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S-I Stratul
D Rusu
A Didilescu
M Mesaros-Anghel
C Lala
L Tion
A Sculean
H Jentsch

Prospective clinical study evaluating the long-time adjunctive use of chlorhexidine after one-stage full-mouth SRP

Authors' affiliations:
S.-I. Stratul, *D. Rusu*, Department of Periodontology, Victor Babes University of Medicine and Pharmacy, Timisoara, Romania
A. Didilescu, Department of Anatomy and Embryology, Carol Davila University of Medicine and Pharmacy, Bucharest, Romania
M. Mesaros-Anghel, *C. Lala*, *L. Tion*, Dental Clinic Dr. Stratul, Timisoara, Romania
A. Sculean, Department of Periodontology, University of Bern, Switzerland
H. Jentsch, Department of Conservative Dentistry and Periodontology, University of Leipzig, Leipzig, Germany

Correspondence to:
Stefan-Ioan Stratul
Department of Periodontology
Victor Babes University
Timisoara
Romania
Tel.: +40 744 521470
Fax: +40 256 495997
E-mail: sbs@online.ro

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Stratul S-I, Rusu D, Didilescu A, Mesaros-Anghel M, Lala C, Tion L, Sculean A, Jentsch H. Prospective clinical study evaluating the long-time adjunctive use of chlorhexidine after one-stage full-mouth SRP.

Abstract: *Objectives:* Scaling and root planing are the causal procedure in the treatment of periodontitis. Many attempts have been made to improve the outcome. The aim of this study was to verify the influence of the extended use of chlorhexidine after one-stage full-mouth (FM) SRP in patients with chronic periodontitis on the clinical outcome after 3 months. *Methods:* Eighty-one patients with pockets ≥5 mm were treated by FM. All patients rinsed additionally with 0.2% chlorhexidine (CHX) twice daily over 3 months. Plaque index, bleeding on probing, probing depth (PD) and clinical attachment level (CAL) were recorded at baseline and after 1 and 3 months. *Results:* In the test group, all variables were significantly improved after 1 and 3 months. Mean reduction of PD and CAL gain was 2.25 ± 1.08 and 1.67 ± 1.08 after 1 and 2.99 ± 1.11 and 2.33 ± 1.31 after 3 months respectively. *Conclusions:* Over 3 months of extended use of CHX mouth rinse after SRP showed slightly but statistically significant better results.

Key words: chlorhexidine digluconate; clinical trial; periodontitis; scaling and root planing

Introduction

Scaling and root planing are the most common treatment of periodontal infection and are efficient in chronic periodontitis (1, 2, 10). The aim of scaling and root planing is the removal of the subgingival biofilm and of the subgingival calculus from the root surfaces. In this way, the ecology of the subgingival environment can be changed. Clinical data and improvements provided by SRP in subgingival microbial counts are described (3, 4). Three

months after periodontal therapy by scaling and root planing, significant reductions in the prevalence and levels of *Porphyromonas gingivalis*, *Tannerella forsythia*, *Campylobacter rectus* and *Actinobacillus actinomycetemcomitans* were found (3). Clinical improvements were 0.11 mm for attachment gain and 0.2 mm for probing depth (PD), and bleeding on probing (BOP) was reduced from 58% to 52% (4). The weighted mean of attachment gain after subgingival debridement in the treatment of chronic periodontitis in pockets ≥5 mm is 0.64 mm, the corresponding reduction of PD is 1.18 mm (5). Nevertheless, after several weeks, the number of subgingival bacteria increases again and the occurrence of clinical inflammatory signs is possible (6, 7). The presence of *A. actinomycetemcomitans, P. gingivalis* and *P. intermedia* was found to be correlated with attachment level changes over 3 years (6). In 2002, Petersilka *et al.* (7) underlined that for the restoration and maintenance of periodontal health, repeated subgingival debridement would be necessary in sites deeper than 3 mm. To overcome the deficiencies of scaling and root planing, Quirynen *et al.* (8) suggested the idea of full-mouth (FM) scaling with special consideration of the FM disinfection procedure for longer-lasting results. Positive results are reported for FM therapy for the period of 8 months (9, 20). Especially for pockets ≥7 mm, significantly higher improvements were found for clinical attachment level (CAL) and PD for single- as well as multi-rooted teeth after 8 months (20). The eradication of *P. gingivalis* as well as the more pronounced reduction of spirochetes and motile microorganisms in the biofilm from single-rooted and multi-rooted teeth could be constated after 8 months (9). The idea is discussed very controversially, as many other authors could not confirm these results in their studies (10–12). In relation to the outcome of the one-stage scaling and root planing, not only the importance of chlorhexidine (CHX), but also of stannous/amine fluoride mouthrinse was underlined (18, 19). CHX is widely studied and is a proven gold standard for oral antiseptics (13). The cationic bis-biguanide has a widespread antibacterial activity and a high affinity to attach to the skin and mucosae (14–17).

