The recolonization hypothesis in a full-mouth or multiple-session treatment protocol: a blinded, randomized clinical trial


Abstract
Aim: To test recolonization of periodontal lesions after full-mouth scaling and root planing (FM-SRP) or multiple session-SRP (MS-SRP) in a randomized clinical trial and whether FM-SRP and MS-SRP result in different clinical outcomes.

Materials and Methods: Thirty-nine subjects were randomly assigned to FM-SRP or MS-SRP groups. At baseline and after 3 months, probing pocket depth (PPD), plaque index (PII) and bleeding on probing (BoP) were recorded. At baseline, immediately after treatment, after 1, 2, 7, 14 and 90 days, paper point samples from a single site from the maxillary right quadrant were collected for microbiological analysis of five putative pathogens by polymerase chain reaction.

Results: FM-SRP and MS-SRP resulted in significant reductions in PPD, BoP and PII and the overall detection frequencies of the five species after 3 months without significant differences between treatments. Compared with MS-SRP, FM-SRP resulted in less recolonization of the five species, significantly for Treponema denticola, in the tested sites.

Conclusion: FM-SRP and MS-SRP result in overall clinically and microbiologically comparable outcomes where recolonization of periodontal lesions may be better prevented by FM-SRP.

Conflict of interest and sources of funding statement
The authors declare that there are no conflicts of interest in this study.
Funding has been made available from the authors institutions.

Periodontitis is an infectious, chronic and multifactorial inflammatory disease that affects the tooth-supporting tissues. Severe periodontitis can ultimately result in tooth loss. Bacteria associated with periodontal diseases are mainly Gram-negative species belonging to the phyla of the Bacteroidetes, Fusobacteria and Spirochetes (Socransky & Haffajee 2005). Besides the microbiological component, risk factors associated with the disease include behavioural factors such as stress and smoking as well as genetic traits (Kinane & Attstrom 2005, Tonetti & Claffey 2005). Non-surgical mechanical scaling and root planing (SRP) aims to reduce the total bacterial load and to remove periodontal pathogens from the subgingival area. Quadrant-wise SRP (Q-SRP) is usually performed in four or more subsequent sessions with weekly intervals. Together with oral hygiene instructions, SRP is the treatment of choice for an effective cause-related periodontal therapy (Cobb 1996). Improved clinical periodontal conditions have been associated with a reduction of the total supra- and subgingival bacterial load including Spirochetes and Capnocytophaga species (Slots et al. 1979), the percentage of sites positive for Prevotella intermedia, Tannerella forsythia and Treponema denticola (Darby et al. 2001) and a prolonged suppression of Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis and P. intermedia (Shiloah & Patters 1996). Van der Velden et al. (1986) and van Winkelhoff et al. (1986) showed that periodontal...
pathogens could also be detected on the dorsum of the tongue and the oral mucosa. Together with the suggested translocation of bacteria from one site in the oral cavity to another, it was hypothesized that in between the subsequent sessions of Q-SRP, previously treated quadrants could be reinfected by bacteria from not yet treated quadrants (Quirynen et al. 1996, Greenstein & Lamster 1997, Quirynen et al. 2001).

Based on this reinfection hypothesis, the full-mouth disinfection (FMD) protocol was introduced by Quirynen et al. (1995) and included full-mouth SRP (FM-SRP) within 24 h. Furthermore, additional disinfection was sought by tongue brushing with chlorhexidine gel (1.0%), rinsing with chlorhexidine 0.2% twice daily and subgingival irrigation with 1% chlorhexidine gel.

