Long-Term Clinical Effects of a Chlorhexidine Varnish Implemented Treatment Strategy for Chronic Periodontitis

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Background: Scaling and root planing in combination with oral hygiene monitoring are still considered the therapeutic standards for periodontitis. Although this treatment concept customarily results in satisfactory clinical improvements, treatment outcome may become less favorable predominantly when full access to periodontal defects is compromised, thereby leaving accretions behind. The purpose of this study was to investigate, over a 9-month period, the clinical benefits of a treatment strategy for chronic periodontitis based on a combination of sequential scaling and root planing and subgingival chlorhexidine varnish administration.

Methods: This randomized controlled, single blind, parallel trial included 26 volunteers with chronic periodontitis. The control group received oral hygiene instructions and was scaled and root planed in two sessions. The test group received the same instructions and treatment; however, all pockets were additionally disinfected using a highly concentrated chlorhexidine varnish. Clinical response parameters were recorded at baseline and at 1, 3, 6, and 9 months. The impact of the initial strategy on the decision-making process for supplementary therapy at 9 months was investigated based on treatment decisions made by five independent clinicians.

Results: Both treatment strategies showed significant reductions in probing depth and gains in clinical attachment at study termination in comparison with baseline (P <0.001). However, combination therapy resulted in a significant additional pocket reduction of 0.62 mm (P <0.001). Initially deep pockets (≥7 mm) around multirooted teeth seemed to benefit most from the combination strategy, resulting in an additive pocket reduction of 1.06 mm (P = 0.009) and a clinical attachment gain of 0.54 mm (P = 0.048) in comparison to scaling and root planing alone. A trend toward a reduction of surgical treatment needs following the varnish-implemented strategy was found (P = 0.076).

Conclusion: These findings suggest that the outcome of initial periodontal therapy may benefit from the adjunctive subgingival administration of a highly concentrated chlorhexidine varnish. *J Periodontol 2006;77:406-415.*

KEY WORDS

Chlorhexidine; clinical study; periodontitis; root planing; scaling; varnish.

Even though the "specific plaque hypothesis"[1] has been acknowledged as an etiologic model for periodontitis, therapy of the latter has mainly remained non-specific. Indeed, scaling and root planing (SRP) are still considered the therapeutic standard for periodontitis, aiming at eliminating supra- and subgingival bacterial masses. Providing that oral hygiene is frequently monitored and, if necessary, reinforced, this treatment concept customarily results in satisfactory clinical improvements. However, treatment outcome can be less favorable and recurrent disease might occur, presumably due to the presence of persistent periodontopathogens. Indeed, limited access predominantly of deep pockets or furcations impedes complete removal of bacterial deposits even by experienced clinicians.[2-4] Furthermore, bacterial invasion in cementum, radicular dentin,[5,6] and the surrounding periodontal tissues[7-10] has been reported. Because these niches cannot be eliminated

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by SRP alone, they might act as bacterial reservoirs from which recolonization of treated sites occurs. These limitations can be addressed only if specific chemo-mechanical treatment concepts are developed.

Although systemic antibiotics have been proven to be beneficial as adjuncts to SRP,[11] their use should be restrained to well-compliant patients poorly responding to conventional therapy for obvious reasons of bacterial resistance.[12]

The surplus value of locally applied slow release antimicrobial agents seems to be controversial: although some studies showed modest benefits,[13-18] others failed to indicate any additive effect.[19-22] Moreover, these innovations remain expensive, which further weakens their cost-benefit ratio.

Finally, a number of treatment concepts using locally applied antiseptics adjunctive to SRP have been proven to be ineffective due to unadjusted vehicles and concentrations of the active agent. Indeed, additive effects due to subgingival irrigation using antiseptic solutions or gels turned out to be clinically negligible.[23-28]

Clearly, the search for safe, effective, and affordable chemical aids remains a challenge.

