Effectiveness of tips for delicate micro-ultrasonic root planing comparing to tips for traditional ultrasonic root planing

Gianna Maria Nardi, RDH, DHA
Roberto Di Giorgio, MD, DDS
Silvia Sabatini, RDH, DHA

Department of Oral and Maxillofacial Sciences, Sapienza University of Rome, Italy

Corresponding author:
Gianna Maria Nardi
Department of Oral and Maxillofacial Sciences,
Sapienza University of Rome, Italy
Via Caserta, 6
00161 Rome, Italy
Phone: +39 3289850146
E-mail: giannamaria.nardi@uniroma1.it

Summary
Aim. **The present study wants to evaluate the effectiveness in the improvement of several periodontal indices, such as probing pocket depth, bleeding on probing and plaque index, and the patient subjective preference to the treatment of root planning with tips for delicate -micro ultrasonic therapy comparing to traditional ones.**
Methods. **Thirty patients were selected for our randomized split mouth study; in each patient two quadrants (test) were treated with tips for delicate micro-ultrasonic root planing, and two quadrants (control) with tips for traditional ultrasonic root planing. Probing pocket depth, bleeding on probing and plaque index were collected at baseline, after six weeks and after six months. Patients were asked to assess the subjective preference of the type of treatment with Visual Analogue Scale (Vas) especially designed and immediately administered after the treatment.**
Results. **Probing pocket depth and plaque index had a parallel improvement in both groups, while the bleeding on probing improved significantly in test group. The majority of patients (23 to 30, 76,6%) has expressed preference with VAS for the treatment with new tips.**
Conclusions. **The new tips created for periodontal maintaining can be really advantageous in terms of reduction of plaque and bleeding indexes; the main point in favor of these tips is the reduction of the discomfort for the patient. Finally this approach tends to be less time consuming than a manual instrumentation method.**

Key words: root surfaces, periodontal disease, ultrasonic instrumentation, cementum.

Introduction

Periodontitis is an immuno inflammatory disease characterized by the loss of tooth supporting structures included the connective tissue attachment and the alveolar bone. Plaque and bacteria are generally recognized as the primary cause of the periodontal disease. Nowadays, scaling and root planning (SRP) represents the most widely used procedure in the treatment of the periodontitis. Its main goal is the removal of the components of the subgingival biofilm, which have the major role in the initiation and in the progression of the disease.
A primary goal in the treatment of periodontitis is the removal of bacterial deposits and the arrest of disease progression. Mechanical removal of these deposits from the root surface is required for establishing and maintaining periodontal health (1). Large number of studies has reported beneficial results from mechanical therapy in term of both clinical and microbiological aspects (1,2). Since long, the hand instruments were the first choice of clinicians. It was believed that these instruments produced a smooth root surface; however, considerable manual dexterity is required for their effective operation. Moreover, hand instruments are more time consuming and are unable to reach deeper root surface where pockets are more than 4 mm deep (3). Ultrasonic tips were originally designed for gross scaling and removal of supragingival calculus and stains. More recently, these power driven instruments have been modified to have smaller diameter tips and longer working lengths, thereby providing better access to deep probing sites and more efficient subgingival instrumentation.
It is known from literature (1-3) that ultrasonic scaling and root planing have the same effectiveness of manual instrumentation in biofilm removal and in creating a biologically compatible surface on the root treated. It has been already proposed that there is no difference in the results of different ultrasonic therapies (4), but to define which kind of available technology is better to use for an ideal minimally invasive treatment plan is necessary. All this could improve the patient acceptance and cutting the work time.
“Root planing” can’t be considered as an appropriate definition to describe the procedures of the non-surgical periodontal therapy, since it emphasizes the “polishing” or “smoothing” of the roots only, while the main aim of such a treatment is to decontaminate and lower the bacterial load of the periodontal pocket. In the past the attention of dental hygienists and dentists was to smoothen the roots as much as possible, many times with too aggressive approaches of instrumentation, and this often jeopardized the root. Nowadays clinical research makes us aware of the importance of a minimally invasive approach of instrumentation, to respect the surfaces of roots, particularly the cementum and cementogenesis.
The objective of this study is to evaluate the effectiveness in the improvement of several periodontal indices, such as probing pocket depth, bleeding on probing and plaque

index, and the patient subjective preference to the treatment of root planning with tips for micro-delicate ultrasonic therapy comparing to traditional ones.

