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Comparing effectiveness of full mouth disinfection protocol with standard treatment of periodontal disease

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Abstract

Introduction and Objective. Periodontal treatment is based on patient motivation and education as well as quadrantwise subgingival instrumentation. The literature suggests that periodontal scaling should be performed in 2 sessions spaced within 24 hours, combined with the use of chlorhexidine to decontaminate all sites in the mouth. The aim of this study is to evaluate and compare the effectiveness of quadrantwise periodontal treatment with the full-mouth disinfection protocol.

Materials and Method. The sample consisted of 58 patients aged between 40 and 60 years with stage III periodontitis. They were randomly divided into test and control groups. The control group was treated with scaling and root planing in several sessions while the test group underwent full-mouth disinfection within 24 hours. These individuals were evaluated at three different times over 60 days.

Results. There were no significant differences in gender or age between the test and control groups. The findings revealed a substantial and progressive decline in the mean probing depth and clinical attachment level at 60 and 120 days for both treatments. A statistically significant difference was observed between the treatments at 60 days (probing depth and clinical attachment level) and 120 days (probing depth), with the test group demonstrating superior outcomes.

Conclusions. It was evident that both treatment options were effective and that the full-mouth disinfection was more effective than the conventional quadrantwise treatment, resulting in a greater improvement in probing depth and clinical attachment level.

Key words

periodontitis, subgingival scaling, disinfection, treatment outcome

INTRODUCTION

The literature has shown a cause-and-effect relationship between plaque and gingivitis, with gingivitis clearly being a response to plaque accumulation. There is a significant degree of variation among individuals, even in the absence of qualitative and quantitative differences in plaque accumulation. Periodontitis is characterized by a process of continuous destruction of the periodontium. Clinically, this condition manifests through signs of bleeding on probing, presence of periodontal pockets, and loss of clinical attachment [1]. Researches also revealed that periodontitis is always preceded by gingivitis. This means that eliminating gingival inflammation and maintaining gingival health would prevent the onset and recurrence of periodontal disease [2].

In 2017, following the deliberations and consensus report of an international workshop in Chicago, in 2018, Papapanou et al. and Tonetti et al. introduced a new classification of periodontal disease and conditions, According to Tonetti et al., periodontal disease is recognized as a single entity that can be classified using two evaluation vectors called stages and degrees. The stages reflect the severity of periodontal disease, observed according to attachment and bone loss and the grade determines the rate of disease progression which takes into account risk factors such as smoking and diabetes.

The Classification of periodontitis is based on Stages defined by severity, extent, distribution and complexity. Stage I is characterized by interdental attachment loss of 1–2 mm, radiographically assessed bone loss <15% of the coronal third, probing depth ≤4 mm. In stage II, interdental attachment loss of 3–4 mm is observed, radiographically assessed bone loss of 15–33% of the coronal third, probing depth ≤5 mm, and normally horizontal bone loss for both stage I and stage II (Tonetti et al. 2018). Stage III, in turn, is recognized by interproximal attachment loss ≥ 5 mm, radiographically assessed bone loss extending to the middle third of the root, loss of up to 4 teeth due to periodontal causes, probing depth between 6–7 mm, presence of vertical bone loss ≥ 3 mm, and furcation involvement grades II and III. Stage IV presents a more destructive picture than that observed in stage III; where interdental attachment loss is ≥

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8 mm, radiographically assessed bone loss reaches the apical third. Tooth loss due to periodontal causes occurs in 5 or more teeth. There is increased complexity, with the presence of, for example, mobility and occlusal collapse.

According to studies, periodontal treatment should be carried out in three phases. The initial phase is marked by the implementation of substantial biofilm management measures, whereas the subsequent phase of treatment is focused on cause-related therapy. This approach, also referred to as non-surgical periodontal therapy, involves the removal of plaque and the elimination of its retentive factors. Subgingival instrumentation, when performed in tandem with effective patient-conducted plaque control, serves this purpose by inducing disruption of the microbial biofilm, altering the subgingival ecology, reducing bacterial levels and suppressing inflammation. The primary goal of non-surgical periodontal therapy is to remove plaque and calculus from the root [3].