A promising vehicle in this regard is a highly concentrated chlorhexidine (CHX) varnish.[‡] This tooth varnish, containing 35% CHX, was originally developed for the prevention of caries in high-risk populations. Indeed, a number of studies showed that repeated applications suppress *Streptococcus mutans* in dental plaque, thereby lowering its cariogenic potential.[29-32] Furthermore, a preliminary report indicated a significant antiplaque effect of the varnish in a short time span.[33] In a recent pilot study, the clinical benefits of the CHX varnish were investigated when subgingivally applied as an adjunct to sequential SRP.[34] This treatment concept resulted in significant additional clinical improvements in comparison to SRP alone at 3 months follow-up. The aim of the present study was to investigate the long-term clinical effects of this combined strategy in a larger group of patients.

MATERIALS AND METHODS

Experimental Design

A total of 26 systemically healthy patients aged 32 to 78 years were recruited between September 5, 2003 and June 12, 2004 from new referrals to the Department of Periodontology of the Free University of Brussels and a private periodontal practice for the treatment of chronic periodontitis.

The presence of ≥20 teeth (wisdom teeth excluded) with a minimum of four multirooted teeth and four teeth per quadrant was a prerequisite for enrollment. Six experimental sites per tooth were selected (mesial, central, and distal; buccally and orally) irrespective of furcation involvement. Each patient had ≥15% of all experimental sites exhibiting a probing depth (PD) of 7 mm or deeper, which bled upon probing (BOP), and radiographic evidence of extended bone loss (≥ one-third of the root length). There was no history of antibiotic therapy within the last 4 months prior to the trial for any of the volunteers. Antibiotic therapy during the trial led to termination. Subjects wearing removable partial dentures or undergoing orthodontic therapy were excluded. Sites neighboring recent extraction sockets were systematically excluded, as were teeth showing endodontic-periodontic lesions.

Table 1.

Demographic Details

Group	N Subjects	Age*	N Males	N Females	N Smokers†
Control	13 (2‡)	51 ± 13	5 (1‡)	8 (1‡)	2
Test	13 (1‡)	49 ± 13	4 (1‡)	9	2

* Mean ± SD.
† ≥10 cigarettes per day.
‡ N premature terminations.

After an initial screening visit for recruitment, baseline measurements were recorded. Thereupon, patients were randomly assigned to the control or test groups (13 patients each). All patients gave informed consent. The demographic details of the volunteers are shown in Table 1; mean age and distribution of gender and smokers were similar in both groups. Subjects were considered smokers if they smoked ≥10 cigarettes per day. Table 2 shows the number of teeth enrolled per group, indicating similar study samples. Table 3 illustrates that both groups were relatively comparable with respect to the degree of periodontal destruction at baseline. The study protocol was submitted and approved by the Ethical Committee of the University Hospital in Brussels.

Treatment

Subjects of the control group received standard periodontal therapy, meaning SRP using an ultrasonic scaler and standard periodontal curets in two sessions of ~1.5 hours, with a time interval of 1 week between both appointments. To synchronize the study, the upper right and lower right quadrants were treated in the first session and the remaining quadrants in the second session. The treated quadrants were polished using a low-abrasive paste,[§] and oral hygiene instructions were given. This included manual brushing and interdental plaque control (by using interdental

‡ EC40, Certichem, Nijmegen, The Netherlands.
§ Nupro fine polishing paste, Ash, Division of Dentsply International, York, PA.

Table 2.

Descriptive Statistics of Experimental Teeth

Group	Total N Teeth	N Teeth/Patient*	Total N Single-Rooted Teeth	N Single-Rooted Teeth/Patient*	Total N Multirooted Teeth	N Multirooted Teeth/Patient*
Control	326	25 (20 to 28)	245	19 (16 to 20)	81	7 (4 to 8)
Test	328	25 (23 to 28)	247	19 (17 to 20)	81	6 (5 to 8)

* Median (minimum to maximum).