Materials and methods

Study population and design

This research is a randomized split mouth study. Thirty patients who were 18 years old or older and able to sign an informed consent form were selected for the study. They were under periodontal maintenance, in a good systemic health condition and they have at least a residual pocket depth of ≥5 mm and a positive bleeding on probing for each quadrant. The criteria for exclusion were as follows: smoking, assuming medications that could affect the periodontal therapy such as long-term non-steroidal anti-inflammatory drug therapy, use of bisphosphonates, unwillingness to return for the follow-up examination. In each patient two quadrants (test) were treated with tips for delicate micro- ultrasonic root planing, and two quadrants (control) with tips for traditional ultrasonic root planing. Each quadrant was randomly allocated to a test group or control group using a specific software package (Random Allocation Software version 1.0, downloadable on http://mahmoodsaghaei.tripod.com/Softwares/randalloc.html).

Treatment

In each patient two quadrants (test) were treated with tips for delicate micro- ultrasonic root planing, and two quadrants (control) with tips for traditional ultrasonic root planing. Clinical indices were collected at baseline (T0), after six weeks (T1) and after six months (T2).
At baseline (T0) probing pocket depth (PPD) and bleeding on probing (BOP) were collected using a periodontal probe (Fig.1). To collect plaque index (PI) was used a fluorescein plaque detector with Blue Phase curing light (Ivoclar®) to motivate the patients to the importance of correct brushing and to make us have more information about their oral hygiene behavior (Fig. 2).
Each patient had at least a pocket depth of ≥ 5 mm, PI was 37% in the test group and 35% in the control one, and BOP was 15% in the test group and 16% in the control one.

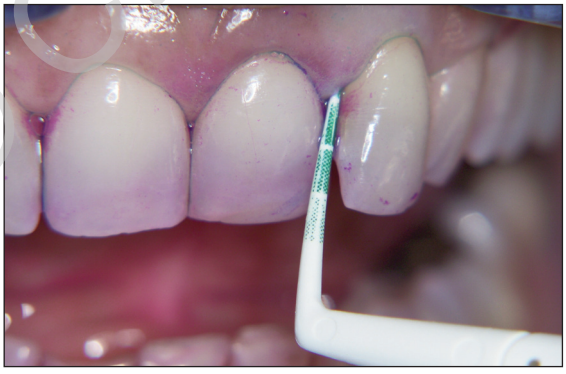

Figure 1. Collecting clinical indexes with a periodontal probe.

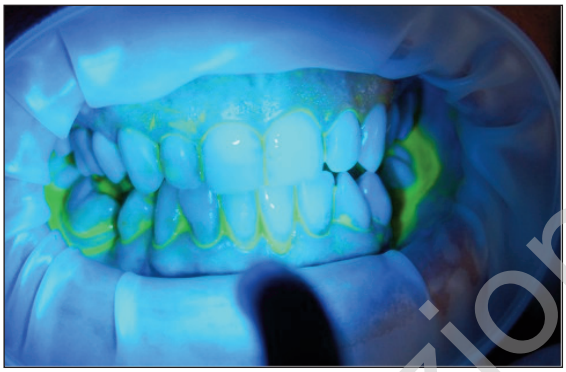

Figure 2. Fluorescein plaque detector with curing light.

Once this clinical index had been collected, each patient received ultrasonic supragingival scaling using a standard tip Mectron® S1, with semi-circular cross-section for work on large areas on all tooth surfaces (Fig. 3), and subgingival scaling and root planing using a traditional periodontal tip Mectron® P1 for the quadrants taken as control and a new tip Mectron® P10 for delicate micro-ultrasonic root planing for the other ones (Fig. 4). The insert P1 is straight with a round tip for universal root planing, the insert P10 is more anatomic with a straight, thin and curved working tip (Fig. 5). No anesthetic has been used.

Figure 3. This picture shows the design of tip S1.

Figure 4. Delicate micro ultrasonic root planing with tip P10.

Figure 5. This image shows the anatomic design of tip P10.