In the present study, the idea of FM disinfection was resumed. The question was if it is possible to improve the clinical outcome with respect to CAL and PD by FM therapy by longer use of CHX mouthrinses by the patient over 3 months this is a longer period of time than described by Quirynen *et al.* (1995) earlier (8).

Study population and methodology

This study was performed after the approval by the Ethical Committee of the Victor Babes University of Timisoara, Romania. Eighty-one (33 males, 48 females) patients attending the university dental school clinic of Periodontology and the Dental Clinic of Dr Stratul, with moderate/severe generalized chronic periodontitis were included in the study. They had an attachment loss ≥4 mm at more than 30% of the sites and an age ≥30 years. After approval of the ethical committee, 81 patients (33 female, 48 male) with chronic periodontitis, displaying pockets ≥5 mm at a minimum of 10 teeth were selected. The inclusion criteria were subjects without any systemic condition with influence on the outcome of the treatment, no intake of antibiotics within the last 6 months and at least 10 treatable teeth. All subjects had improved levels of oral hygiene [plaque index (PI) <50%] after at least one session of professional tooth cleaning. Volunteers were excluded if they were not willing to follow the recommendations for mechanical plaque control and the use of CHX mouthrinse.

Periodontal examination was performed at baseline, after 1 and 3 months. PD, CAL, BOP and PI (Quigley and Hein, 18) were recorded in a six point measurement per tooth. Third molars were not included in the study. The PCP15 probe (HuFriedy, Chicago, IL, USA) was used for clinical recordings.

All patients underwent a one-stage FM scaling and root planing, with adjunctive use of 0.2% CHX rinsing, 0.2% CHX solution gargling, intrasulcular irrigation with 0.2% CHX solution and tongue brushing with CHX gel, described as 'full-mouth disinfection' by Quirynen *et al.* (1995). Hand and ultrasonic instruments were used. After 4 and 8 weeks, the teeth were professionally cleaned during an appointment of supportive periodontal care and the oral hygiene was reinforced. The patients used twice daily 10 ml of a 0.2% CHX mouthrinse (Dentaton®; Ghimas s.p.a., Casalecchio di Reno, Italy) and rinsed for 1 min.

Maximum values per quadrant (MQ) and mean values per subject (XS) were calculated. All values are given as mean ± SD and median. The statistical unit was the patient. Statistical analysis was performed using the Friedman/Wilcoxon tests. The Friedman/Wilcoxon tests were used for the within-group differences. A level of $\alpha \leq 0.05$ was considered significant.

Results

All volunteers from the baseline measurements could be examined after 1 and 3 months. The general information on the gender and age of the subjects in the tested group is given in Table 1.

The results calculated as MQ and XS as well as the statistical analysis for the values recorded at the different appointments are given in the Tables 2–4. Figures 1 and 2 represent

the CAL changes and gains in the maximal/quadrant group and XS at baseline, 1 and after 3 months. After 1 and after 3 months all recorded variables, PDCAL, BOP and PI, respectively were significantly improved. The mean attachment gain at the worst sites was 1.67 mm after 1 month and 2.33 mm at the end of the study. Starting with relatively high BOP values, the reduction was 44% and 51% after 1 and 3 months respectively. The mean PD was decreased with 2.25 and 2.99 mm at the second and third appointment.

The XS of the changes of the studied variables and the corresponding statistical analysis are given in Table 4. The improvement in PD was 1.65 mm after 1 month and 2.11 mm after 3 months. CAL was improved by 1.34 mm after 1 month and 1.75 mm at the end of the study.

Both groups of values (MQ and XS) resulted in significant improvements in all clinical parameters. In the MQ group, the mean PD changed from 8.34 ± 1.87 to 6.08 ± 1.72 mm ($P < 0.001$) after 4 weeks, and to 5.34 ± 1.83 mm ($P < 0.001$) after 3 months; CAL changed from 9.39 ± 2.17 mm to 7.71 ± 2.30 mm ($P < 0.001$) after 4 weeks and to 7.06 ± 2.43 mm ($P < 0.001$) after 3 months. The mean PI changed from 0.50 ± 0.37 (baseline) to 0.34 ± 0.34 (after 4 weeks) and to 0.30 ± 0.41 (after 3 months), while the mean BOP changed from 74 ± 25 (baseline) to 31 ± 21 (after 4 weeks) and to 24 ± 18 (after 3 months).

