Clinical and Microbiological Comparison of Three Non-surgical Protocols for the Initial Treatment of Chronic Periodontitis

Carlos Serrano, Nidia Torres, Angela Bejarano, Marcela Caviedes and María Eugenia Castellanos

School of Dentistry, Pontificia Universidad Javeriana, Bogotá, Colombia

Abstract

Objective: To compare the clinical and microbiological effects of three protocols for non-surgical periodontal therapy, including full-mouth scaling and root planing plus systemic antibiotics, on the treatment of chronic periodontitis patients. **Methods**: Twenty-nine patients diagnosed with moderate to severe chronic periodontitis, selected according to specific criteria, were randomly assigned to one of three treatment groups: quadrant scaling, full-mouth scaling, and full-mouth scaling supplemented by systemic antibiotics. Antibiotic selection was based on the results of individual susceptibility testing. Oral hygiene instructions and reinforcement were given during the study. All patients received a clinical periodontal and microbiological examination at baseline and at re-examination, 4-6 weeks after therapy. Means and standard deviations were calculated and differences between groups were analyzed via the Kruskal-Wallis test, $p < 0.05$. **Results**: The mean age of the study sample was 49.1 ± 11.6 years old, and there were 17 men and 12 women. Patients treated with antibiotics showed antimicrobial susceptibility for amoxicillin and doxycycline. All study groups showed a similar significant improvement in periodontal parameters. Plaque scores were reduced in a range of 29.0% to 42.6%. Bleeding on probing was reduced by 34.8% to 55.0%; the reduction for the full-mouth scaling group was larger. Mean reduction in pocket depth was 1.2 to 1.3 mm in all groups. Mean bacterial counts were reduced in the groups receiving full-mouth treatment, but not in the quadrant treatment group. **Conclusion**: The three protocols for non-surgical periodontal treatment demonstrated a similar positive effect on clinical parameters; however, only full-mouth treatment groups showed a reduction in anaerobic microbial counts at re-examination.

Key words: Chronic periodontitis, scaling and root planing, antibiotics, full-mouth scaling

Introduction

The main goal of periodontal therapy is to control the infection associated with chronically inflamed tissues through a series of activities aimed at reducing the bacterial destructive effect, such as oral hygiene instruction, subgingival debridement and surgical pocket reduction. These protective measures, when reinforced by meticulous self-performed oral hygiene and regular professional maintenance, lead to the re-establishment of periodontal health (Tunkel *et al.,* 2002; van der Wejden and Timmerman, 2002). Initial therapy for disease includes root surface instrumentation procedures, scaling and root planing, usually performed on jaw quadrants during a series of appointments. Systematic reviews on non-surgical periodontal therapy have considered scaling and root planing an effective treatment, measured by clinical parameters such as reduction of bleeding upon probing, reduction of probing pocket depth and gain in probing attachment level (van der Wejden and Timmerman, 2002; Hung and Douglass, 2002; Hallmon and Rees, 2003). Studies on the microbiological effect of scaling and root planing have shown that it produces a marked disruption of the subgingival biofilm, leading to decreased levels and proportion of sites colonized by periodontal pathogens (Teles *et al.,* 2006).

Considering that periodontal pathogens can be found in different intra-oral niches besides periodontal pockets, such as the tongue, the tonsils, the saliva and other mucous membranes (van Winkelhoff *et al.,* 1986; Asikainen *et al.,* 1991), and that translocation of pathogens from the above niches or untreated periodontal pockets to recently treated pockets is possible (Quyrinen *et al.,* 1996), the Leuven University research group de-

Correspondence to: Carlos Serrano, MSc., Specialist in Periodontology, Department of Periodontal System, School of Dentistry, Pontificia Universidad Javeriana, Carrera 7 # 40-62, Edificio de Odontología, Bogotá, Colombia. E-mail: serrano-c@javeriana.edu.co

veloped the full-mouth disinfection concept (Quyrinen *et al.,* 1995). This treatment protocol includes scaling and root planing in two sessions within 24 hours, and usage of different therapeutic forms of clorhexidine for brushing the tongue, rinsing the mouth, spraying the tonsils and irrigating pockets. Reports from the original research group have concluded that full-mouth disinfection has a beneficial effect in the treatment of moderate and severe periodontitis, evidenced by 15% greater reduction in bleeding on probing, 1.3-1.8 mm greater reduction in probing pocket depth, and ≥ 1.5 mm additional gain in probing attachment level over quadrant scaling (Mongardini *et al.,* 1999; Quyrinen *et al.,* 2006). A modification of the full-mouth disinfection protocol is one stage full-dentition scaling and root planing only, since it was identified as the key component responsible for the additional clinical and microbiological improvements over traditional treatment (Quyrinen *et al.,* 2000). During recent years, several clinical reports on the effect of full-mouth treatment concepts have yielded contradictory findings (Apatzidou and Kinane, 2004; Koshy *et al.,* 2005; Wennstrom *et al.,* 2005; Jervoe-Storm *et al.,* 2006; Zanatta *et al.,* 2006). Two recent systematic reviews concluded that differences between full-mouth disinfection, full-mouth scaling and root planing and traditional treatment were modest, so that any of the three treatment modalities may be used for initial therapy for chronic periodontitis (Lang *et al.,* 2008; Eberhard *et al.,* 2008).