After scaling and root planing have been performed, all dental surfaces, both of crowns and roots, received an air-polishing treatment with glycine powder (Fig. 6).
Patients were asked to assess the subjective preference of the type of treatment with Visual Analogue Scale (VAS) especially designed and immediately administered after the treatment. The scale consisted of ten possible values, corresponding to six different stages of pain: 0 was “no pain”, from 1 to 2 “mild annoying pain”, from 3 to 4 “uncomfortable pain”, from 5 to 6 “distressing pain”, from 7 to 8 “intense pain” and from 9 to 10 “worst possible pain”.

Figure 6. Airpolishing treatment with glycin powder.

We gave oral hygiene instruction for home maintenance, suggesting to brush twice per day for two minutes at least with oscillating rotating mechanical toothbrush (Fig. 7) using a pea size quantity of generic fluoride toothpaste and to rinse mouth after brushing with zero alcohol essential oils mouthwash for 30 seconds. Patients had to perform this protocol for six weeks, until they received the control visit.

Figure 7. Home maintenance protocol instruction with oscillating mechanical toothbrush.

Clinical indices were collected again after six weeks from the treatment (T1), to assess if PI, PPD and BOP have had any improvement. There was a general improvement of clinical indices, so we performed airpolishing with glycine powder to remove the new biofilm where necessary and let the patients continue with the same home maintenance protocol until the final evaluation of the study after six months from the initial treatment (T2).
At T2 PI, PPD and BOP were collected again and professional oral hygiene was scheduled for each patient the week after.

Results

The PI at baseline was 37% in test group and 35% in the control one, and after six weeks both groups showed a PI of 15%. Each patient had at least a residual pocket depth ≥ 5 mm at baseline, while after the treatment no probing depths ≥ 3 mm were collected in both groups. BOP at

baseline was 15% in the test group and 16% in the control one. At T1 it was 8% in the test group and 15% in the control group. The values were the same at T2: the test group showed PI = 15%, PPD ≤ 3 mm and BOP = 8%, while the control group showed PI = 15%, PPD ≤ 3 mm and BOP = 15% (Figs. 8, 9).

Statistical analysis indicated that differences between test and control sites were significant (t= -2.37, sdev=0.431, degrees of freedom = 22, the probability of this result, assuming the null hypothesis, is 0.027< 0.05).
The majority of patients (23 to 30, 76,6%), has expressed preference with VAS for the treatment with new tips. The

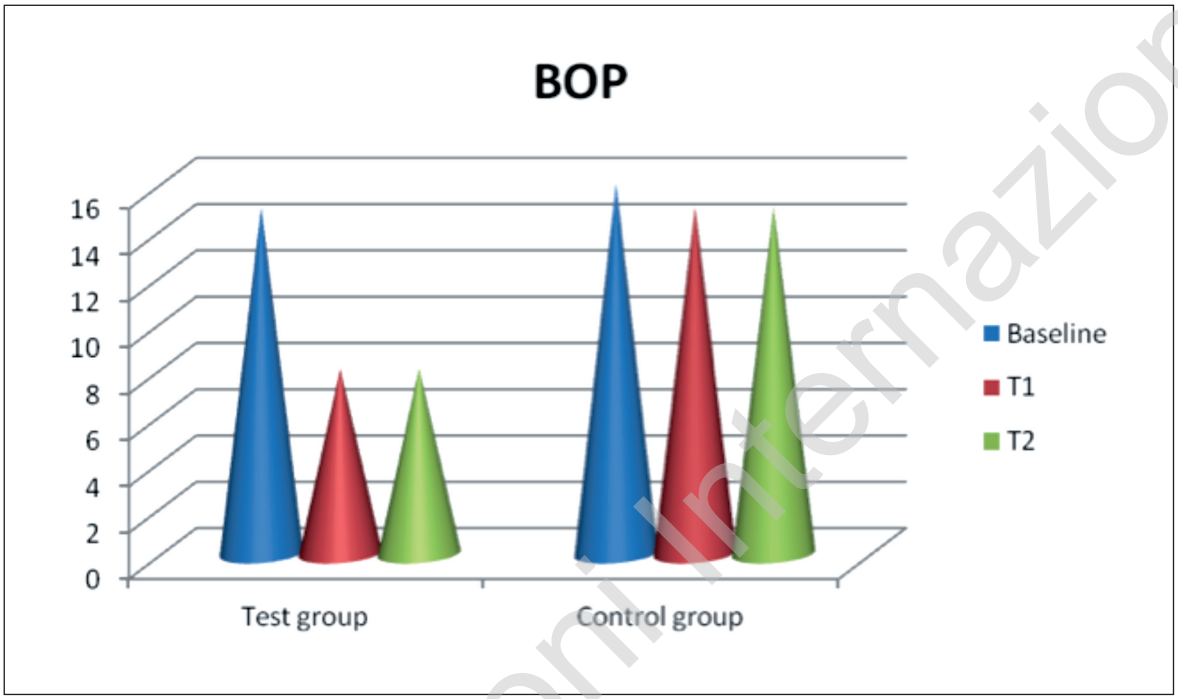

Figure 8. Graph showing the changing of BOP from baseline to T2.