The clinical outcome of the traditional Q-SRP and FM-SRP or FMD has been compared in several studies (Quirynen et al. 1995, Apatzidou & Kinane 2004, Koshy et al. 2005, Wennström et al. 2005, Jervøe-Storm et al. 2006, Quirynen et al. 2006, Swierkot et al. 2009). Recently, a meta-analysis by Eberhard et al. (2008) showed only differences in the weighted mean differences (WMD) between FMD and Q-SRP of 0.53 mm for PPD and 0.33 mm for clinical attachment level (CAL) in favour of FMD. When comparing FMD with FM-SRP the WMD for CAL amounted 0.74 mm in favour of FM-SRP. The included studies differed however in study design i.e., FMD or FM-SRP versus Q-SRP, included both smokers and non-smokers (Apatzidou & Kinane 2004, Wennström et al. 2005, Jervøe-Storm et al. 2006, Quirynen et al. 2006). Only the studies performed by Koshy et al. (2005), Wennström et al. (2005) and Jervøe-Storm et al. (2006) showed a low risk of bias based on randomization, allocation concealment, blinding and completeness of follow up (Eberhard et al. 2008). Finally, only the studies of Wennström et al. (2005) and Jervøe-Storm et al. (2006) were powered to detect predefined statistical differences in treatment outcomes. The presented literature shows that, within the limitations of the studies, FMD and FM-SRP and Q-SRP show minor differences in clinical treatment outcome. However, outcome of clinical trials do not prove nor deny the hypothesis of reinfection of treated periodontal pockets by bacteria. In the study of Quirynen et al. (1995), a significantly better reduction in the number of pathogens was observed in the FMD group 1 month after treatment. Other authors have not been able to show additional microbiological effects of FM-SRP over Q-SRP alone (Apatzidou et al. 2004b, Koshy et al. 2005, Jervøe-Storm et al. 2007) nor with the addition of povidone iodine (Koshy et al. 2005) or with subgingival irrigation with chlorhexidine gel, tongue brushing with chlorhexidine gel for 1 min and post-treatment rinsing daily with chlorhexidine (Swierkot et al. 2009) by polymerase chain reaction (PCR). In addition, RT-PCR analysis revealed no microbiological differences between the different treatment modalities after 1 day, and 1, 2, 4, 8, 12 or 24 weeks (Jervøe-Storm et al. 2007). However, microbiological samples from different pockets were pooled and/or taken months after treatment (Quirynen et al. 1995, Bollen et al. 1998, Apatzidou et al. 2004b, Koshy et al. 2005, Swierkot et al. 2009). The aim of the present study is, therefore, to test recolonization of periodontal lesions after FM-SRP or multiple session SRP (MS-SRP) in a randomized clinical trial and test whether FM-SRP and MS-SRP result in different clinical outcomes.

Materials and Methods

Experimental design and patient selection

The patients in this study were referred to a private clinic for periodontology in Groningen. After recording probing pocket depth (PPD), bleeding on probing (BoP), levels of supragingival plaque, presence of furcation lesions and medical history of the patient, an external examiner (V. Z.) selected 44 patients who were eligible and fit the inclusion criteria. Patients diagnosed with chronic periodontitis, aged 25–75 years and with >16 teeth and >10% of the sites with PPD ≥ 6 mm were candidates for inclusion. Patients were not admitted to the study if any of the following criteria were present: (1) smokers and former smokers who stopped <5 years ago, (2) use of local or systemic antibiotics 3 months before the study, (3) removable partial dentures, (4) pregnancy or lactation, (5) presence of systemic diseases requiring drug therapy and (6) periodontal treatment within the past 5 years. Patients participated in the study based on informed consent. The patients were stratified for the two trained and experienced (≥8 years) oral hygienists who performed the treatment. The clinical protocol and the time-points for microbiological sampling are shown in Fig. 1.

The hygienists were instructed to start periodontal treatment in the maxillary right quadrant (test-quadrant), in order to obtain the highest level of operator blinding and the prevention of an operator bias. When the treatment was finished, a second independent person informed them whether they had to continue the treatment in the other quadrants (FM-SRP) or continue treatment in another session (MS-SRP), based on a computer-generated randomization table. After 3 months the patients were examined by a periodontist. All study personnel was blinded to treatment assignment for the duration of the study. The research protocol was approved by the Ethical Committee of the University Medical Center Groningen.