Considering the lack of significant differences between full-mouth treatment concepts and traditional therapy referred to in systematic reviews (Lang *et al.,* 2008; Eberhard *et al.,* 2008), and the additional clinical benefit over scaling and root planing described for the adjunctive use of systemic antibiotics (Herrera *et al.,* 2002; Haffajee *et al.,* 2003), Cionca *et al.* (2009) studied the effects of combining metronidazole and amoxicillin, proper oral hygiene, and scaling and root planing over 24 hours in chronic periodontitis patients. The authors conducted a placebo-controlled clinical trial of six months duration, reporting significant clinical improvements for both patient groups, but greater reduction in the number of pockets > 4 mm and percentage of sites with bleeding on probing for subjects receiving amoxicillin and metronidazole. In conclusion, the authors stated that systemic antibiotics significantly improved the clinical outcome of full-mouth non-surgical periodontal therapy and reduced the need for additional therapy.

The purpose of this study was to compare the clinical and microbiological effects of three protocols for non-surgical periodontal therapy, including full-mouth scaling and root planing plus systemic antibiotics, on the treatment of chronic periodontitis patients.

Materials and Methods

Study design

This was a parallel design, randomized clinical trial performed at the Specialist Periodontal Clinic, School of Dentistry, Javeriana University in Bogotá, Colombia. Approval for the protocol was obtained from the Ethics Committee, Javeriana University; all patients signed an informed consent form before the start of the study.

Patients

Twenty-nine patients were recruited from new referrals to the Javeriana University, Specialist Clinic, according to the following criteria: age ranging from 25-75 years; possession of a minimum of 16 teeth; diagnosis of chronic periodontitis (according to the criteria of the International Classification System for Periodontal Diseases [Armitage, 1999]) with severity ranging from moderate to severe and multiple sites showing clinical attachment loss ≥ 3 mm in all jaw quadrants; available for participation in a follow-up examination after two months. Patients were excluded if they had uncontrolled systemic conditions, such as diabetes or cardio-vascular disease, or required antibiotic coverage for treatment; were pregnant or breast-feeding; were taking medication that could affect the periodontal condition or had received antibiotic therapy during the previous three months; had suspected or confirmed allergy to antibiotic agents, including β-lactam or tetracycline group antibiotics; or were current smokers, defined as having a consumption rate of ≥ 10 cigarettes per day.

Experimental design

Enrolled subjects were randomly assigned by a computer-generated table to one of three non-surgical treatment modalities (Research Randomizer, Social Psychology Network, 1997-2009):

Control group (Q): scaling and root planing quadrant by quadrant at weekly intervals.

Full-mouth scaling and root planing (FM): full-mouth scaling and root planing performed over two consecutive days.

Full-mouth scaling and root planing plus antibiotics (FMa): full-mouth scaling and root planing performed over two consecutive days combined with the administration of systemic antibiotics determined by susceptibility testing for each subject.

All patients had a clinical examination and microbiological sampling before any treatment procedure was performed (baseline), and at a period 4-6 weeks after the last appointment for scaling and root planing (re-examination).

Clinical examination

Clinical measurements of bleeding on probing, probing pocket depth and clinical attachment level were performed on all present teeth at six tooth surfaces. Four surfaces were examined for the O´Leary plaque score [percentage of presence/absence of plaque using a disclosing solution: mesial, buccal, distal and lingual (O´Leary, 1972)]. Probing pocket depth (PPD) was measured with a manual periodontal probe to the closest millimeter. Bleeding on probing (BoP) was recorded as the percentage of sites bleeding after probing pocket depth measurements. Specific analysis was performed for moderate pockets (5 - 6 mm), and for deep pockets (≥ 7 mm). The gingival margin (GM) level was measured from the gingival margin to a reference point, either the cemento-enamel junction or the margin of a restoration. In case of gingival recession, the gingival margin level has a negative value. The probing attachment level (PAL) was measured as ± GM – PD. Reduction in the percentage of sites with PPD ≥ 4 mm from baseline to re-examination was recorded.

Microbiological examination

After cotton roll isolation and removal of supragingival plaque, pooled microbial samples were taken with paper cones from the deepest periodontal pocket in each quadrant for 15 seconds (Mombelli *et al.,* 1991). Samples were placed in vials containing anaerobic VMGA III transport medium (Möller, 1966) and transferred for processing.

At the microbiological laboratory, samples were vortex-mixed for 30 seconds and serially diluted 10-fold five times. One hundred µL of 10^{-1} dilution was plated on blood agar and incubated for three days under aerobic conditions. One hundred µL of 10^{-4} dilution was plated on anaerobic Wilkins-Chalgren agar (Oxoid, United Kingdom); plates were incubated for seven days at 37 ºC in 80% N_2, 10% CO_2 and 10% H_2. Colony forming units (CFU) were enumerated on blood and Wilkins-Chalgren agar plates after the period of incubation. Presumptive identification of periodontal pathogens was performed based on colony morphology, Gram staining, aerotolerance test and a commercial identification micromethod system (RapID ANA II, Oxoid, United Kingdom).

Patients randomly assigned to the FMa group had an antimicrobial susceptibility testing on identified periodontal pathogen colonies, mainly *Porphyromona gingivalis, Prevotella intermedia, Fusobacterium nucleatum* and *Wollinela spp.* Five different commercially available antibiotic strips were used: amoxicillin, metronidazole, azithromycin, tetracycline and doxycycline (E-test, AB Biodisk, Solna, Sweden). Viable pure colonies were homogenized in 0.85% saline solution and adjusted to the MacFarland turbidity standard 1.0. Using a sterile glass rod, 0.1 mL of the inoculum was spread over Wilkins-Chalgren agar plates and allowed to dry for 15 minutes. E-test strips were gently placed over the agar surface and incubated under anaerobic conditions for three days. The intersection between the zone of bacterial inhibition and the E-test strip represented the minimal inhibitory concentration (MIC). The antibiotic with the lowest MIC was selected to be used; if several tests were made for the same patient the antibiotic with the lowest average MIC was chosen.