Table 3.

Descriptive Statistics of Degree of Periodontal Destruction at Baseline (mean ± SD)

	Initial Full-Mouth PD	% Sites With PD ≥7 mm and BOP	% Sites With Angular Defects*	% Sites With Calculus*
Control group	4.67 ± 0.32	20 ± 5	22 ± 8	47 ± 28
Test group	4.94 ± 0.70	24 ± 5	21 ± 8	39 ± 17
Independent samples *t* test	NS	NS	NS	NS

NS = not significant at the 5% level of significance.
* Estimated on intraoral long-cone radiographs.

brushes or toothpicks). All patients were provided with the same toothpaste[‖] and toothbrush.[¶] Oral hygiene was reviewed and, if necessary, reinstructed at the second treatment session and at 1, 3, and 6 months.

Subjects of the test group received the same treatment and instructions; however, SRP was followed by the administration of the CHX varnish in all pockets mechanically treated in that session regardless of their initial PD. A blunt needle was used for its application. The varnish was slowly released while the needle was moved in a coronal direction from the bottom of the pocket. Pockets were deliberately overfilled. The varnish was gently removed 15 minutes after its application using a standard periodontal curet. To ensure blindness, one investigator performed SRP and collected all clinical data, whereas another investigator was charged with the application of the varnish (test group) and all polishing procedures (control and test groups). Adverse effects and the intake of medication were recorded 24 hours after the first treatment session and after 7 days by means of a questionnaire.

Examination Criteria

The following clinical parameters were recorded in a sequential order by the same calibrated investigator at baseline (prior to therapy): 1) location of the gingival margin in relation to the cemento-enamel junction was measured to the nearest millimeter; recession was given a positive value, whereas pseudo-pockets were given a negative value; 2) the sulcus bleeding index (SBI)[35] was measured at six sites (mesial, central, and distal; buccally and orally) at the Ramfjord teeth (or neighboring teeth in case of absence); the scores ranged from 0 to 5; 3) BOP was evaluated 15 seconds after pocket probing; a dichotomous score was given; and 4) the Quigley and Hein plaque index (PI)[36] was measured at six sites (mesial, central, and distal; buccally and orally) at the Ramfjord teeth (or neighboring teeth in case of absence); the scores ranged from 0 to 5.

The initial PD, measured to the nearest millimeter at six sites per tooth (mesial, central, and distal; buccally and orally) using a manual probe,[#] was measured immediately after SRP to avoid interference with calculus deposits.

The initial clinical attachment level (CAL) was calculated for each site as the sum of PD and gingival recession or overgrowth.

The following response parameters were recorded again in a sequential order by the same calibrated investigator after 1, 3, 6, and 9 months: SBI, PD, BOP, and PI. Recessions/pseudopockets and CAL were measured again, respectively, and calculated again at study termination.

All recordings were made without access to previous measurements to avoid measurement bias.

In addition, intraoral long-cone radiographs were taken of all teeth at baseline and 9 months. The technique described by Vandekerckhove et al.[37] was used

‖ Elmex, GABA, Almere, The Netherlands.
¶ Lactona, Voprak Lactona, Bergen op Zoom, The Netherlands.
# CP 15 UNC, Hu-Friedy, Chicago, IL.

to detect a gain or loss of marginal bone. The scores used were: −1 = further bone loss; 0 = no difference; and +1 = bone gain.

The possible impact of the initial treatment strategy on the decision-making process at 9 months was verified: five independent periodontists, who had recently graduated from the Dental School of the University in Brussels and were unaware of the initial treatment strategy that was conducted, were asked to make treatment decisions for all patients on a tooth level at 9 months. Per tooth, one of the following treatment options had to be selected: supportive periodontal care, meaning regular maintenance care including supragingival plaque control without further active therapy; supra- and subgingival reinstrumentation and reevaluation; or periodontal surgery and reevaluation. The clinicians had access to the final intraoral long-cone radiographs and to all clinical information from baseline and 9 months.