Treatment

FM-SRP

The patients that were assigned to the FM-SRP protocol received a full-mouth subgingival debridement with manual periodontal curettes (Hu-Friedy Manufacturing Co., Chicago, IL, USA) in a 3-h single session. Treatment was performed under local anaesthesia on patient’s request. Patients received standard oral hygiene instructions including tooth brushing and inter-dental plaque control by inter-dental brushes. 1, 2, 7 and 14 days after treatment patients returned to the clinic for microbiological sampling. At days 7 and 14 the oral hygiene instructions were reinforced.

MS-SRP

The patients assigned to the MS-SRP protocol received subgingival debridement with manual periodontal curettes (Hu-Friedy Manufacturing Co.) in three sessions of 1 h at 1-week intervals according to the protocol of the clinic. Treatment was performed under local anaesthesia on patient’s request. The first quadrant was always treated in the first session. The rest of the dentition was divided in two equal portions and treated in the two consecutive sessions. One and 2 days after the first treatment, patients returned to the clinic for microbiological sampling. At each treatment...
Clinical measurements

Before treatment and 3 months (3.5 months for the test-quadrant in the MS-SRP group) after completion of the treatment, clinical parameters were assessed by a blinded examiner. PPD to the nearest millimeter was assessed at six sites per tooth using a manual probe (PCP-UNC 12, Hu-Friedy Manufacturing Co.), and BoP (Van der Velden et al. 1979) and plaque index (PlI) (Silness & Løe 1964) were recorded. According to the practice protocol, pockets measuring <3 mm were considered healthy and not recorded.

Microbiological sampling

In each quadrant, a single pocket with PPD ≥6 mm on a single rooted tooth was selected by the external examiner. Microbiological samples from this specific tooth in the test-quadrant were collected at seven time-points in the test-quadrant: before treatment, immediately after SRP, 1 day, 2 days, 1 week, 2 weeks and 3 months after treatment.

The other quadrants were sampled before treatment, immediately after treatment and after 3 months. After removal of supragingival plaque and the isolation of the site with cotton rolls, sampling was performed with a single sterile paper point (ROEKO®, size M, Coltene/Whaledent GmbH, Langenau, Germany), which was left in place for 20 s. Samples were collected in coded screw-cap tubes and transported to the laboratory and stored at −20°C until further processing.

DNA extraction

DNA was extracted according to the extraction protocol of Zijnge et al. (2006) with minor modifications. 200 µl of demineralized H2O and four glass beads were added to the tubes with the paper points. After homogenizing thoroughly for 5 s using a vortex, three cycles of freeze–thawing at −80°C for 15 min and 5 min at 80°C were performed. Subsequently, the samples were incubated for 1 h at 37°C with 10 µl lysozyme (40 mg/ml), followed by an incubation for 1 h at 58°C with 100 µl lysis buffer (10% SDS, 0.2 mg/ml proteinase K). Proteinase K was inactivated by incubation at 80°C for 10 min. For DNA isolation, 200 µl phenol and 200 µl chloroform/isooamyalcohol (24:1 v/v) were added to the samples. The samples were centrifuged for 5 min at 14,000 g. A second phenol/chloroform/iso-amylalcohol extraction was performed on the aqueous phase and centrifugation, DNA was precipitated from the aqueous phase with 1/10 v/v 3 M sodium acetate (pH 5.2) and 2.5 v/v 96% ethanol at −20°C overnight. After centrifugation for 15 min at 14,000 g, the supernatant was discarded and the pellet washed twice with 100 µl 70% alcohol. After centrifugation for 15 min at 14,000 g, the supernatant was removed. The pellet was dissolved in 50 µl sterile TE buffer and stored at −20°C.

