreover, this will provide clear guidelines to the dentists providing this type of therapy.

Considering contradictory results published so far, the aim of this study was to evaluate, in our group of patients, the clinical and microbiological efficacies of single-visit full-mouth debridement in comparison with the traditional quadrantwise therapy.

Materials and methods

Selection of participants

The study population included 40 adult patients (31 females and 9 males, aged 49.75 ± 9.65 years) suffering from chronic periodontitis. All patients had a minimum of 21 teeth, with at least two teeth per quadrant, with a minimum PD of 5 mm and bleeding on probing. Exclusion criteria were as follows: evidence of systemic diseases or use of medication that can affect the periodontal tissue, use of antibiotics during the previous 3 months, periodontal treatment within the previous 6 months, and pregnancy.

The clinical study was carried out in the Department of Periodontology, Clinic for Dentistry, Medical Faculty, Novi Sad, Serbia.

The study was approved by the Ethics Committee at the Medical Faculty in Novi Sad. Informed consent was obtained from all the study participants before commencement of treatment, after they were provided with verbal and written explanation regarding the nature of the study.

Patients were randomized into two groups according to a computer-generated list provided by a person not involved in the study: (1) scaling and root planing, quadrant by

Table 1 Patient characteristics at baseline.[a]

	QRP ($n = 20$)	FMRP ($n = 20$)
Age (y) (range)	48.75 (32–63)	50.75 (32–75)
No. of male/female	5/15	4/16
No. of smokers	3	4

FMRP = full-mouth root planing; QRP = quadrant root planing.
[a] No significant difference between groups ($P > 0.05$).

quadrant, at 1-week intervals and (2) full-mouth scaling and root planing within 2 consecutive days. Patient characteristics are presented in Table 1.

Clinical examination

All participants were examined at baseline, as well as at 1 month and 3 months following the completion of treatment with a Michigan "O" probe with William's markings.

The following variables were recorded at the mesial, buccal, distal, and lingual surfaces of each tooth: plaque index (PI) according to Silness and Löe,[21] gingival index (GI) according to Löe and Silness,[22] papilla bleeding index (PBI) according to Saxer and Mühlemann,[23] PD was calculated as the distance in millimeters from the gingival margin to the bottom of the pocket, and CAL was calculated as the distance in millimeters from the cementoenamel junction to the bottom of the pocket.

All the measurements have been conducted by the same investigator blind to the therapeutic protocol applied.

Microbiological analysis

Subgingival plaque samples were collected from the deepest pocket in each quadrant and pooled for microbiological analysis. After removal of supragingival plaque and isolation of the site with cotton rolls, the subgingival samples were taken using individual sterile Gracey curettes. Plaque samples were placed immediately in separate Eppendorf tubes containing saline solution and stored at $-80\ ^{\circ}C$ until further processing at the Department of Human Genetics, School of Dentistry, Belgrade. Plaque samples were collected before and 3 months after treatment at the same site.

Polymerase chain reaction analysis

Periodontopathogens were detected by means of multiplex polymerase chain reaction (PCR) using the following primers: *Porphyromonas gingivalis* (Pg1: 5′ CAA TAC TCG TAT CGC CCG TTA TTC 3′),[24] *Aggregatibacter actinomycetemcomitans* (Aa1: 5′ CAC TTA AAG GTC CGC CTA CGT GC 3′),[24] *Tannerella forsythia* (TF V530: 5′ GTA GAG CTT ACA CTA TAT CGC AAA CTC CTA 3′),[25] and *Prevotella intermedia* (Pi: 5′GTT GCG TGC ACT CAA GTC CGC C 3′).[25]

For PCR, the samples were dispersed by vortex for 1 minute and subsequently boiled for 10 minutes. PCR was performed in a reaction volume of 25 μL containing PCR buffer, 0.2 mm of each Deoxyribonucleotide triphosphate (dNTP), 0.2 μM of each primer, 0.5 U *Taq* DNA polymerase, and 3—5 μL of template DNA containing supernatant.

The amplification was performed in a DNA thermal cycler programmed at 94°C (5 minutes), followed by 35 routine cycles at 94°C (1 minute), annealing at temperatures adequate for each primer pair (1 minute), and extension at 72°C (1 minute 30 seconds), as well as a final extension at 72°C (5 minutes). The amplicons were visualized on 8% native polyacrylamide gels stained with ethidium bromide, and visualized on a UV transilluminator. For the negative control, DNA samples were replaced by distilled water.