Calibration Session

To ensure the reliability of test results, the investigator charged with clinical assessments had to be calibrated for intraexaminer repeatability prior to the start of the trial. Three patients with chronic periodontitis were enrolled for this purpose. Duplicate measurements (N = 414) for PI, PD, and CAL were collected with an interval of 30 minutes between the first and second recordings.

Statistical Analysis

Data analysis was performed using the patient as the experimental unit. For all clinical parameters, mean values per subject and per visit were calculated. The clinical changes over time within each group (within-group comparison) and the impact of the treatment strategy on these parameters (between-group comparison) were examined by means of repeated measures analysis of variance (ANOVA) with treatment, time, and their interaction as fixed effects, and the subject as a random effect. A model with measurements at baseline and 1, 3, 6, and 9 months was used to compare the changes over time in the two groups (interaction effect). Subsequently, the data were split per tooth type (single- versus multirooted teeth) and initial PD (medium deep: between 4 to 6 mm; and deep: ≥7 mm) to allow a site-specific analysis.

The independent samples *t* test was used to compare the proportion of pockets that showed a pocket reduction ≥2 mm at 9 months from baseline between both treatment strategies.

The interexaminer agreement on the decision-making process at 9 months between the five independent clinicians was verified by means of the Pearson correlation coefficient. Thereupon, a mean value per treatment category (supportive periodontal care, supra- and subgingival reinstrumentation, and periodontal surgery) and per patient was calculated. These data were expressed as a proportion of the total number of teeth per patient. The independent samples *t* test was used to detect significant differences between control and test groups.

RESULTS

A total of 26 patients entered the trial and 23 fully completed it. Terminations were due to the use of systemic antibiotics, illness, and lack of compliance.

Intraexaminer repeatability was good to excellent for PI (Spearman correlation: r = 0.86; P <0.001), PD (Pearson correlation: r = 0.92; P <0.001), and CAL (Pearson correlation: r = 0.91; P <0.001).

Plaque Indices, Gingival Indices, and Bleeding on Probing

The changes over time in gingival indices, plaque indices, and bleeding on probing are given per treatment strategy in Table 4. At baseline, there were no statistically significant differences for any of these parameters between control and test groups. All indices decreased significantly over time irrespective of the treatment strategy. Between-group differences could not be detected at any time.

Probing Depth

At each follow-up visit, the full-mouth PD decreased significantly in reference to baseline levels for both treatment strategies (P <0.001). The largest reductions were expressed during the first month. When a comparison was made between control and test groups, the latter scored significantly better at each reexamination visit (P <0.001). At study termination, the full-mouth PD was reduced by 1.19 mm for the control group and 1.81 mm for the test group, pointing to a significant additional reduction of 0.62 mm in favor of the test group (Table 4). The data were split per tooth type and initial PD to scrutinize intergroup disparities. The changes in PD over time for each subgroup and tooth type are depicted in Figure 1. Significant additional pocket reductions were systematically recorded for initially medium deep pockets around single-rooted teeth (P ≤0.006). At the end of the study, the extra pocket reduction in favor of the test group was 0.54 mm (P = 0.005). For initially deep pockets around single-rooted teeth, an analog but non-significant trend was seen. Diseased pockets around multirooted teeth of the test group expressed a significant additive pocket reduction at each reexamination visit (P ≤0.012). At 9 months, the additional pocket reduction around multirooted teeth was 0.66 mm (P = 0.004) for initially medium deep pockets and 1.06 mm (P = 0.009) for initially deep pockets. Disregarding tooth type, pooled analysis of all periodontally affected teeth indicated that the largest reductions at the end of the study were obtained for

Table 4.