The mean PD reduction was 2.25 ± 1.08 mm ($P < 0.001$) after 1 month and 2.99 ± 1.11 mm ($P < 0.001$) after 3 months, and the mean CAL gain was 1.67 ± 1.08 mm ($P < 0.001$) after

Table 1. **General information on the subjects in the tested group**

No. subjects	Mean age	Male/female ratio	Smoker/non-smoker ratio
81	43.15	50/31	48/33

Table 2. **The MQ and the XS recorded at baseline, at 1 and 3 months**

	Baseline			1 month			3 months		
	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median
MQ									
PD	8.34	1.87	8.00	6.08	1.72	5.75	5.34	1.83	4.75
CAL	9.39	2.17	9.50	7.71	2.30	7.50	7.06	2.43	6.75
BOP	74	25	75	31	21	28	24	18	21
PI	0.50	0.37	0.44	0.34	0.34	0.26	0.30	0.41	0.20
XS									
PD	4.88	0.80	4.86	3.23	0.72	3.21	2.77	0.71	2.72
CAL	5.71	1.22	5.63	4.36	1.33	4.31	3.95	1.32	3.83
BOP	74	25	75	31	21	28	24	18	21
PI	0.50	0.37	0.44	0.34	0.34	0.26	0.30	0.41	0.20

MQ, maximal values per quadrant; XS, mean values per patient; PD, probing depth; CAL, clinical attachment level; BOP, bleeding on probing; PI, plaque index.

Table 3. **Within-group differences in the tested group for MQ**

	Δ MQ at 1 month	Δ MQ at 3 months	Δ MQ at 1–3 months
PD			
Mean ± SD	2.25 ± 1.08	2.99 ± 1.11	0.73 ± 0.78
Friedman test		$P < 0.001$	
Wilcoxon test	$P < 0.001$	$P < 0.001$	$P < 0.001$
CAL			
Mean ± SD	1.67 ± 1.08	2.33 ± 1.31	0.65 ± 0.71
Friedman test		$P < 0.001$	
Wilcoxon test	$P < 0.001$	$P < 0.001$	$P < 0.001$
BOP			
Mean ± SD	43.51 ± 31.85	50.46 ± 27.74	6.95 ± 23.38
Friedman test		$P < 0.001$	
Wilcoxon test	$P < 0.001$	$P < 0.02$	$P < 0.05$
PI			
Mean ± SD	0.15 ± 0.33	0.19 ± 0.40	0.04 ± 0.36
Friedman test		$P < 0.001$	
Wilcoxon test	$P < 0.001$	$P < 0.02$	$P < 0.05$

MQ, maximal values per quadrant; PD, probing depth; CAL, clinical attachment level; BOP, bleeding on probing; PI, plaque index.

Table 4. **Within-group differences in the tested group for XS**

	Δ XS at 1 month	Δ XS at 3 months	Δ XS at 1–3 months
PD			
Mean ± SD	1.65 ± 0.60	2.11 ± 0.69	0.46 ± 0.38
Friedman test		$P < 0.001$	
Wilcoxon test	$P < 0.001$	$P < 0.001$	$P < 0.001$
CAL			
Mean ± SD	1.34 ± 0.78	1.75 ± 0.91	0.41 ± 0.50
Friedman test		$P < 0.001$	
Wilcoxon test	$P < 0.001$	$P < 0.001$	$P < 0.001$
BOP			
Mean ± SD	43.51 ± 31.85	50.46 ± 27.74	6.95 ± 23.38
Friedman test		$P < 0.001$	
Wilcoxon test	$P < 0.001$	$P < 0.02$	$P < 0.05$
PI			
Mean ± SD	0.15 ± 0.33	0.19 ± 0.40	0.04 ± 0.36
Friedman test		$P < 0.001$	
Wilcoxon test	$P < 0.001$	$P < 0.02$	$P < 0.05$

XS, mean values per patient; PD, probing depth; CAL, clinical attachment level; BOP, bleeding on probing; PI, plaque index.

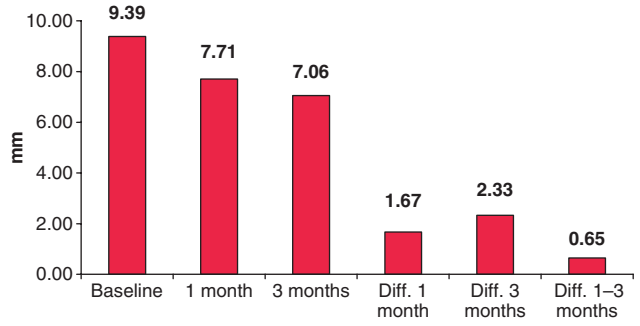

Fig. 1. CAL changes and gains in the maximal/quadrant (MQ) group: baseline, 1 month and after 3 months.