Treatment

As noted above, the participants were randomly assigned to one of the following groups: the FMRP group, where 20 patients were treated in two sessions with subgingival scaling and root planing within 24 hours on 2 consecutive days, starting with the right maxillary and mandibular quadrants; and the quadrant root planning (QRP) group, where 20 patients were treated with subgingival scaling and root planing, quadrant by quadrant, starting in the upper right jaw and proceeding clockwise in four sessions at weekly intervals. Each patient was given oral hygiene training.

Scaling and root planing was performed under local anesthesia (2% lidocaine with adrenaline 1:100.000) using periodontal curettes (Gracey Access curettes, Kohler, Austria) and ultrasonic scalers (Mini Piezon, Electro-Medical Systems, Nyon, Switzerland), without additional use of antiseptics or antibiotics. The same therapist provided all oral hygiene instructions and performed subgingival debridement.

Statistical analysis

Statistical analysis was performed using the software SPSS 16.0 for Windows (SPSS Inc., Chicago, IL, USA). The assumption of equality of the clinical parameter values (mean $\pm$ standard deviation) between the QRP and FMRP group of patients, as well as in each group before and after treatment was tested by conducting the t test (for normal distribution) and the Wilcoxon test (for no normal distribution). The percentages of bacterial frequencies were compared between groups using Fisher's and Chi-square test.

A Chi-square test was also used to test for differences in proportions of numbers of sites with $PD \leq 4$ mm, $5\ mm \leq PD < 7$ mm and $PD \geq 7$ mm between two treatment groups. The correlation between the clinical and microbiological parameters was evaluated with the Spearman correlation at a statistical significance of $P < 0.05$.

Results

Clinical improvements

The eligible sample population was recruited from a total of 120 patients who attended the Department of Periodontology, Clinic for Dentistry, Novi Sad, Serbia, during 2011. After screening for the exclusion criteria, which have been described earlier, 48 patients with chronic periodontitis were recruited for the study. Subsequently, eight more patients were excluded from the study for various reasons, including failure to attend their appointment twice ($n = 6$; QRP $n = 4$, FMRP $n = 2$) and intake of antibiotics during treatment ($n = 2$; QRP $n = 1$, FMRP $n = 1$). One of the participants was prescribed antibiotics for a periodontal abscess and another for a sinusitis infection.

There were no statistically significant differences between the two treatment groups in terms of clinical parameters before treatment. After treatment, in both groups, significant reductions of PI, GI, and PBI could be observed at each control examination point. CAL and PD were also improved significantly when compared to the baseline. Both therapy protocols resulted in significant reductions in PD for moderate (5 mm $\leq$ PD $<$ 7 mm) and deep periodontal pockets (PD $\geq$ 7 mm).

However, there was no statistically significant difference between the FMRP and QRP groups in the reductions in clinical parameters at any point in time (Table 2).

The number of sites with a PD of 7 mm or more was also reduced 1 month and 3 months following treatment. In addition, 3 months after treatment, the proportion of pockets with PD $\geq$ 7 mm was slightly lower in the FMRP group compared to the QRP group. By contrast, at 1- and 3-month time points, in the QRP group, proportion of pockets with PD $\leq$ 4 mm was higher, although not significantly (Table 3).

Table 3 Changes in the number (%) of sites with PD $\leq$ 4 mm, 5 $\leq$ PD $<$ 7, and PD $\geq$ 7.[a]

	Baseline	1 mo	3 mo	P[d]
PD $\leq$ 4 mm				
FMRP[b]	1581 (90.4)	1643 (94.0)	1665 (95.3)	0.91
QRP[c]	1563 (88.9)	1658 (94.3)	1652 (94.0)	
5 mm $\leq$ PD $<$ 7 mm				
FMRP	137 (7.98)	85 (4.84)	75 (4.27)	0.72
QRP	171 (9.78)	91 (5.20)	90 (5.15)	
PD $\geq$ 7 mm				
FMRP	30 (1.71)	19 (1.08)	12 (0.68)	0.45
QRP	22 (1.26)	8 (0.46)	10 (0.57)	

Data are presented as *n* (%).
FMRP = full-mouth root planing; PD = probing depth; QRP = quadrant root planing.
[a] Chi-square test.
[b] *N* (FMRP) = 1757 sites.
[c] *N* (QRP) = 1748 sites.
[d] No statistically significant differences were noted between QRP and FMRP treatment groups during the time (P $>$ 0.05).