The conventional treatment modality during the cause-related phase involves subgingival instrumentation by quadrant or sextant [4, although alternative therapeutic modalities also exist. Full-mouth scaling (subgingival instrumentation of all quadrants within 24 hours), or the approach that determines the subgingival instrumentation of the entire dentition within 24 hours and indicates tongue brushing and intervention in all areas of bacterial colonization with the use of chlorhexidine – a protocol called full-mouth disinfection. This protocol is intended to ensure that untreated sites would not r-infect those already treated [4]. According to Quirynen et al. [5] reports indicate that this full-mouth treatment approach resulted in superior microbiological effects and clinical outcomes than conventional quadrant SRP.

On the other hand, Gaddam [6], in a controlled clinical trial, observed significant clinical improvements in both the test group (FMD) and the control group. However, when comparing the two groups, the differences between the strategies were small and not statistically significant. Jervoe-Storm et al., in a systematic review of the Cochrane Library (Cochrane Database of Systematic Reviews), observed no scientific evidence of benefit in the use of FMD when comparing clinical findings obtained from group test (FMD) and a control group characterized by gingival instrumentation by sextants or quadrants. There was no greater reduction in PPD, less attachment loss, or a more significant reduction in bleeding on probing. They concluded that the decision to select one approach to non-surgical periodontal therapy over another, should include patient preference and the convenience of the treatment schedule.

The present study aims to clinically evaluate whether the mechanical therapy by quadrant and the full-mouth disinfection are effective in eliminating or controlling periodontal disease and also to confront the clinical findings from each technique in order to understand which one shows better results.

MATERIALS AND METHOD

Study population. The convenience sample was composed of 80 patients aged between 40–60 years, randomly divided into two groups – test and control. The study evaluated and compared the effectiveness of quadrantwise periodontal treatment with full-mouth disinfection. The treatment evaluation protocol was quite strict and required a follow-up of 120 days, compliance with the medication regimen, together with the avoidance of antibiotics and anti-inflammatory drugs during the period of the study. This led to the substantial loss of 22 subjects. The final sample finally consisted then of 58 individuals. The test group underwent full-mouth disinfection therapy, whereas the control group was treated with quadrantwise subgingival instrumentation every two weeks. The participants signed an Informed Consent Form and showed motor skills for mechanical plaque control.

Inclusion criteria. Men and women aged between 40–60 years; diagnosed with stage III periodontitis, grades 1 or 2; having at least 20 teeth distributed in the four quadrants, with no less than two true periodontal pockets per quadrant, with probing depth (PD) ≥ 5mm and clinical attachment level (CAL) ≥ 3 mm plus bleeding on probing (BOP).

Exclusion criteria. Systemic diseases; alterations to the medication protocol during the study period, development of any other type of inflammatory process apart from periodontal disease, use of antibiotics during or two months prior to the start of treatment; smoking, pregnancy or lactation, immune disorders, having undergone periodonal therapy in the past 12 months, missing any treatment appointment, and not having stage III periodontitis, grade 1 or 2.

According to Tonetti et al. [2], stage III, in turn, is recognized by interproximal attachment loss ≥ 5 mm, radiographically assessed bone loss extending to the middle third of the root, loss of up to 4 teeth due to periodontal causes, probing depth between 6–7 mm, presence of vertical bone loss ≥ 3 mm, and furcation involvement grades II and III. The grade determines the rate of disease progression, defined as a 3-level variable: A, B and C. Grade A suggests a slower rate of progression. Grade B is assumed to be a moderate rate of progression of periodontitis, and grade C as a more rapid rate of progression.

Research design. 58 patients with stage III periodontitis and who met the inclusion and exclusion criteria, were randomly selected and examined by an experienced periodontist responsible for the periodontal charting of the study. The patients were then randomized between 2 groups of treatment. Another trained specialist performed the designed treatment protocols on the patients according to the randomization. All referred individuals were treated, regardless of whether or not they were included in the study sample. The enrolled patients were monitored in 3 stages: a periodontal examination in time zero, and on 2 more occasions separated by an interval of 60 days (times 0, 1 and 2). The clinical periodontal evaluation yielded data on the PD measurement, the CAL, percentage of BOP dental faces, and recession and enlargement measurements. This allowed the analysis of the initial state of the periodontium at time 0, and whether or not there was an improvement in the periodontal infection after the 2 proposed therapies.