Treatment procedures

Scaling and root planing were performed by three periodontal graduate students (AB, MC and MEC). The FM and FMa received scaling and root planing on two consecutive days; in addition, for the FMa group the antibiotic showing the lowest minimal inhibitory concentration was prescribed for a one-week period. The control group (Q) received scaling and root planing in four sessions, quadrant by quadrant, at one-week intervals. All scaling was performed using manual curettes (Hu-Friedy, Chicago, IL, U.S.A.) and ultrasonic magnetostrictive instruments (Cavitron, Dentsply, York, PA, U.S.A.) without any time restriction.

At the baseline examination, all patients were given detailed oral hygiene instructions, including toothbrush and dental floss or inter-dental brush use. No mouth rinses were used during the study. Patients received oral hygiene reinforcement at weeks 2 and 4. Teeth judged ready to be extracted due to poor periodontal condition were extracted and not included for analysis; restorations with overhangs were replaced during treatment.

Statistical analysis

Mean and standard deviation values for the O´Leary plaque score, percentage of BoP, PPD, PAL and percentage of pockets were calculated for each subject. Mean and standard deviation of logarithmically transformed CFU counts were calculated. The changes within groups from baseline to re-examination were analyzed using the paired Wilcoxon test. The differences between groups were analyzed using the Kruskal-Wallis test. The level of significance was set at $p < 0.05$.

Results

A total of twenty-nine patients completed the clinical study: 10 patients in the control Q group, nine patients in the FM group, and 10 patients in the FMa group. The mean age of the patient sample was 49.1 ± 11.6 years old; there were 17 men and 12 women. Twenty-six patients were non-smokers, two patients were smoking 2 - 5 cigarettes per day, and a third patient smoked 2 - 3 cigarettes per week. Demographic characteristics of the patient sample are described in Table 1.

Antimicrobial susceptibility testing results for the 10 subjects included in the FMa group revealed that in four subjects, the lowest MIC value was for amoxicil-

Table 1. Demographic characteristics of the patient sample

	Q	FM	FMa
Number of patients	10	9	10
Mean age	46.6 (10.9)	52.8 (10.6)	48.2 (13.3)
Gender male/female	6/4	6/3	4/6

Q, control; FM, full mouth scaling and root planing; FMa, full mouth scaling and root planing plus systemic antibiotics

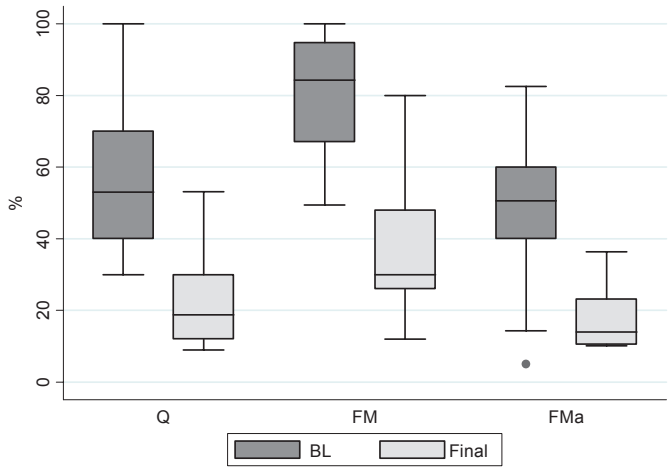

Figure 1. Change in O`Leary plaque score

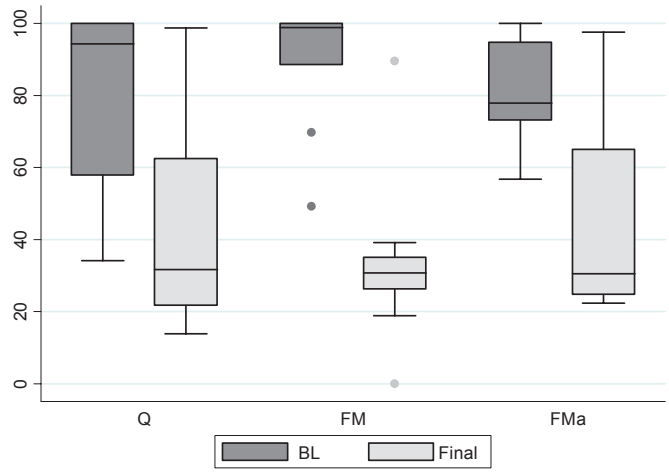

Figure 2. Percentage of sites with bleeding on probing

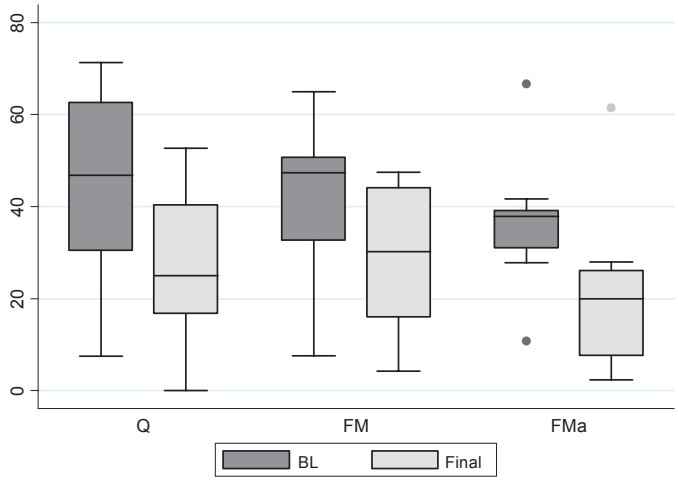

Figure 3. Percentage of sites with probing pocket depth (PPD) ≥ 4 mm

lin; for the other six subjects the lowest value was for doxycycline. As a consequence, four subjects received amoxicillin 875 mg twice a day for seven days; and six subjects received doxycycline 100 mg once a day for seven days.