Species-specific PCR

PCR for the detection of P. gingivalis (Fg), A. actinomycetemcomitans (Aa), T. forsythia (Tf) and T. denticola (Td) was performed according to Zijnge et al. (2006). For the detection of Fusobacterium nucleatum (Fnu) the primers Fnu607-GCGCGTCTAGGTGGTTATGT AA and Fnu1060-CTGTCTTTAGGGTCCCGAAG were developed using the ARB software package (Ludwig et al. 1998). These primers were opti-
mized and tested for sensitivity and specificity with strain *F. nucleatum* ATCC 25586 and against a panel of reference strains with the PCR protocol by Zijinge et al. (2006) for species-specific PCR. For the PCR reactions, the limit of detection was 50 cells.

**Statistical analysis**

The clinical hypothesis to test is whether FM-SRP and MS-SRP results in different reductions in PPD. The primary response variable is therefore PPD. According to Wennström et al. (2005), 20 patients in each treatment group were required based on an expected mean difference in PPD between groups of 0.5 mm and a common standard deviation of 0.6 mm. During the course of the study, a meta-analysis by Eberhard et al. (2008) precised the expected mean difference in PPD between the two treatment groups to 0.53 mm. With a common standard deviation of 0.6 mm, the z-error predefined to 0.05 and the β-error to 0.2, a power analysis for a two-tailed *t*-test for independent means revealed that in each group 22 patients were required. In all tests, the patient was set as the experimental unit. Change in BoP and PII was defined as the percentage of sites that were positive at baseline and negative for respectively bleeding and visible plaque after 3 months. The percentage of healthy pockets is defined as the percentage of the pockets for which PPD ≤5 mm at baseline were reduced to PPD ≤3 mm after 3 months.

Within group changes in PPD between baseline and after 3 months were tested with a paired two-tailed *t*-test. Differences in PPD between FM-SRP and MS-SRP were tested with a two-tailed *t*-test for independent means. Pockets measuring <3 mm after 3 months were set to 3 mm to be able to calculate an average PPD.

Within group differences in BoP and PII between baseline and after 3 months were tested with the non-parametric Wilcoxon test while differences between FM-SRP and MS-SRP were tested with the non-parametric Mann–Whitney test.

Within group changes for the detection of the five species between baseline and after 3 months were tested by the non-parametric McNemar test while differences between FM-SRP and MS-SRP were tested with the non-parametric Mann–Whitney test.

Timeline bacterial results of the test-quadrant pocket were categorized into predefined categories. “Success” was defined as when a pocket was positive for a species at baseline and continuously became negative for that species after treatment until the end of the study. “Failure” was defined as when a pocket was positive for that a species at every time-point. “Recolonization” was defined as when a positive pocket that became negative for a species and showed positive thereafter in the course of the study. “Neutral” was defined as pockets that were negative for a species and remained negative during the study. Only pockets with baseline values that could possibly result in “Success”, “Failure” or “Recolonization” were considered for statistical analysis. Differences in category distribution between FM-SRP and MS-SRP were tested for by the χ²-test except when expected counts were <5 where the Fisher’s exact test was used. The level of significance was set to *p* < 0.05.

The SPSS 15.0 software package (SPSS Inc., Chicago, IL, USA) was used for data handling and statistical testing.

**Results**

**Study descriptives**

Between September 2007 and December 2008, 44 patients were recruited that fulfilled the inclusion criteria. Of the patients who attended the baseline examination, five refrained to participate and one person, originally assigned to the FM-SRP group, dropped out 10 weeks after treatment for financial reasons. In total, 38 patients completed the follow-up of the study. For statistical analysis, only the data of the included patients that completed follow-up of the study were used. This resulted in a power of 0.75, which is the probability that this study rejected a false hypothesis. Demographic characteristics are summarized in Table 1. There were no significant differences between FM-SRP and MS-SRP groups for baseline values of PPD, BoP and PII in the whole mouth. There was only a significant difference in PPD of deep pockets in the test-quadrant at baseline (Table 2). There were no reports of adverse events or severe side effects of both treatments.

**Clinical effects of treatment**

The results of the test-quadrant and whole-mouth analyses showed no significant clinical differences within each treatment group (data not shown), and whole-mouth results were used for hypothesis testing. In general, both FM-SRP and MS-SRP resulted in significant reductions in PPD compared with baseline values. There were no significant differences in PPD reduction between FM-SRP and MS-SRP (Table 3).