Microbiological results

Microbiological results indicate that most of the patients were PCR positive for periodontal pathogens pretreatment, with no differences in the frequency of detection for any of the tested species between groups. Three months after the patients received therapy, both treatment protocols resulted in reduction of the number of patients positive for *P. gingivalis* and *P. intermedia*; however, this decline was not statistically significant. The number of patients in the FMRP group positive for *T. forsythia* and

Table 2 Clinical findings before and after therapy.[a,b]

	Baseline	1 mo	3 mo	Baseline−1 mo	Baseline−3 mo	Mean difference (baseline−3 mo) CI
PI						
FMRP	1.17 ± 0.48	0.56 ± 0.34	0.43 ± 0.24	0.61 ± 0.39***	0.74 ± 0.33***	0.053
QRP	1.10 ± 0.34	0.58 ± 0.28	0.41 ± 0.21	0.52 ± 0.39***	0.69 ± 0.37***	(−0.172, 0.277)
GI						
FMRP	0.97 ± 0.62	0.41 ± 0.47	0.21 ± 0.26	0.56 ± 0.49***	0.76 ± 0.48***	0.033
QRP	1.05 ± 0.58	0.53 ± 0.44	0.32 ± 0.35	0.52 ± 0.51***	0.73 ± 0.57***	(−0.304, 0.369)
PBI						
FMRP	1.46 ± 0.86	0.93 ± 0.62	0.85 ± 0.80	0.53 ± 0.84**	0.62 ± 0.88**	0.085
QRP	1.32 ± 0.70	0.76 ± 0.29	0.78 ± 0.42	0.56 ± 0.59***	0.53 ± 0.56***	(−0.386, 0.556)
PD (mm)						
FMRP	2.72 ± 0.80	2.26 ± 0.77	2.14 ± 0.84	0.47 ± 0.58**	0.58 ± 0.78**	0.136
QRP	2.91 ± 0.50	2.48 ± 0.47	2.47 ± 0.39	0.44 ± 0.30**	0.44 ± 0.28**	(−0.239, 0.510)
CAL (mm)						
FMRP	1.81 ± 1.17	1.32 ± 0.99	1.22 ± 0.92	0.50 ± 0.51***	0.59 ± 0.60***	0.383
QRP	2.30 ± 1.01	1.55 ± 0.88	1.33 ± 0.83	0.75 ± 0.49***	0.97 ± 0.75***	(−0.816, 0.050)
5 mm $\leq$ PD $<$ 7 mm						
FMRP	5.22 ± 3.12	3.54 ± 0.64	3.69 ± 1.03	1.68 ± 0.64***	1.53 ± 0.93***	0.397
QRP	5.27 ± 0.23	3.59 ± 0.66	3.91 ± 0.56	1.68 ± 0.64***	1.35 ± 0.61***	(−0.145, 0.938)
PD $\geq$ 7 mm						
FMRP	7.48 ± 0.40	5.37 ± 0.73	5.27 ± 1.18	2.11 ± 0.46***	2.21 ± 0.88***	0.000
QRP	7.37 ± 0.59	5.32 ± 0.47	5.06 ± 0.66	2.06 ± 0.56***	2.31 ± 0.78***	(−1.151, 1.151)

Data are presented as mean ± SD.
** P $<$ 0.01.
*** P $<$ 0.001.
CAL = clinical attachment level; CI = confidence interval; FMRP = full-mouth root planing; GI = gingival index; PBI = papilla bleeding index; PD = probing depth; PD $\geq$ 7 = deep pockets; PI = plaque index; QRP = quadrant root planning; SD = standard deviation; 5 $\leq$ PD $<$ 7 = moderately deep pockets.
[a] P values represent longitudinal changes from baseline within QRP and FMRP groups (*t* test).
[b] No statistically significant differences were noted between QRP and FMRP treatment groups (P $>$ 0.05; *t* test).

Table 4 Percentage of patients positive for the four putative periodontal pathogens before and after QRP and FMRP.