Changes in Periodontal Parameters (mean ± SD)

Periodontal Parameter	Group	Baseline	1 Month	3 Months	6 Months	9 Months
Gingival index (SBI)	Control	1.19 ± 0.54	0.38 ± 0.21*	0.26 ± 0.15*	0.36 ± 0.24*	0.32 ± 0.17*
	Test	1.21 ± 0.60	0.30 ± 0.15*	0.34 ± 0.21*	0.31 ± 0.15*	0.37 ± 0.18*
PI	Control	2.56 ± 0.59	1.99 ± 0.57*	1.99 ± 0.49*	1.88 ± 0.53*	1.72 ± 0.52*
	Test	2.44 ± 0.49	1.80 ± 0.48*	1.57 ± 0.37*	1.74 ± 0.48*	1.78 ± 0.44*
BOP %	Control	73 ± 13	25 ± 7*	25 ± 9*	26 ± 6*	23 ± 5*
	Test	72 ± 15	23 ± 5*	22 ± 6*	21 ± 7*	25 ± 6*
Full-mouth PD	Control	4.67 ± 0.32	3.49 ± 0.41*	3.40 ± 0.37*	3.45 ± 0.39*	3.48 ± 0.33*
	Test	4.94 ± 0.70	3.17 ± 0.29*†	3.02 ± 0.44*†	3.05 ± 0.55*†	3.13 ± 0.59*†

* Within-group differences: $P \leq 0.005$ (between baseline and follow-up visits).
† Between-group differences: $P \leq 0.005$.

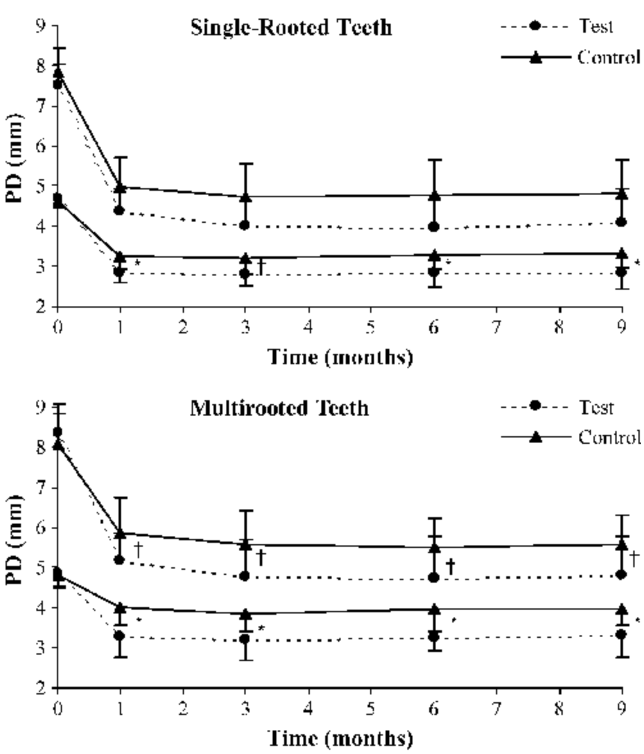

Figure 1.
*Changes in PD over time for deep (≥7 mm) and medium deep (4 to 6 mm) pockets. The data are depicted per strategy (test and control) and tooth type (single-rooted and multirooted). Between-group differences: *P ≤0.005; †0.005 < P ≤0.05.*

initially deep pockets in both treatment groups, notably 2.71 mm in the control group versus 3.54 mm in the test group, pointing to an additional reduction in the test group of 0.83 mm ($P = 0.018$). For initially medium deep pockets, the additional reduction in favor of the test group was 0.56 mm ($P = 0.002$). To emphasize the clinical relevance of these results, the proportion of pockets that showed a pocket reduction ≥2 mm at 9 months from baseline was calculated: 32% of the control pockets versus 51% of the test pockets. This difference was highly statistically significant ($P < 0.001$).