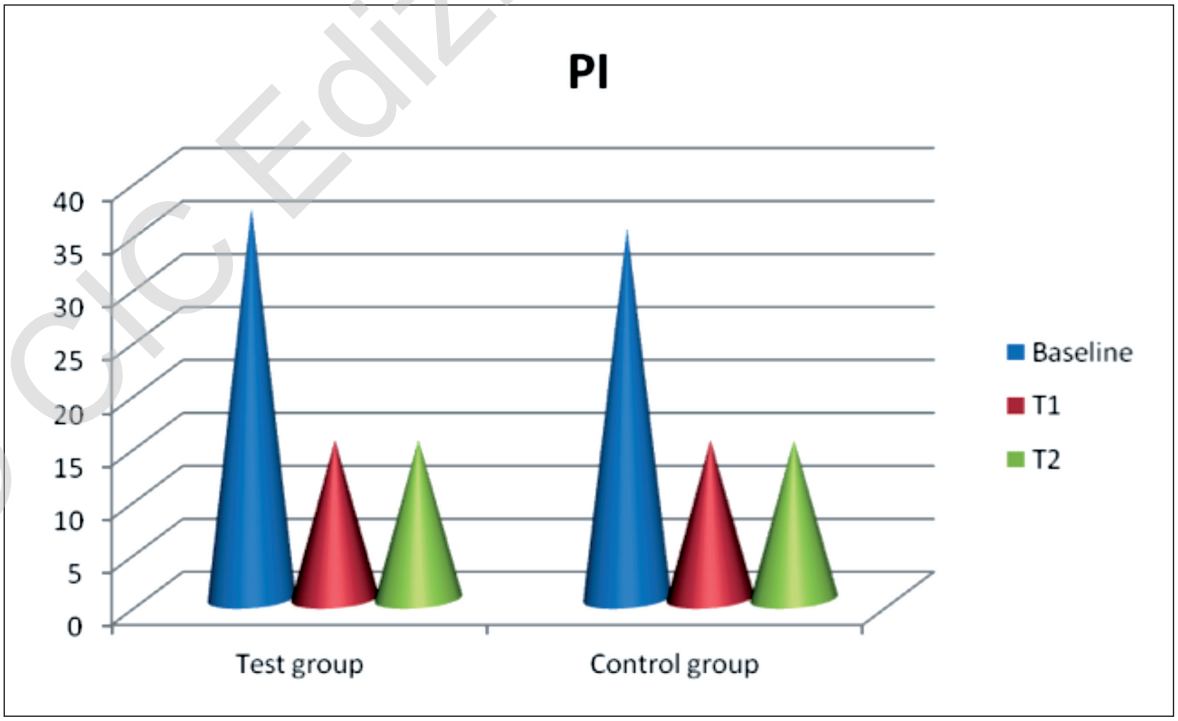

Figure 9. Graph showing the changing of PI from baseline to T2.

Tips	Score						
	0	1	2	3	4	5	6
P10	14	12	4	-	-	-	-
P1	3	10	11	5	-	-	1

Table 1. Table showing numbers of patients that expressed scores collected with VAS after the treatment with tip P1 and tip P10.

7 who did not preferred the tip P10 found no differences between the two inserts. The maximum score attributed to the treatment with P10 was "2" (mild annoying pain), while the maximum one given to treatment with P1 was "6" (distressing pain). Using the test tip, the patients gave the following scores to the treatment: fourteen patients gave "0", twelve patients gave "1" and four patients gave "2"; using the control tip the scores were: three patients gave "0", ten patients gave "1", eleven patients gave "2", five patients gave "3" and one patient gave "6" (Tab. 1).