This result was confirmed by the absence of a significant difference between FM-SRP and MS-SRP with respect to the percentage of pockets initially measuring ≥5 mm and which were reduced to ≤3 mm and considered healthy or remained ≥5 mm after 3 months. FM-SRP and MS-SRP showed significant improvements after 3 months in BoP and PII, without significant differences between FM-SRP and MS-SRP (Table 3).

**Microbiological effects of treatment**

Microbiological observations in the test-quadrant showed that FM-SRP and MS-SRP resulted in significant reductions in the number of pockets positive for *T. denticola* and *T. forsythia* compared with baseline. No significant reductions in *A. actinomycetemcomitans*, *P. gingivalis* and *F. nucleatum* were observed after treatment. When samples from all four quadrants were analysed, there was also a significant reduction in the number of pockets positive for *P. gingivalis* at the end of the study. Between the two treatment protocols there were no significant differences in the reduction of the number of pockets positive for *A. actinomycetemcomitans*, *P. gingivalis*, *T. denticola*, *F. nucleatum* and *T. forsythia* after 3 months (Table 4).

Changes in the frequency of detection of *T. denticola*, *F. nucleatum* and *T. forsythia* in the pockets of the test-quadrant are represented on a timeline in Fig. 2. Mechanical treatment itself had a limited effect on the elimination of *T. denticola*, *F. nucleatum* or

| Table 1. Demographic and baseline characteristics of the patients |
|---------------------------------|-----------------|-----------------|
| **Patient** | **FM-SRP** | **MS-SRP** |
| No. of subjects | 18 | 20 |
| Age (years) | 47 ± 9 | 54 ± 10.2 |
| No. of male:female | 10:8 | 12:8 |
| No. of teeth | 27.5 ± 1.5 | 27.2 ± 1.9 |

FM-SRP, full-mouth scaling and root planning; MS-SRP, multiple session-SRP.
Table 2. Probing pocket depth (PPD) results in the test-quadrant for moderate (4–6 mm) and deep pockets (≥7 mm), the percentage of healthy pockets obtained (PPD ≤ 3 mm) and pockets that remain deep (PPD ≥ 5 mm) after 3 months and bleeding on probing (BoP) and plaque index (PlI) results (mean ± SD)

| Test quadrant Baseline 3 months Change baseline-3-months Pockets initial | Baseline Baseline Relative change baseline-3-months Pockets initial |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FM-SRP | MS-SRP | FM-SRP | MS-SRP | FM-SRP | MS-SRP | FM-SRP | MS-SRP | FM-SRP | MS-SRP | FM-SRP | MS-SRP | FM-SRP | MS-SRP |
| 4–6 mm | 4–6 mm | 7 mm | 7 mm | 4–6 mm | 4–6 mm | 7 mm | 7 mm | 4–6 mm | 4–6 mm | 7 mm | 7 mm | 4–6 mm | 4–6 mm |
| 4.90 ± 0.23 | 4.91 ± 0.31 | 2.77 ± 0.62 | 3.73 ± 0.38 | 3.80 ± 0.55 | 3.71 ± 0.49 | 6.25 ± 1.32 | 5.78 ± 1.04 | 1.18 ± 0.38 | 1.27 ± 0.32 | 1.59 ± 0.84 | 1.69 ± 0.76 | 37.1 ± 17.0 | 33.0 ± 21.0 |
| 3.05 ± 1.01 | 3.18 ± 0.74 | 51.8 ± 21.0 | 46.0 ± 22.0 | 4.88 ± 2.53 | 3.88 ± 2.57 | 22.7 ± 73.4 | 22.1 ± 43.5 | 0.23 | 0.22 | 0.24 | 0.25 | 21.0 | 20.3 |
| 51.0 | 46.0 | 70.3 ± 23.0 | 65.5 ± 22.7 | 71.8 ± 19.1 | 59.9 ± 29.1 | 42.9 | 43.5 | 70.6 ± 22.3 | 73.4 ± 22.1 | 46.8 | 49.4 | 22.3 |

*Significant change from baseline (p<0.05).
†Significant difference between FM-SRP and MS-SRP (p<0.05).
FM-SRP, full-mouth scaling and root planning; MS-SRP, multiple session-SRP.