Plaque scores

All study groups showed a high level of plaque accumulation at baseline before oral hygiene instructions were given, Q 56.7% ± 22.8, FM 77.8% ± 38.7 and FMa 47.3% ± 18.2. Nevertheless, with a random group assignment the O`Leary plaque score was higher for the FM group than for the other two groups. At re-examination, all three groups showed a statistically significant improvement in the O`Leary plaque score, with mean reduction values ranging from 29.0% for the FMa group to 42.6% for the FM; no statistically significant differences were detected among the three groups at re-examination (*Figure 1*).

Bleeding on probing

Percentage of sites bleeding on probing was equally high for all three groups at baseline: at re-examination, a statistically significant reduction in percentage of sites bleeding on probing was present in all groups. For the Q, the BoP percentage decreased from 78.7 ± 26.3% to 44.0 ± 29.0%, for the FM from 88.6 ± 17.8% to 33.6 ± 24.0%, and for the FMa from 80.0 ± 14.5% to 46.3 ± 27.9%. There were no statistically significant differences when the three groups were compared; however, the FM group obtained a 20% greater BoP percentage reduction when compared with the other two groups (*Figure 2*).

Reduction in the percentage of pockets

At baseline, the percentage of sites with increased PPD varied from 36.3% ± 20.9 for the FMa group, to 45.0% ± 28.1 for the Q group. A statistically significant reduction in the percentage of sites showing PPD ≥ 4 mm was observed at re-examination compared with baseline in all three groups. The reduction in percentage had a range from 12 to 17%; the greatest reduction was obtained in the Q group, and the least in the FM group. However, no statistically significant differences were obtained between groups (*Figure 3*).

Probing pocket depth

The mean baseline PPD was similar in all three groups: it varied from 5.0 ± 0.6 mm for the Q group to 5.5 ± 0.7 mm for the FM group. At re-examination, all three groups showed a 1.2 - 1.3 mm significant reduction of PPD; no significant differences were present among the groups. When a separate analysis for pockets initially 5 - 6 mm and ≥ 7 mm was performed, no significant differences were found for mean change values among the three groups, but greater variability in the healing response of deep pockets was found for the Q group (*Table 2, Figures 4, 5*). Not all patients exhibited ≥ 7 mm deep pockets at baseline: three patients in the Q group and one patient each in the FM and FMa groups did not have pockets in that depth category.

Probing attachment level

A significant gain in PAL of about 1.0 mm was measured at re-examination for the three groups. No significant differences were found among the groups.

Microbiological anaerobic CFU counts

Great variability in log-transformed anaerobic CFU counts characterized the subjects in the three groups, which was reflected in high standard deviation values. As a partial consequence, no significant differences were observed in CFU counts at re-examination compared with baseline. A decrease in log-transformed CFU counts was measured for the FM and FMa groups, 0.34 and 1.33 respectively. In contrast, a slight increase was measured for the Q group, -0.41 log-transformed CFU count. Nevertheless, no significant differences were obtained among the three study groups (*Figure 6*). Of interest, only in the FMa group were there patients whose oral flora was below microbiological culture detection levels for anaerobes at re-examination (*Figure 6*).

Discussion

The results of the present study showed that periodontal therapy in all three study groups resulted in a significant improvement of periodontal clinical parameters. The percentage of BoP sites was reduced in the range of 34 - 55%, PPD was reduced by 1.2 - 1.3 mm, and the PAL gain was approximately 1 mm. These changes in

Table 2. Mean probing pocket depth (SD) values according to 5 - 6 and ≥ 7 mm depth categories

	Q		FM		FMa	
	5-6	≥7	5-6	≥7	5-6	≥7
Baseline	5.2 (0.1)	7.4 (0.3)	5.5 (0.2)	8.0 (0.8)	5.4 (0.2)	7.5 (0.4)
Re-examination	4.0 (0.6)	5.3 (1.6)	4.2 (0.9)	6.2 (0.8)	4.0 (0.7)	5.8 (1.1)
Change	1.2 (0.5)	2.1 (1.3)	1.3 (0.6)	1.8 (0.9)	1.4 (0.5)	1.7 (0.9)

Q, control; FM, full mouth scaling and root planing; FMa, full mouth scaling and root planing plus systemic antibiotics