Clinical Attachment Level

Again, the data were split per tooth type and initial PD to allow a detailed analysis. Statistically significant clinical attachment gains were systematically recorded in relation to baseline levels for control and test groups at 9 months ($P < 0.001$). Figure 2 presents mean clinical attachment gains per subgroup and tooth type at study termination. A significant additional gain in clinical attachment was shown for initially medium deep (0.29 mm; $P = 0.038$) and initially deep pockets (0.54 mm; $P = 0.048$) around multirooted teeth of the test group. There were no significant differences in CAL at 9 months follow-up for diseased sites around single-rooted teeth between control and test groups.

Radiographs

A total of 37% of the interproximal sites in the test group and 27% in the control group showed a radiographically detectable gain of marginal bone. The sites with ongoing bone loss were, respectively, 9% and 12% at study termination (Table 5).

Impact on Decision-Making Process

The interexaminer agreement between the five independent clinicians making treatment decisions at 9 months on tooth level was good to excellent (Pearson correlation between 0.84 and 0.97; $P < 0.001$).

Figure 3 shows the proportional tooth distribution derived from treatment decisions of five independent clinicians sorted per treatment category (supportive periodontal care, supra- and subgingival reinstrumentation, and periodontal surgery) and per initial strategy (control versus test). Although no significant

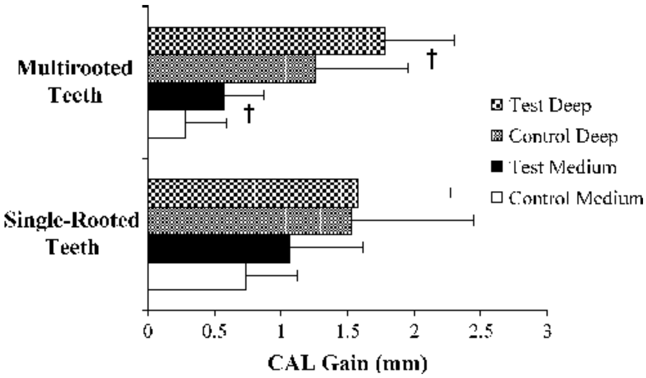

Figure 2.
Changes in CAL at 9 months in reference to baseline levels for deep (≥7 mm) and medium deep (4 to 6 mm) pockets. The data are depicted per strategy (test and control) and tooth type (single-rooted and multirooted). †Between-group differences: 0.005 < P ≤0.05.

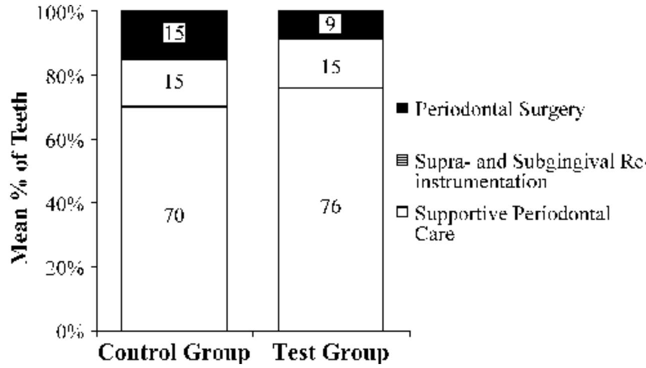

Figure 3.
Impact on decision-making process at 9 months in reference to strategy (control versus test). Based on data of 23 patients ($N_{control}$ = 11; N_{test} = 12) and 573 teeth ($N_{control}$ = 271; N_{test} = 302).

differences were found between control and test groups, there was an important trend toward a reduction of surgical treatment needs following the test strategy ($P = 0.076$).

Adverse Effects

The major complaints of patients are summarized in Table 6. The pain experience immediately following therapy and during the first week seemed similar in both groups. The number of patients taking painkillers during the first day was slightly higher in the test group, yet the amount of analgesics taken was comparable in both groups.