Periodontal treatment. After their first appointment for treatment, the control group received the conventional periodontal therapy with subgingival instrumentation per quadrant at 2-week intervals, while the test group underwent full-mouth disinfection therapy in 2 sessions at 24-hour

intervals, combined with brushing the dorsum of the tongue with 1% chlorhexidine gel for 1 minute, mouth rinsing twice with 0.2% chlorhexidine for 1 minute, spraying the tonsils 4 times with 0.2% chlorhexidine; and irrigating all periodontal pockets 3 times with 1% chlorhexidine gel at 10-minute intervals. The procedure was to be repeated 8 days later. Separate syringes and needles were used for the upper and lower arches to prevent recontamination. Finally, the protocol that was followed through consisted of the use of mouthwashes at home containing 0.2% chlorhexidine twice a day for 1 minute for 14 days [3]. All subjects were taught oral hygiene using the modified Bass Technique with the help of dental demonstration models. Gracey curettes and sickle scalers were used for subgingival instrumentation. All patients were allowed to withdraw from the experiment any time they wished.

Measurement of clinical periodontal parameters. All periodontal assessment parameters were evaluated by a single trained and calibrated researcher specialist in periodontics. The Kappa statistic was used to measure the clinical parameters of PD measurement and CAL at 2 time points separated by 2 weeks [7]. The two-time intra-examiner evaluation of these measurements revealed a κ value greater than 93%. The evaluation of the BOP followed a dichotomous criterion. After probing to the bottom of the pocket, there was a waiting time of 30 seconds to check for bleeding. The North Carolina probe was used to determine PD measurement, CAL, recession, and hyperplasia. The CAL was obtained either by subtracting the value obtained from the PD and the hyperplasia measurement,or by adding the value obtained from the PD and the recession measurement. Gingival enlargement was measured as the distance between the cement-enamel junction and the coronal gingival margin; recession was measured as the distance between the cemento-enamel junction and the apical gingival margin.

Statistics. For the analysis of clinical parameters, a mean was calculated per individual and per study phase to maintain the patient as a statistical unit. The mean, standard deviation (SD), median, interquartile range (IQR), and absolute and relative frequencies were used for descriptive analysis of the data. The assumptions for the use of parametric statistics were assessed using the Shapiro-Wilk (normality) and Levene (homoscedasticity) tests. The balance of demographic conditions at baseline between experimental groups was verified using Student's *t*-test for independent samples (age) and chi-square test (gender). Repeated-measures analysis of variance (ANOVA) (gingival recession or enlargement index) and Friedman and Mann-Whitney tests (PD, CAL, and BOP index) were used to test the effect of time and treatment on periodontal clinical parameters. *Post hoc* tests for multiple comparisons were performed with Bonferroni adjustments. The significance level used in the analyses was 5% (α = 0.05). Data were tabulated and analyzed using IBM SPSS Statistics for Windows (IBM SPSS. 21.0, 2012, Armonk, NY: IBM Corp).

Table 1. Demographic characteristics at baseline

Variable	Test group (n = 29)	Control Group (n = 29)	*p-value
Age (years)	53.63 ± 5.43	51.17 ± 5.35	0.082
Gender			
Male	11 (40.0%)	11 (40%)	1.000
Female	18 (60.0%)	18 (60%)	

Mean age ± standard deviation. * Student's *t*-test for independent samples (age) and chi-square (gender).

RESULTS

Table1 summarizes the demographic characteristics of the sample, Table 2 and Figure 1 show the clinical parameters at baseline, 60 days and 120 days after treatment. There were no significant differences ($p > 0.05$) between the test and control groups in terms of gender and age and in the clinical parameters evaluated ($p > 0.05$).