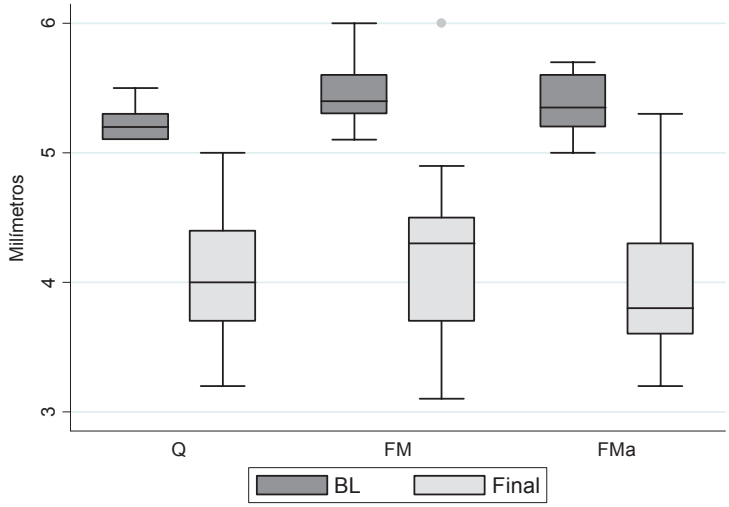

Figure 4. Probing pocket depth reduction from baseline: 5 - 6 mm depth category

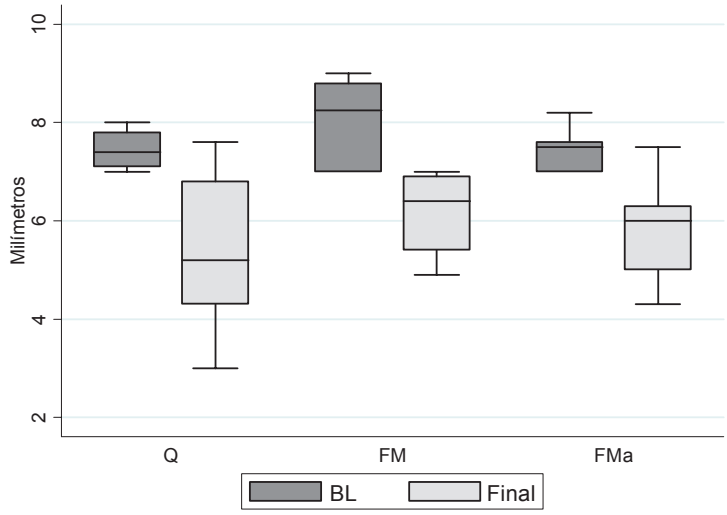

Figure 5. Probing pocket depth reduction from baseline: ≥ 7 mm depth category

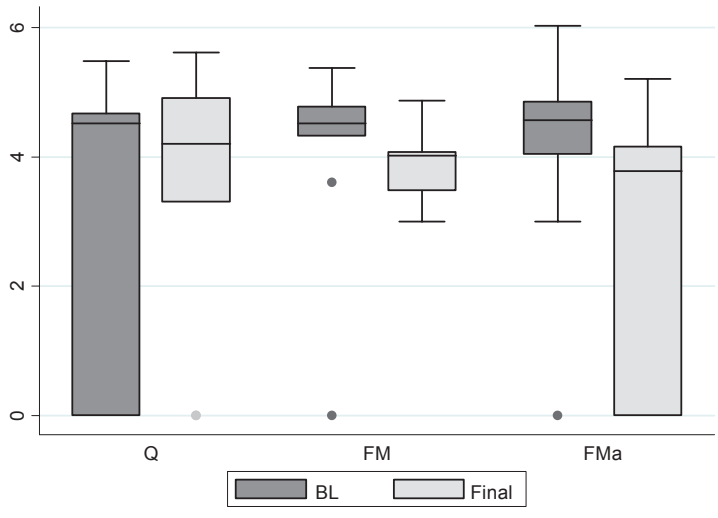

Figure 6. Log-transformed anaerobic bacterial colony counts

clinical parameters are in the same range as results of systematic literature reviews on the effects of non-surgical periodontal therapy (van der Wejden and Timmerman, 2002; Hung and Douglass, 2002). The majority of subjects in the present study showed great severity of periodontal disease, as over 40% of the surfaces were affected by periodontal pockets with a mean PPD range of 5.0 - 5.5 mm, and a large number of pockets ≥ 7 mm deep were present.

No significant differences were found between the control group receiving quadrant scaling and root planing, and the other two groups receiving full-mouth scaling and root planing. This is in agreement with two recently published systematic reviews on the effects of full-mouth treatment concepts: they concluded that only modest differences were present between quadrant and full-mouth treatment (Eberhard *et al.,* 2008; Lang *et al.,* 2008). Noteworthy, in the present study the FM group had a 20% greater reduction in BoP percentage compared with the other two groups; however, due to a large standard deviation, this difference was not statistically significant. The systematic review by Lang *et al.* (2008) reported an opposite finding, as the weighted mean difference for BoP percentage reduction was 8.45% larger in the quadrant scaling groups.

Of interest, no additional clinical benefit was obtained from systemic antibiotic administration even if the antibiotic showing the lowest microbial inhibitory concentration was selected. This is contradictory to the conclusion of systematic reviews on the effects of systemic antimicrobials as adjuncts to non-surgical periodontal treatment. The review of Herrera *et al.* (2002) reported a small additional gain in PAL of 0.3 mm and additional reduction of PPD ranging from 0.05 to 0.6 mm for patients receiving systemic antibiotics. Specific significant additional effects were found for the use of spiramycin regarding PPD change, and amoxicillin plus metronidazole regarding PAL change. The review of Haffajee *et al.* (2003) found that adjunctive systemic antibiotics led to an additional gain in PAL of 0.29 mm for pockets initially 4 - 6 mm deep, and of 0.45 mm for pockets initially ≥ 7 mm deep. Separate analysis by antibiotic type showed that tetracycline and metronidazole had a significant adjunctive benefit, followed by borderline results for the combination of amoxicillin plus metronidazole. In the present study, no greater reduction of PPD or gain of PAL was found in patients receiving systemic antibiotics, even when considering specific categories of initial PPD. As a possible explanation for the lack of any additional effect for systemic antibiotic administration, patient selection or antibiotic regime could be analyzed. The current sample age range was wide (25 - 75 years old), which could lead to the inclusion of subjects with different rates of disease progression and tissue destruction, even if all patients exhibited clinical characteristics of chronic periodontitis. The 10 patients included in the FMa group were distributed to receive amoxicillin (four cases) or doxycycline (six cases); this reduced number of subjects does not allow analyzing the effect of each antibiotic in addition to non-surgical treatment. The combination of different antibiotics was not tested in the present study, even if the combination of amoxicillin and metronidazole in addition to scaling and root planing has been found to improve the clinical outcome of periodontal therapy on different populations (Pavicic *et al.,* 1994; Winkel *et al.,* 2001; Guerrero *et al.,* 2005). The combination was not used for the present population due to the large levels of antimicrobial resistance to metronidazole. It may be that antibiotic regimens could have different adjunctive clinical benefits based on population variation for microbial antibiotic susceptibility. Nevertheless, healing in pockets initially ≥ 7 mm deep demonstrated a smaller range of variability in the FMa than in the Q group, where box plots for baseline and re-examination nearly overlap. The less variable healing response in the antibiotic group could lead to clinical differences during a longer healing time.