DISCUSSION

Even though the outcome of mechanical debridement usually satisfies in terms of reduction in PD and BOP, difficulties reaching the bottom of the pocket can lead to its failure. As a consequence, supplementary treatment becomes inevitable. Moreover, it has also been demonstrated that the time spent on therapy, the number of sites that require instrumentation,[38] and the experience of the clinician may influence the success of SRP.[39] These findings indicate that SRP is a technique-sensitive method for treating periodontitis. Furthermore, some microbiota simply cannot be mechanically eradicated. Indeed, bacterial invasion in cementum, radicular dentin,[5,6] and the surrounding periodontal tissues[7-10] has been reported.

The idea of subgingivally applying a highly concentrated antiseptic as an adjunct to SRP was the result of an increased consciousness of the limitations of the former. The objective was to compensate for these shortcomings, thereby improving treatment outcome.

The highly concentrated CHX varnish appeared to fulfill the criteria for adequate subgingival infection control: 1) this varnish can be easily applied within the pocket using a blunt needle; 2) it seemed ideal as a vehicle for antiseptic delivery because crevicular fluid promotes its hardening, avoiding fast clearance from the subgingival area; 3) the varnish contains CHX, one of the most effective antiseptics reported to date;[40-42] and 4) its CHX concentration is sufficiently high and adjusted to the ultimate goal. Indeed, a 35% CHX concentration will induce local cytotoxic effects and a delay of wound healing;[43-47] yet, concurrently, these cytotoxic effects can be therapeutic by inducing superficial necrosis of the outer connective tissue layers, thereby targeting invading periodontopathogens. A reduced contact time of 15 minutes was chosen because it assures superficial cytotoxic effects and bactericidal concentrations of CHX within the crevicular fluid[48] without the risk of serious adverse effects, such as taste disturbances or advanced gingival necrosis leading to high pain levels.

The results of this study showed that a treatment strategy supplementing mechanical debridement by subgingival CHX varnish application provides significantly greater improvements in PD compared to those obtained by SRP alone in the treatment of chronic periodontitis. At study termination, combination therapy resulted in a full-mouth additional pocket reduction of 0.62 mm. Pooled analysis of periodontally

Table 5.

Radiographic Examination of Interproximal Sites Over a 9-Month Period (mean ± SD)

Group	−1*	0†	+1‡
Control	12 ± 7%	61 ± 7%	27 ± 6%
Test	9 ± 5%	54 ± 10%	37 ± 9%

* Further bone loss.
† No difference.
‡ Bone gain.

Table 6.

Side Effects in Study Groups

Group	Pain Rating (0 to 10) Day 1*	Pain Rating (0 to 10) Day 7*	N Patients/ Analgesics Day 1	N Patients/ Analgesics Days 2 to 7	N Analgesics Day 1*	N Analgesics Days 2 to 7*	N Patients/ Fever	N Patients/ Herpes Labialis	N Patients/ ROU	N Patients/ Taste Disturbances
Control	5 (1 to 10)	0 (0 to 4)	10	1	2 (0 to 10)	0 (0 to 4)	0	1	1	0
Test	6 (2 to 10)	0 (0 to 5)	13	1	3 (1 to 6)	0 (0 to 4)	1	0	1	1

ROU = recurrent oral ulcerations.
* Median (minimum to maximum).

affected teeth indicated additive reductions between 0.56 and 0.83 mm. The major response to therapy occurred during the first month in both groups and flattened for the remainder of the study. This is in accordance with previous findings describing the early effects[49,50] and delayed effects[51-56] of SRP on periodontal parameters, at least for pockets managed by SRP alone. To what extent the additive effects in the test group are related to antiseptic effects and/or superficial necrotic effects remains unclear and should be explored further.