Table 3. Probing pocket depth (PPD) results in the whole mouth for moderate (4–6 mm) and deep pockets (≥7 mm), the percentage of healthy pockets obtained (PPD ≤ 3 mm) and pockets that remain deep (PPD ≥ 5 mm) after 3 months and bleeding on probing (BoP) and plaque index (PlI) results (mean ± SD)

| Whole mouth Baseline 3 months Change baseline-3-months Pockets initial | Baseline Baseline Relative change baseline-3-months Pockets initial |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FM-SRP | MS-SRP | FM-SRP | MS-SRP | FM-SRP | MS-SRP | FM-SRP | MS-SRP | FM-SRP | MS-SRP | FM-SRP | MS-SRP | FM-SRP | MS-SRP |
| 4.82 ± 0.18 | 4.83 ± 0.27 | 1.8 ± 0.08 | 8.81 ± 0.52 | 8.61 ± 0.25 | 3.70 ± 0.46 | 7.07 ± 1.31 | 6.54 ± 0.71 | 1.12 ± 0.39 | 1.18 ± 0.29 | 1.74 ± 1.15 | 2.07 ± 0.78 | 31.8 ± 15.0 | 32.5 ± 15.0 |
| 3.64 ± 0.36 | 3.05 ± 1.01 | 50.5 ± 15.6 | 48.2 ± 18.0 | 23.0 | 22.7 | 15.6 | 15.7 | 0.23 | 0.24 | 0.24 | 0.25 | 64.8 | 66.9 |
| 34.1 | 31.9 | 64.8 | 66.9 | 46.8 | 49.4 | 22.3 |

*Significant change from baseline (p<0.05).
†Significant difference between FM-SRP and MS-SRP (p<0.05).
FM-SRP, full-mouth scaling and root planning; MS-SRP, multiple session-SRP.
Table 4. Treatment results in the test-quadrant (18 or 20 pockets) and between brackets all 4 quadrants (72 or 80 pockets) for the presence of Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, Treponema denticola, Fusobacterium nucleatum and Tannerella forsythia in the FM-SRP (N = 18) and MS-SRP (N = 20) group after 3 months and the distribution of the species in the tested pockets over the different categories

<table>
<thead>
<tr>
<th>Category distribution (# pockets)</th>
<th>Number of pockets positive for a species</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>before</td>
</tr>
<tr>
<td>FM-SRP</td>
<td></td>
</tr>
<tr>
<td>A. actinomycetemcomitans</td>
<td>2</td>
</tr>
<tr>
<td>P. gingivalis</td>
<td>9</td>
</tr>
<tr>
<td>T. denticola</td>
<td>16</td>
</tr>
<tr>
<td>F. nucleatum</td>
<td>18</td>
</tr>
<tr>
<td>T. forsythia</td>
<td>19</td>
</tr>
<tr>
<td>P. gingivalis</td>
<td>10</td>
</tr>
<tr>
<td>T. denticola</td>
<td>14</td>
</tr>
<tr>
<td>F. nucleatum</td>
<td>20</td>
</tr>
<tr>
<td>T. forsythia</td>
<td>19</td>
</tr>
</tbody>
</table>

*Significant difference from baseline (p < 0.05).

Significant difference between FM-SRP and MS-SRP (p < 0.05).

FM-SRP, full-mouth scaling and root planning; MS-SRP, multiple session-SRP.