As demonstrated in Table 2, both treatments resulted in a significant ($p < 0.001$) and progressive decrease in the overall mean of PD and CAL at 60 and 120 days. After 60 days, these reductions were 0.44 mm for both parameters in

Table 2. Clinical parameters changes (probing depth measurement, clinical attachment level and bleeding on probing index) at baseline, 60 and 120 days

Clinical parameter	Grup	Phase of the study			*p-value
		Baseline	60 days	120 days	
Probing depth measurement (mm)	Test	3.54 ± 0.46[a]	3.10 ± 0.33[b]	2.98 ± 0.41[c]	< 0.001
	Control	3.80 ± 0.82[a]	3.33 ± 0.89[b]	3.20 ± 0.80[c]	< 0.001
	[T]p-value	0.075	0.005	0.011	
Clinical attachment level (mm)	Test	2.02 ± 1.02[a]	1.58 ± 1.18[b]	1.48 ± 1.06[c]	< 0.001
	Control	2.38 ± 1.04[a]	2.10 ± 1.11[b]	2.06 ± 1.11[c]	< 0.001
	[T]p-value	0.062	0.040	0.055	
Bleeding on probing index (%)	Test	51.19 ± 29.10[a]	21.43 ± 12.02[b]	15.38 ± 12.48[b]	< 0.001
	Control	50.00 ± 16.24[a]	21.43 ± 6.80[b]	15.98 ± 11.01[c]	< 0.001
	[T]p-value	0.957	0.900	0.784	

Values expressed as median ± interquartile range. * Friedman test: [a,b,c] different letters indicate a statistical difference among the phases of the study according to the Wilcoxon test; [T] Mann-Whitney test.

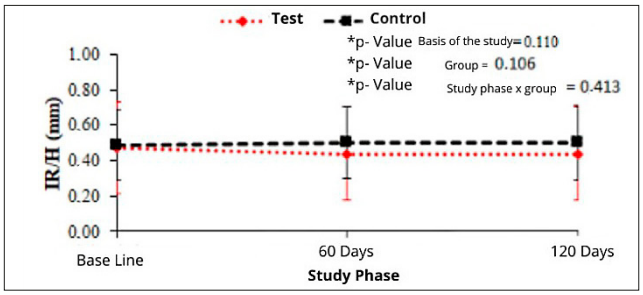

Figure 1. Changes in the index of gingival recession or enlargement at baseline, 60 and 120 days. Values are expressed as mean ± standard deviation. * Repeated measures ANOVA.

the test group and 0.47 mm and 0.28 mm, respectively, in the control group. Additional improvements of 0.12 mm and 0.10 mm in the test group and 0.13 mm and 0.04 mm in the control group for DP and CAL, respectively, were observed between the 60 and 120 day assessments.

The differences between treatments were significant at 60 days (PD: $p = 0.005$; CAL: $p = 0.040$) and 120 days (PD: $p = 0.011$) in favour of the test group.

A subsequent analysis of the BOP index revealed a progressive statistical reduction ($p<0.001$) at the conclusion of each treatment phase in both the test and control groups. A 60-day post-treatment evaluation revealed a decline of 29.76 and 28.57 percentage points in the sites that showed BOP, test and control groups, respectively. A further reduction of 5.45 percentage points was observed between the 60- and 120-day assessments in the control group. Intra-group analysis at each time point indicated no significant differences between the treatments.

No significant changes ($p > 0.05$) were observed in the recession or hyperplasia index in the test and control groups at the end of 60 days and 120 days. The inter-group analysis in each phase of the study also indicated no statistical difference among the different phases of the study (Fig. 1).

DISCUSSION

The sample in the study exhibited homogeneity regarding age and gender between the test and control groups. This similarity is a critical factor in the subsequent comparison of the groups. The relationship between age and periodontal disease is not easy to understand, for years it has been fundamental foro understanding the differences observed in patterns of periodontal destruction, and has even been part of the 1999 American Academy of Periodontology (AAP) classification of periodontal disease – adult or prepubertal periodontitis. It is not possible to state that periodontal disease is associated with age or that it is age-dependent; however, it would be biologically plausible to accept that susceptibility to periodontitis is increased among the elderly. The gender parity is also salutary, as its absence would bring into the discussion introduce important behavioural differences in periodontal treatment outcomes, as it has been found that men have worse periodontal status than women, despite no differences in susceptibility between them [8]. Prevention and treatment of gingivitis and periodontitis must include education about the role of biofilm in the etiology of the condition, and also about the absolute necessity of mechanical plaque control by the patient in their home care [1].