Several methods of describing the effect of periodontal therapy on microbiological parameters have been used in the literature: for example, change in bacterial counts, proportion of colonized sites, or level of specific periodontal pathogens, including presence or absence at different threshold values (Teles, 2006). The systematic review by Lang *et al.* (2008) stated an equally positive improvement in microbiological parameters for quadrant and full-mouth scaling and root planing. However, in the present study no improvement in bacterial counts was seen in the Q group, whereas both full-mouth treatment groups showed decreased bacterial counts, the change being larger in the group that received antibiotics. Using similar methods, Quyrinen *et al.* (2000) found a small decrease in microbial counts for quadrant scaling, compared to a larger 1 logarithmic unit decrease in full-mouth treatment protocols, a comparable finding to the present study. On the contrary, studies that have used polymerase chain reaction techniques to detect specific periodontal pathogens before and after periodontal treatment have not found significant differences between quadrant and full-mouth treatment groups (Jervoe-Storm *et al.,* 2007; Koshy *et al.,* 2005). An exception occurred for *Treponema denticola*, which had a larger reduction in the full-mouth treatment group in the report by Apatzidou *et al.* (2004).

The articles by Cionca *et al.* (2009, 2010) performed a clinical and microbiological comparison between full-mouth scaling and full-mouth scaling supplemented by systemic amoxicillin and metronidazole. The clinical results showed a significant clinical improvement for both treatment groups: bleeding on probing was re-

duced by 37 to 45%, PPD was reduced by 1.2 - 1.3 mm, and gain in PAL was 0.7 to 0.9 mm., showing a similar clinical improvement to the present study. The main outcome of therapy in the Cionca *et al.* (2009) report was the number of sites with PPD ≥ 4 mm and bleeding on probing. This figure was significantly reduced in both treatment groups, with a statistically greater reduction for the group receiving antibiotics: 4.4 versus 1.3 remaining bleeding pockets. The present study used a different method, as the percentage of sites ≥ 4 mm deep, independent of bleeding on probing, was calculated. The microbiological study by Cionca *et al.* (2010) reported lower bacterial counts for both study groups, without any significant difference between them, similar to the present study. The addition of systemic antibiotics produced a greater reduction in the detection frequency of *Aggregatibacter actinomycetemcomitans* and *P. gingivalis*.

Significant levels of antibiotic resistance to periodontal pathogens in samples taken from Colombian patients has led to the suggestion of performing antibiotic susceptibility testing before adjunctive antibiotic therapy (Ardila *et al.,* 2010; Serrano *et al.,* 2009). In the present study, amoxicillin or doxycycline was used for the treatment of the 10 patients included in the FMa group. Few studies have analyzed the effect of amoxicillin administration alone as an adjunct to non-surgical periodontal therapy, while the combination of amoxicillin and metronidazole is more common (van Winkelhoff *et al.,* 1992). It has been reported that the combination regimen produced a larger improvement in clinical parameters compared to placebo therapy, especially for patients who were initially positive for *A. actinomycetemcomitans* and *P. gingivalis*, and who became negative at re-examination (Pavicic *et al.,* 1994; Winkel *et al.,* 2001). However, a combination regimen was not used in the present study, as bacterial isolates showed significant resistance against metronidazole, a finding that has been described by other research groups in the same geographic area (Jaramillo *et al.,* 2005; Ardila *et al.,* 2010). The use of systemic doxycycline, 100 mg a day, as an adjunct of periodontal therapy, has produced additional benefits in the periodontal treatment of diabetic patients (Grossi *et al.,* 1997; Martorelli de Lima *et al.,* 2004; Llambés *et al.,* 2005). Lately, those prescribing doxycycline have looked not only for its antimicrobial effect but also for inhibition of matrix metalloproteinases (Salvi and Lang 2005).

An inclusion criterion in systematic reviews about the effects of full-mouth non-surgical periodontal therapy has been study duration of 3 or 6 months (Eberhardt *et al.,* 2008; Lang *et al.,* 2008). Nevertheless, in the present study re-examination was performed after 4 to 6 weeks in order to assess the need for surgical periodontal therapy in patients affected primarily by severe chronic periodontitis. A consensus report by the American Academy of Periodontology stated that a 4- to 6-week interval seems appropriate to assess the initial response to non-surgical periodontal therapy (Ciancio, 1989). The review article by Segelnick and Weinberg (2006) proposed to perform re-evaluation of basic periodontal therapy 4 to 8 weeks after scaling and root planing, based on evidence from clinical studies and the histology of periodontal wound healing. However, Badersten *et al.* (1981, 1984) reported that clinical improvement after therapy leveled off after 3 - 4 months for moderate periodontal cases, but the periodontal condition could continue to improve even for 6 to 9 months in advanced periodontal cases. The present study showed a trend toward larger PPD reduction for deep pockets and greater microbial count reduction in the group receiving full-mouth therapy supplemented by antibiotics; probably this trend would become significant in a longer healing time.

In the present study, scaling and root planing was performed by periodontal graduate students. Different literature reports showed that experienced operators have better results regarding calculus removal during non-surgical instrumentation than graduate students (Brayer *et al.,* 1989; Fleischer *et al.,* 1989). Nevertheless, results of the present study are similar to the outcome of non-surgical therapy reported in systematic reviews in the literature.