	Before treatment	After treatment	Change (before − after)	P[a]	P[b]
Aa					
FMRP	15 (75)	6 (30)	9 (45)	0.007**	0.006**
QRP	13 (65)	13 (65)	0 (0)	1.000	
Pg					
FMRP	15 (75)	11 (55)	4 (20)	0.102	0.648
QRP	17 (85)	16 (80)	1 (5)	0.655	
Pi					
FMRP	17 (85)	14 (70)	3 (15)	0.083	0.597
QRP	16 (80)	14 (70)	2 (10)	0.317	
Tf					
FMRP	17 (85)	14 (70)	3 (15)	0.257	0.149
QRP	16 (80)	16 (80)	0 (0)	1.000	
All					
FMRP	11 (55)	2 (10)	9 (45)	0.003**	0.031*
QRP	9 (45)	7 (35)	2 (10)	0.157	

Data are presented as *n* (%).
*P < 0.05.
**P < 0.01.
Aa = *Aggregatibacter actinomycetemcomitans*; FMRP = full-mouth root planing; *Pg* = *Porphyromonas gingivalis*; *Pi* = *Prevotella intermedia*; QRP = quadrant root planing; *Tf* = *Tannerella forsythia*.
[a] P value represents longitudinal changes within each group (Wilcoxon signed-rank test).
[b] P value represents differences between QRP and FMRP groups (Pearson Chi-square test).

A. actinomycetemcomitans was reduced by 15% and 45%, respectively, whereas in the QRP group, all the patients who were initially positive for *T. forsythia* and *A. actinomycetemcomitans* were still positive 3 months after treatment (Table 4).

When the two groups were compared, no statistically significant difference was detected in the detection frequency of the periodontal pathogens after treatment, except for *A. actinomycetemcomitans*, which was more reduced in the FMRP group (P = 0.007).

In the FMRP group, all four tested species were found in 55% and 10% of patients before and after treatment, respectively, which was a statistically significant decrease (P = 0.003). By contrast, in the QRP group, all four tested species were found in 45% of the patients earlier, and in 35% of patients after treatment; however, this decline was not at the statistically significant level (P = 0.157; Table 4).

A. actinomycetemcomitans showed a significant positive correlation with PD ≥ 7 mm in the FMRP group and with CAL in the QRP group 3 months after the therapy. In addition, there was a significant negative correlation at this time between *A. actinomycetemcomitans* and PBI in the QRP group (Table 5).

Discussion

The aim of this study was to compare clinical and microbiological effects following either quadrantwise therapy or full-mouth scaling and root planing.

Both treatment strategies resulted in similar and significant (P < 0.01) improvements in PI, GI, PBI, and CAL from baseline at 1 month and 3 months following the completion of therapy (Table 2). The present results indicate a continuous clinical improvement at 1 month and 3 months, thus confirming previous findings of Badersten et al.[26] Moreover, in our study, the PD in the area of an initial pocket depth of 4–6 mm decreased by 1.35 mm after QRP and 1.53 mm after FMRP. Lee et al[20] reported a PD in the area of an initial pocket depth of 4–6 mm, which decreased by 1.4 mm and 1.7 mm after QRP and FMRP, respectively.

However, there were no significant differences in the clinical effectiveness between QRP and FMRP. These findings are in accordance with the results reported by

Table 5 Correlations between clinical and microbiological parameters 3 months after treatment.

	PI	GI	PBI	PD	CAL	5 mm ≤ PD < 7 mm	PD ≥ 7 mm
Aa							
FMRP	0.057	0.000	0.152	0.208	0.038	−0.157	0.840*
QRP	−0.173	−0.310	−0.500*	0.091	0.464*	−0.170	0.000
Pg							
FMRP	0.166	0.262	0.025	−0.113	0.157	−0.090	−0.396
QRP	0.347	−0.316	−0.477	0.043	0.043	0.258	0.000
Pi							
FMRP	0.019	−0.104	−0.133	0.095	−0.095	0.412	0.315
QRP	−0.123	−0.144	−0.095	0.360	−0.322	0.132	−0.198
Tf							
FMRP	0.066	−0.123	−0.190	0.378	0.095	0.367	−0.133
QRP	−0.108	0.109	0.412	0.347	−0.347	−0.057	0.399

* Significant correlations (Spearman correlation).
Aa = *Aggregatibacter actinomycetemcomitans*; CAL = clinical attachment level; FMRP = full-mouth root planing; GI = gingival index; PBI = papilla bleeding index; PD = probing depth; PD ≥ 7 = deep pocket; *Pg* = *Porphyromonas gingivalis*; PI = plaque index; *Pi* = *Prevotella intermedia*; QRP = quadrant root planning; *Tf* = *Tannerella forsythia*; 5 ≤ PD < 7 = moderately deep pockets.