Interestingly, the data of the present study showed that initially deep pockets (≥7 mm) around multirooted teeth seemed to benefit most from the combination strategy, resulting in an additive pocket reduction of 1.06 mm and a clinical attachment gain of 0.54 mm in comparison to SRP alone. This observation, which is in accordance with findings of a preliminary investigation,[34] seems logical taking into account that clinical improvements following therapy depend upon the severity of the disease, with the higher level of disease leading to a greater margin for differences to be detected.[57,58] Furthermore, SRP is usually very efficacious around single-rooted teeth. Indeed, their anterior position in the oral cavity and their simple root anatomy, usually without furcations, make it easier to remove accretions. Hence, when SRP is meticulously performed around single-rooted teeth, further improvements by antimicrobials may be beyond a level of detection.

To emphasize the clinical relevance of the results of the present study, the proportion of pockets that showed a pocket reduction ≥2 mm at 9 months from baseline was calculated. Indeed, a pocket reduction ≥2 mm is believed to be clinically relevant.[17,18] The data indicated that 32% of the control pockets and 51% of the test pockets expressed such a reduction in depth, pointing to a significant difference of 19% favoring the test strategy. A trend toward a reduction of surgical treatment needs following the varnish-implemented strategy further substantiates the clinical relevance of these results. However, it has to be anticipated that this trend may not be generalized because of the following: 1) the results of treatment decisions were based on a convenience sample of only five recent graduates from one dental school who were possibly influenced by a common treatment philosophy; and 2) only three conventional options were given, namely supportive care, meaning regular maintenance care, including supragingival plaque control without any further active therapy; supra- and subgingival reinstrumentation and reevaluation; and periodontal surgery and reevaluation. This strategy may not totally reflect daily clinical practice; however, including other less common treatment options would increase complexity and possibly mask any difference in surgical treatment needs between control and test groups, especially when using relatively small study samples. The possible impact of the test strategy on further decision making needs to be investigated further.

Multicenter studies have indicated significant additive pocket reductions of 0.46 mm[17] and 0.30 mm[18] after 6 months and 9 months, respectively, of follow-up due to insertion of the CHX chip.**[59] Even though test pockets with a residual PD ≥5 mm were systematically retreated every 3 months using the CHX chip, and residual control pockets were left untreated[17,18] or subjected to a placebo chip,[18] the present study still indicates higher additional pocket reductions (0.56 to 0.83 mm) as a result of CHX varnish administration. This confusing observation might be explained by the following considerations. First, little is known about the severity of disease in the multicenter studies providing data only in reference to control and test sites with an initial PD from 5 to 8 mm. However, the present study also comprised severely advanced lesions (>8 mm). Indeed, it is well documented that these sites have a higher potential for clinical improvements, leaving a greater margin for differences to be detected.[57,58] Second, it has to be acknowledged that we recorded initial PD immediately following SRP, thereby possibly

** PerioChip, Perio Products, Jerusalem, Israel.

overrating values at baseline. Concurrently, initial PD may have been slightly underrated due to the presence of subgingival calculus deposits in the study by Soskolne et al.[17] The exact moment when initial PD measurements were recorded was unclear in the study by Jeffcoat et al.[18] Third, the total microbial load had to be lower in the present study because CHX was administered in all pockets. Finally, the dimensions of the CHX chip wafer may not allow efficacy beyond residual pockets ≥6 mm.[58]

CONCLUSIONS

The findings of this study suggest that the outcome of initial periodontal therapy may benefit from the adjunctive subgingival administration of a highly concentrated CHX varnish. However, we wish to emphasize that meticulous SRP remains of primordial importance for treating chronic periodontitis: the application of an antiseptic, regardless of its concentration, cannot replace SRP under any circumstances. More research is needed describing periodontal wound healing following the administration of a highly concentrated CHX varnish. Microbiological data are mandatory to assess the effects on the subgingival microflora. Furthermore, it might be interesting to explore the possible surplus value of subgingival CHX varnish administration as a part of other treatment concepts such as same-day full-mouth root planing and for other forms of disease such as aggressive periodontitis. The effects of repeated applications on the periodontal status of weakly responding sites to SRP should also be investigated.

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