Conclusion

The three protocols for non-surgical periodontal treatment demonstrated a similar positive effect on clinical parameters; however, only full-mouth treatment groups showed a reduction in anaerobic microbial counts at re-examination.

Acknowledgement and conflict of interest

The authors declare there are no conflicts of interest. This study was supported by a research grant from the Research Promotion Office, Javeriana University.

References

Apatzidou, D.A. and Kinane, D.F. Quadrant root planing versus same-day full-mouth root planing I. Clinical findings. *Journal of Clinical Periodontology* 2004; **31**:132-140.

Apatzidou, D.A., Riggio, M.P. and Kinane, D.F. Quadrant root planing versus same-day full-mouth root planing II: Microbiological findings. *Journal of Clinical Periodontology* 2004; **31**:141-148.

Ardila, C.M., Granada, M.I. and Guzman, I.C. Antibiotic resistance of subgingival species in chronic periodontitis patients. *Journal of Periodontal Research* 2010; **45**:557-563.

Armitage G.C. Development of a classification system for periodontal diseases and conditions. *Annals of Periodontology* 1999; **4**:1-6.

Asikainen, S., Alaluusua, S. and Saxén, L. Recovery of *A. actinomycetemcomitans* from teeth, tongue and saliva. *Journal of Periodontology* 1991; **62**:203-206.

Badersten, A., Nilveus, R. and Egelverg, J. Effect of non-surgical periodontal therapy. I. Moderately advanced periodontitis. *Journal of Clinical Periodontology* 1981; **8**:57-72.

Badersten, A., Nilveus, R. and Egelberg, J. Effect of non-surgical periodontal therapy. II. Severely advanced periodontitis. *Journal of Clinical Periodontology* 1984; **11**:63-76.

Brayer, W.K., Mellonig, J.T., Dunlap, R.L., Marinak, K.W. and Carson, R.E. Scaling and root planing effectiveness: the effect of root surface access and operator experience. *Journal of Periodontology* 1989; **60**:67-72.

Ciancio, S.G. Non-surgical periodontal treatment. In: *Proceeding of the World Workshop in Clinical Periodontics*. American Academy of Periodontology; 1989: 11-14

Cionca, N., Giannopoulou, C., Ugolotti, G. and Mombelli, A. Amoxicillin and metronidazole as an adjunct to full-mouth scaling and root planing of chronic periodontitis. *Journal of Periodontology* 2009; **80:**364-371.

Cionca, N., Giannopoulou, C., Ugolotti, G. and Mombelli, A. Microbiologic testing and outcomes of full-mouth scaling and root planing with or without amoxicillin/metronidazole in chronic periodontitis. *Journal of Periodontology* 2010:**81**:15-23.

Eberhardt, J., Jervoe-Storm, P.M., Needleman, I., Worthington, H. and Jepsen, S. Full-mouth treatment concepts for chronic periodontitis: a systematic review. *Journal of Clinical Periodontology* 2008; **35**:591-604.

Fleischer, H.C., Mellonig, J.T., Brayer, W.K., Gray, J.L. and Barnett, J.D. Scaling and root planing efficacy in multirooted teeth. *Journal of Periodontology* 1989; **60**:402-409.

Grossi, S.G., Skrepcinski, F.B., deCaro, T., *et al.* Treatment of periodontal disease in diabetes reduces glycated hemoglobin. *Journal of Periodontology* 1997; **68**:713-719.

Guerrero, A., Griffiths, G.S., Nibali, L., *et al.* Adjunctive benefit of systemic amoxicillin and metronidazole in non-surgical treatment of generalized aggressive periodontitis: a randomized placebo-controlled clinical trial. *Journal of Clinical Periodontology* 2005; **32**:1096-1107.

Haffajee, A.D., Socransky, S.S. and Gunsolley, J.C. Systemic antiinfective periodontal therapy. A systematic review. *Annals of Periodontology* 2003; **8**:115-181.

Hallmon, W.W. and Rees, TD. Local anti-infective therapy: mechanical and physical approaches. A systematic review. *Annals of Periodontology* 2003; **8**:99-114.

Herrera, D., Sanz, M., Jepsen, S., Needleman, I. and Roldán, S. A systematic review on the effect of systemic antimicrobials as an adjunct to scaling and root planing in periodontitis patients. *Journal of Clinical Periodontology* 2002; **29(Suppl. 3)**:136-159.

Jaramillo, A., Arce, R.M., Herrera, D., Betancourth, M., Botero J.E. and Contreras, A. Clinical and microbiological characterization of periodontal abscesses. *Journal of Clinical Periodontology* 2005; **32**:1213-1218.

Jervoe-Storm, P.M., Semaan, E., AlAhdab, H., Engel, S., Fimmers, R. and Jepsen, S. Clinical outcomes of quadrant root planing versus full-mouth root planing. *Journal of Clinical Periodontology* 2006; **33**:209-215.

Jervoe-Storm, P.M., AlAhdab, H., Semaan, E., Fimmers, R. and Jepsen, S. Microbiological outcome of quadrant versus full-mouth root planing as monitored by real-time PCR. *Journal of Clinical Periodontology* 2007; **34**:156-163.

Koshy, G., Kawashima, Y., Kiji, M., *et al.* Effects of single-visit full-mouth ultrasonic debridement versus quadrant-wise ultrasonic debridement. *Journal of Clinical Periodontology* 2005; **32**:734-743.

Lang, N.P., Tan, W.C., Krähenmann, M.A. and Zwahlen, M. A systematic review of the effects of full-mouth debridement with and without antiseptics in patients with chronic periodontitis. *Journal of Clinical Periodontology* 2008; **35(Suppl. 8)**:8-21.