Apatzidou and Kinane[13] and Koshy et al[19] who also failed to find statistically significant differences between the two treatment modalities.

The results reported here thus failed to demonstrate additional clinical benefits of FMRP, as proposed by Quirynen et al.[9] The reasons behind this finding could be that we changed the original protocol for one-stage full-mouth disinfection proposed by Quirynen et al, [9] and did not use chlorhexidine for pocket irrigation and additional disinfection of other intraoral niches. Yet, in our opinion, this is unlikely because other authors who compared between full-mouth scaling with or without the use of antiseptics and quadrant scaling found only minor differences between the treatment strategies for adults diagnosed with chronic periodontitis.[27,28]

Several authors compared the microbiological effects of full-mouth disinfection with quadrantwise root planing, reporting differing results. For example, the studies by Quirynen et al[9,29] and De Soete et al[30] indicated advantages of the full-mouth approach versus quadrantwise treatment. By contrast, Apatzidou and Kinane[13] and Jervøe-Storm et al[16] reported no significant differences between the groups for the bacterial load. Nevertheless, a comparison between studies is difficult due to their differences with respect to sampling time points, sampling methods, and microbiological techniques applied. Quirynen et al[29] used differential phase contrast microscopy for microbiological investigation and conducted the analysis with bacterial cultivation, which may have some limitations in the identification of subgingival periodontal microorganisms. Apatzidou et al[31] used PCR and Jervøe-Storm et al[16] used real-time PCR for bacterial identification. In the present study, PCR was used for the detection of periodontal pathogens, as it is a rapid and sensitive method for the detection of bacterial DNA sequences,[32,33] but this method does not provide a quantitative analysis of the pathogens.

In our study, no differences in the frequency of detection for tested species were found at baseline between the two groups. In the QRP group, the treatment resulted in a negligible reduction in the levels of *P. gingivalis* and *P. intermedia* 3 months after the completion of the procedure, whereas the prevalence of *A. actinomycetemcomitans* and *T. forsythia* did not change at all. Several authors reported that conventional periodontal therapy is not effective in reducing the levels of *A. actinomycetemcomitans*.[34,35] Our findings contradict those of Haffajee et al,[36] who found a significant decrease in the mean prevalence of *P. gingivalis* and *T. forsythia*. However, the authors used checkerboard DNA—DNA hybridization for microbial analysis.

In the FMRP group, the relative proportions of *A. actinomycetemcomitans* were reduced for 45% patients 3 months after treatment, and this difference was statistically significant ($P = 0.007$). Zijnge et al[37] speculate that a single-session FMRP provokes a quantitatively more pronounced acute immune response when compared to QRP. This quantitative difference in the immune response may explain the more pronounced reduction in the detection frequencies of the pathogens by FMRP found in this study.

Although FMRP was more successful in eliminating the four tested species, this difference did not result in improved clinical outcomes following FMRP, when compared to the QRP protocol. Periodontal diseases result from an interaction of environmental, host, and microbial factors, and the mere presence or absence of a single species is not a sufficient factor for the clinical success of therapy.

Despite uncertain success of full-mouth disinfection, its use has some practical benefits. It will be convenient for some patients if treatment can be completed in a single visit, especially if it yields results similar to those achieved by the conventional treatment. FMRP is particularly effective when the risk of cross-contamination is high as a result of inadequate plaque control and massive deposition of plaque and calculus in the untreated areas.[20]

Conversely, carrying out the entire treatment over one or two sessions for a full-mouth disinfection procedure does not provide as frequent opportunities for inducing patient motivation and oral hygiene monitoring as does the conventional treatment. This may be seen as a limitation of full-mouth therapy, unless more frequent recall appointments, specifically aimed at monitoring plaque control, are scheduled.

Furthermore, according to current clinical recommendations, both modalities may be recommended for debridement, and clinicians should choose the modality of debridement according to the needs and preferences of patients, their personal skills and experience, the logistic setting of the practice, and cost effectiveness of the therapy rendered.

In conclusion, results of the present study indicate similar clinical outcomes following both treatment modalities. Although all four species responded more favorably to FMRP, a statistically significant decrease was recorded only in case of *A. actinomycetemcomitans* following treatment in this group of patients.

Conflicts of interest

The authors declare that there are no conflicts of interest that could influence their work.

Acknowledgments

This study was financially supported by Research Grant No. 175075 from the Ministry of Education and Science of Serbia.

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