Discussion

Analyzing the clinical indices, they show a parallel improvement in PPD and PI. No patient had residual pocket depth ≥ 3 mm at T1 or T2, and PI was 15% in both groups after six weeks and also after six months. There were no significant differences in the indices measured in the treated sites with the new tips comparing to those treated with traditional ones, except in BOP, which showed an improvement in the test sites (test group: BOP = 8%, control group: BOP = 15%), both at T1 and T2. These results mean that ultrasonic therapy is efficient in clinical indices' reduction, as the patients of both groups show improvement, but that the tip for a micro- delicate root planing is more efficient in managing bleeding on probing than the universal tip.

The partial results were satisfying, but more satisfying were the final results: no differences were showed among the values collected at T1 and those collected at T2, meaning that the home maintenance protocol was efficient and the clinical situation can be considered permanent.

23 on 30 patients preferred the treatment with the test tip and the other 7 found no difference between the two tips used; no patients received anesthetics, so the insert P10 for micro delicate root planing can be used as minimally invasive treatment.

Ultrasonic instruments have been used as valuable adjuncts to conventional hand instruments for many years. Newly designed thin ultrasonic tips have allowed better access to sub-gingival areas previously accessible only with hand instruments. Earlier studies using older tip designs generally showed that ultrasonic instruments left a "stippled" root surface and had a greater potential for producing root surface damage than curettes (5-7). More recent studies, especially those using the newer, thinner tips show that ultrasonic instruments can produce root surfaces as smooth as or smoother than what is produced by the curettes (8,9). Current evidence suggests that ultrasonic tips used on medium power may do less damage to the root surface than the hand or sonic scalers (10). Some studies suggested that the rotary instruments at high speed (2,00,000 revolutions per minute) and ultrasonic instruments caused more damaged to root surface when compared with hand curettes (11).

All in all this research stresses the idea that these new tips created for periodontal maintaining can be really advantageous in terms of reduction of plaque and bleeding indexes. Moreover it should be considered that the main point in favor of these tips is the reduction of the discomfort for the patient. Finally this approach tends to be less time consuming than a manual instrumentation method. However what the effective advantage in term of preservation of cementum is remains elusive. Further researches in this area might include a quantitative study of tooth substance loss with various periodontal instruments and effects of root surface characteristics on fibroblast attachment after mechanical debridement. Such studies will be very helpful in opening new vistas of research for understanding the treatment modalities for optimal regeneration of supporting tissue onto the tooth surface affected by periodontitis.

References

1. Wilkins EM. La pratica clinica dell'igienista dentale, PICCIN 2010.
2. Singh S, Uppoor A, Nayak D. A comparative evaluation of the efficacy of manual, magnetostrictive and piezoelectric ultrasonic instruments—an in vitro profilometric and SEM study. J Appl Oral Sci. 2012 Feb;20(1):21-6.
3. Dahiya P, Kamal R, Gupta R, Pandit N. Comparative evaluation of hand and power-driven instruments on root surface characteristics: A scanning electron microscopy study. Contemp Clin Dent. 2011 Apr;2(2):79-83.
4. Silva LB, Hodges KO, Calley KH, Seikel JA. A comparison of dental ultrasonic technologies on subgingival calculus removal: a pilot study. J Dent Hyg. 2012;86(2):150-8.
5. Clark S, Group H, Mabler D. The effect of ultrasonic instrumentation on root surfaces. J Periodontol. 1968;39:125-32.
6. Garrett JS. Effects of non-surgical periodontal therapy on Periodontitis in humans.A review. J Clin Periodontol. 1983;10:515-21.[PubMed]
7. Dragoo MR. A clinical evaluation of hand and ultrasonic instruments on subgingival debridement. Part I with unmodified and modified ultrasonic inserts. Int J Periodontol. 1992;12:311-7.
8. Drisko CL. Scaling and root planing without over instrumentation: Hand versus poser – driven scalers. Curr Opin Periodontol. 1993;3:78-84. [PubMed]
9. Jacobson L, Blomlof J. Root surface texture after different scaling modalities. Scan J Dent Res. 1994;102:156-60.
10. Lie T, Mayer K. Calculus removal and loss of tooth substances in response to different periodontal instruments. J Clin Periodontol. 1977;4:250-62. [PubMed]
11. Wilkinson RF, Maybury JE. Scanning electron microscopy of root surface following instrumentation. J Periodontol. 1973;44:559-63. [PubMed]