Fig. 2. The percentage of tested pockets in the test-quadrant that was positive for Fusobacterium nucleatum, Tannerella forsythia and Treponema denticola at baseline and at different time-points after full-mouth scaling and root planning (FM-SRP) or multiple session-SRP (MS-SRP).

patients, this may lead to the development of periodontitis, in others not. Hence, even in the presence of so-called periodontal pathogens, a susceptible host is needed for periodontitis to develop, as presented by the pathogenesis model in Page & Kornman (1997). Because the term “infection” also implies a host response, we consider the term recolonization more appropriate to study bacterial (re)appearance.

The aim of the present study was to test the recolonization of periodontal lesions after FM-SRP or MS-SRP in a randomized clinical trial and test whether FM-SRP and MS-SRP result in different clinical outcomes. The setting of this study was a private clinic for periodontology requiring compromises on trial design. The protocol of the clinic demanded for example a three session SRP protocol and did not include the registration of pockets <3 mm and CAL. We believed that a three session SRP protocol was still suitable for testing the recolonization hypothesis because in this setting there were remaining quadrants that could serve as a reservoir for periodontal pathogens. CALs are prone to measurement errors, especially in inflamed periodontal tissues (Van der Velden & Jansen 1980). PPD was therefore regarded as the appropriate measure for short-term periodontal treatment outcome. This study was designed as a randomized clinical trial according to the guidelines set by the Consort group CONSORT (2001) for the blinding of the oral hygienists, randomization concealment, completeness of follow up and an a priori power analysis to determine sample size. Blinding of the oral hygienists who performed the SRP was sought by designing the upper right quadrant as the test-quadrant. Moreover, in the present study, patients were stratified for the oral hygienists, thereby reducing eventual intra-operator differences that might have biased the clinical outcomes. Analysis of the test-quadrant results and the whole-mouth clinical data revealed no statistical differences and whole-mouth data were therefore used for hypothesis testing. With the inclusion of 18 (FM-SRP) and 20 (MS-SRP) instead of the 22 required subjects in each group, this study reached a power of 0.75 of drawing the correct conclusion when the null-hypothesis that FM-SRP and MS-SRP result in equal reductions in PPD would be rejected.

For microbiological measurements a single pocket in the test-quadrant was selected to monitor recolonization, because from a microbiological point of view the pocket is the ecological determinant. However, sampling multiple pockets from the test-quadrant would have increased the strength of the analysis. This was however beyond our logistical capabilities.

In general, both FM-SRP and MS-SRP resulted in significant reductions in PPD compared with baseline values. The reductions in PPD in the MS-SRP group were comparable to meta-analysis results from the studies of Badersten et al. (1981), Badersten et al. (1984) and Cobb 1996. FM-SRP resulted in slightly less reductions in PPD with 1.12 mm in deep pockets. That FM-SRP results in lesser, however not significantly, differences in the reductions in PPD has also been observed by Apatzidou et al. (2004b), Koshy et al. (2005) and Jervpe-Storm et al. (2006), but not by others (Quirynen et al. 1995, Wennström et al. 2005, Swierkot et al. 2009).


Quirynen, M., De Soete, M., Boschmans, G., Pauwels, M., Coucke, W., Teughels, W. & van Steenbergh, D. (2006) "Benefit of 'one-stage full-mouth disinfection’ is explained by disinfection and root planing within 24 hours: a randomized controlled trial. *Journal of Clinical Periodontology* 33, 639–647.


Address:

F. Abbas
Department of Periodontology
Center for Dentistry and Oral Hygiene
University Medical Center Groningen
PO Box 30.001
9700 RB Groningen
The Netherlands

E-mail: f.abbas@med.umcg.nl

---

**Clinical Relevance**

*Scientific rationale for the study:* The clinical outcome of SRP of subgingival pockets in subsequent sessions might be challenged by recolonization of already treated sites from not yet treated sites.

*Principal findings:* FM-SRP and MS-SRP result in comparable, significant overall clinical and microbiological improvements. FM-SRP prevents recolonization.

*Practical implications:* Considering the good clinical outcomes of both treatment modalities, the argument of recolonization is of limited value in choosing a preferred treatment option.