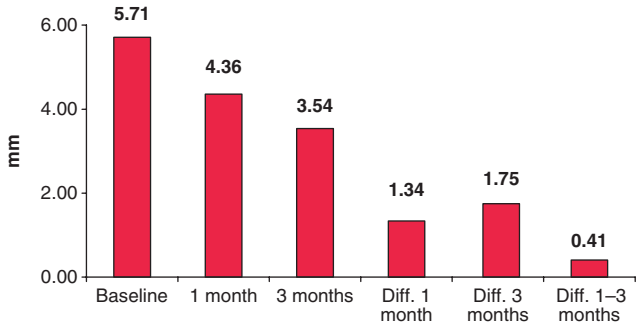

Fig. 2. CAL changes and gains in the mean values per subject (XS) group: baseline, 1 month and after 3 months.

1 month and 2.33 ± 1.31 mm ($P < 0.001$) after 3 months, respectively, in the MQ group of values.

In the XS group, the mean PD changed from 4.88 ± 0.80 to 3.23 ± 0.72 mm ($P < 0.001$) after 4 weeks and to 2.77 ± 0.71 mm ($P < 0.001$) after 3 months, and CAL changed from 5.71 ± 1.22 to 4.36 ± 1.33 mm ($P < 0.001$) after 4 weeks and to 3.95 ± 1.32 mm ($P < 0.001$) after 3 months.

The mean PD reduction was 1.65 ± 0.60 mm ($P < 0.001$) after 1 month and 2.11 ± 0.69 mm ($P < 0.001$) after 3 months, and the mean CAL gain was 1.34 ± 0.78 mm ($P < 0.001$) after 1 month and 1.75 ± 0.91 mm ($P < 0.001$) after 3 months, respectively, in the XS group of values.

Discussion

The aim of this study was to verify the influence on the clinical outcome after 3 months of extended use of CHX after one-stage FM SRP in the same group of patients with chronic periodontitis, when compared with baseline and 1-month examination.

The 0.2% CHX digluconate has been used for rinsing after FM scaling and root planing for 3 months because in the study of Quirynen *et al.* (8), only 14 days for individual use of CHX as a mouthrinse was planned. Furthermore, in another study of Quirynen *et al.* (1999), the test group used individually CHX for 12 months after FMD, but the control group underwent partial-mouth desinfection (21). In the present study, the detailed FM treatment procedure with subgingival rinsing and gargling with CHX during the SRP has also been performed. In our study, the PD improvement was 1.65 mm and 2.25 mm in comparison with 1.8 mm for multi-rooted teeth and about 2 mm for deep pockets of 7 and 8 mm in the study by Quirynen *et al.* (1995) after 1 month (8). Here at single-rooted teeth, the improvement was 2.4 mm. The additional improvement of PD was 0.46 and 0.73 mm in our study after further 2 months. The reason for the similar outcome could be the extended use of CHX rinsing. CHX is acknowledged as a strong antiplaque and antigingivitis agent in concentrations of 0.1% and 0.2% and also in a concentration of 0.12% (22–25). CHX has a good substantivity because it also binds to salivary pellicle (26). The antibacterial action of CHX is described by the binding to negative-charged sites on the bacterial wall by electrostatic force (26, 27). In this manner, the membrane of the bacteria is damaged and the leakage of the intracellular organites from the cytoplasm as well as the coagulation of the cytoplasm follows (28, 29). CHX is a strong inhibitor of Gram-positive bacteria, and Gram-negative bacteria are susceptible to a lesser extent (30–32). *Porphyromonas gingivalis* can be resistant to CHX by the expression of outer membrane vesicles (33), but on the other hand, a significant reduction of the adherence of *P. gingivalis* and the inhibition of MMPs (matrix metalloproteinases) *in vitro* have also been described (34, 35). The proteolytic activity of periodontopathogenic bacteria is diminished by the CHX digluconate (36, 37). The virucidal effect

of CHX could be also of importance because viruses are discussed in relation to periodontitis (38, 39). The influence on *de novo*-plaque-accumulation has been demonstrated (40).

It has to be discussed that the present study has some disadvantages. One is the absence of a control group, as the same group of 81 patients is submitted to the same examination, repeatedly at 1 and at 3 months (which also explains the presence of identical PI and BOP measurements in the Tables 2–4). Because of this fact, the comparison could be made only to the results of Quirynen *et al.* (8). The bias in our study could be avoided under a different study design: in our study several clinicians have been involved and the repeated measurements have been executed by different previously calibrated examiners**.** On the other hand, the study design does not permit any differentiation between the effect of mechanical instrumentation of the root surfaces by SRP and the effect that is the result of the CHX action.

Conclusions

At 1 and 3 months, there were significant clinical improvements in the PD reductions and CAL gains in both data groups. Additional adjunctive use of 0.2% CHX in the form of mouthwashes prolongated over 3 months provided more favourable CAL gain and PD reduction.

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