Llambés, F., Silvestre, F.J., Hernández-Mijares, A., Guiha, R. and Caffesse, R. Effect of non-surgical periodontal treatment with or without doxycycline on the periodontium of type 1 diabetic patients. *Journal of Clinical Periodontology* 2005; **32**:915-920.

Martorelli de Lima, A.F., Cury, C.C., Palioto, D.B., Duro, A.M., Da Silva, R.C. and Wolff, L.F. Therapy with adjunctive doxycycline local delivery in patients with type 1 diabetes mellitus and periodontitis. *Journal of Clinical Periodontology* 2004; **31**:648-653.

Möller, AJ. Microbiological examination of root canals and periapical tissues of human teeth. Methodological studies. *Odontologisk Tidskrift* 1966; **74(Suppl. 1)**:1-380.

Mombelli, A., McNabb, H. and Lang, NP. Black-pigmenting Gram-negative bacteria in periodontal disease. II. Screening strategies for detection of *P. gingivalis*. *Journal of Periodontal Research* 1991; **26**:308-313.

Mongardini, C., van Steenberghe, D., Dekeyser, C. and Quirynen, M. One stage full-mouth versus partial-mouth disinfection in the treatment of chronic adult or generalized early-onset periodontitis. I. Long-term clinical observations. *Journal of Periodontology* 1999; **70**:632-645.

O'Leary, T.J., Drake, R.B. and Naylor, J.E. The plaque control record. *Journal of Periodontology* 1972; **43**:38.

Pavicic, M.J., van Winkelhoff, A.J., Douqué, N.H., Steures, R.W. and de Graaf, J. Microbiological and clinical effect of metronidazole and amoxicillin in *Actinobacillus actinomycetemcomitans*-associated periodontitis. A 2-year evaluation. *Journal of Clinical Periodontology* 1994; **21**:107-112.

Quirynen, M., Bollen, C.M., Vandekerckhove, B.N., Dekeyser, C., Papaioannou, W. and Eyssen, H. Full- versus partial-mouth disinfection in the treatment of periodontal infections: short-term clinical and microbiological observations. *Journal of Dental Research* 1995; **74**:1459-1467.

Quirynen, M., Papaioannou, W. and van Steenberghe, D. Intraoral transmission and the colonization of oral hard surfaces. *Journal of Periodontology* 1996; **23**:960-970.

Quirynen, M., Mongardini, C., Pauwels, M., Bollén, C., van Eldere, L and van Steenberghe, D. One stage full- vs. partial-mouth disinfection in the treatment of patients with chronic adult or early-onset periodontitis. Part II: Long-term impact on microbial load. *Journal of Periodontology* 1999; **70**:646-656.

Quirynen, M., Mongardini, C., de Soete, M., *et al.* The role of chlorhexidine in the one-stage full-mouth disinfection treatment of patients with advanced adult periodontitis. *Journal of Clinical Periodontology* 2000; **27**:578-589.

Quirynen, M., De Soete, M., Boschmans, G., *et al.* "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* 2006; **33**:639-647.

Salvi, G.E. and Lang, N.P. Host response modulation in the management of periodontal diseases. *Journal of Clinical Periodontology* 2005; **32(Suppl. 6)**:108-129.

Segelnick, S.L. and Weinberg, M.A. Reevaluation of initial therapy: When is the appropriate time? *Journal of Periodontology* 2006; **77:**1598-1601.

Serrano, C., Torres, N., Valdivieso, C., Castaño, C., Barrera, M. and Cabrales, M.A. Antibiotic resistance of periodontal pathogens obtained from frequent antibiotic users. *Acta Odontologica Latinoamericana* 2009; **22**:99-104.

Teles, R.P., Haffajee, A.D. and Socransky, S.S. Microbiological goals of periodontal therapy. *Periodontology 2000,* 2006; **42**:180-208.

Tunkel, J., Heinecke, A. and Flemming, T.F. A systematic review of efficacy of machine-driven and manual subgingival debridement in the treatment of chronic periodontitis. *Journal of Clinical Periodontology* 2002; **29(Suppl. 3)**:72-81.

Van der Wejden, G.A. and Timmerman, M.F. A systematic review on the clinical efficacy of subgingival debridement in the treatment of chronic periodontitis. *Journal of Clinical Periodontology* 2002; **29(Suppl. 3)**:55-71.

Van Winkelhoof, A.J., Van der Velden, U., Winkel, E.G. and de Graaf, J. Black-pigmented bacteroides and motile organisms on oral mucosal surfaces in individuals with and without periodontal breakdown. *Journal of Periodontal Research* 1986; **21**:434-439.

Van Winkelhoff, A.J., Tojhof, C.J. and de Graaf, J. Microbiological and clinical results of metronidazole plus amoxicillin therapy in *Actinobacillus actinomycetemcomitans*–associated periodontitis. *Journal of Periodontology* 1992; **63**:52-57.

Wennstrom, J.L., Tomasi, C., Bertele, A. and Dellasega, E. Full-mouth ultrasonic debridement versus quadrant scaling and root planing as an initial approach in the treatment of chronic periodontitis. *Journal of Clinical Periodontology* 2005; **32**:851-859.

Winkel, E.G., Van Winkelhoff, A.J., Timmerman, T.F., Van der Velden, U. and Van der Wejden, G.A. Amoxicillin plus metronidazole in the treatment of adult periodontitis patients. A double-blind placebo-controlled study. *Journal of Clinical Periodontology* 2001; **28**:296-305.

Zanatta, G.M., Bittencourt, S., Nociti Jr., F.H., Sallum, E.A., Sallum, A.W. and Casati, MZ. Periodontal debridement with povidone-iodine in periodontal treatment: Short-term clinical and biochemical observations. *Journal of Periodontology* 2006; **77**:498-505.