In 2020, a clinical practice guideline showed that there is a certain consensus that scaling and root planing, combined with supragingival plaque control, is an interesting treatment modality in reducing probing pocket depth, and improving clinical attachment levels [3].

As expected, the results obtained in the current study support those found in previous studies, showing a statistically significant decrease in clinical parameters (PD, CAL, and BOP) 60 days after treatment, while a continuous decline was also significant at 120 days. These results demonstrate the effectiveness of periodontal treatment by quadrants in controlling periodontal disease. Statistically significant reductions in the clinical periodontal parameters: PD, CAL and BOP, were also observed at 60 and 120 days after treatment with full-mouth disinfection. This improvement in periodontal condition has also been reported in other clinical studies, as well as in important systematic reviews, all of which describe a positive effect of full-mouth disinfection therapy on clinical periodontal parameters [9].

It is suggested that the control or elimination of periodontal disease can be achieved by teaching and encouraging home biofilm control, combined with periodontal instrumentation by quadrants in multiple sessions, or mechanical periodontal therapy in 2 sessions within 24 hours, or full-mouth disinfection. The choice between these 3 therapeutic possibilities should be based on criteria related to the patient and the dentist [3]. During the VI Workshop on Periodontics of the European Academy, however, it was stated that full-mouth disinfection and instrumentation do not offer clinically relevant advantages over treatment by quadrants [9]. The choice of method should be based on the patient's needs and preferences, skills of the specialist, and the logistics of the location and cost-benefit balance. Gaddam et al. [6] drew attention to patient comfort, and that operator fatigue could influence treatment choices.

On the other hand, Mandil et al. [10] warned about predictors of worse prognosis, such as diabetes, smoking, and advanced periodontitis, when choosing FMD in the treatment of periodontal disease. Another impactful point regarding FMD is the reduction in the number of sessions between patient and dentist. These sessions, during a long treatment, are invaluable for stimulating the control of oral biofilm and for its evaluation by the professional.

The present study found a statistically significant improvement in the results obtained in the reduction of the PD measurement at 60 and 120 days and CAL at 60 days, after treatment in the group that underwent full-mouth disinfection, compared to treatment by quadrants in several sessions. This finding corroborates the conclusions of Quirynen et al. [5], and from several other publications from the same research group [9].

The current study comparing standard periodontal treatment with full-mouth disinfection treatment using propolis solution, evidenced a significant improvement in PD and CAL measurements after 4 and 12 weeks [11]. It is possible to associate this greater improvement in the test group with the antimicrobial role of chlorhexidine and its influence on the periodontal healing process. It is clearly indicated that the most outstanding results in the group were observed at 2 and 4 months. In a longer evaluation period of about 8 months, systematic reviews have reported similar results between multiple-session subgingival instrumentation and full-mouth disinfection groups [9].

Some important systematic reviews, however, have shown different results, that there was no statistically significant difference in efficacy between quadrantwise treatment and full-mouth disinfection during an observation period of 6–8 months [9,12]. Several articles comparing full-mouth disinfection and quadrantwise treatment have also concluded that there is no difference between them [9,12,13]. In terms of microbiology, when comparing the 2 techniques, no superior reduction in bacterial load or specific periodontal pathogens was observed [11,13]. Farooqui et al. propose using the BANA assay (14) to detect specific periodontopathogenic bacteria associated with periodontal disease to evaluate the effectiveness of periodontal treatment.

In the current study, quadrantwise subgingival instrumentation – the effectiveness of which has been established since 1984 [3] – was utilized in the control group. It is important to note that alternative treatment protocols have also been proposed. [14,15]. All presented adequate? therapeutic results show that different protocols are efficient for root decontamination, while other substances, apart from the chlorhexidine used in this study, e.g. Triphala [15] and ozonated water [16], also showed efficient results.

The findings of the present study show similarities with those of others and demonstrate better outcomes when associating subgingival instrumentation with the use of antimicrobial substances in a short period of time [5].

CONCLUSIONS

Based on the results presented, it is possible to conclude that:
- both therapies, conventional by quadrant and full-mouth disinfection, are effective in promoting improvement in clinical periodontal parameters;
- full-mouth disinfection treatment is more effective than conventional treatment by quadrant, resulting in a more marked improvement in PD and CAL.

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