J Clin Periodontol 2004; 31: 193–199
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Journal of Clinical Periodontology

Comparative clinical responses related to the use of various periodontal instrumentation

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Obeid PR, D'Hoore W, Bercy P. Comparative clinical responses related to the use of various periodontal instrumentation. J Clin Periodontol 2004; 31: 193–199. © Blackwell Munksgaard 2004.

Abstract

Aim: The aim of this study was to evaluate in vivo the effectiveness of scaling and root planing of a power-driven mechanism compared with hand instruments and ultrasonic insert alone with a split-mouth design after 3 and 6 months.

Methods: Healing events after initial periodontal therapy were investigated in 20 patients with moderate-to-severe adult periodontitis. Plaque index (PlI), bleeding on probing (PBI), probing pocket depth (PPD), probing attachment level (PAL) and number of moderate and deep pockets (NMP, NDP) were recorded at baseline and 3 and 6 months after treatment. Oral hygiene instruction was provided for each patient. Randomly assigned quadrants per patient were scaled and root planed with hand instrumentation (curettes, hoes and files), with reciprocating power-driven instruments, with ultrasonic scaler alone and with the combined use of ultrasonic scaler and power-driven inserts. The Friedman test was applied to test the significance of difference between the various methods of root instrumentation. Repeated measures of analysis of variance (MANOVA) were used to analyse the time effect on the different treatments.

Results: At the 6-month evaluation, all groups in the scaling and root planing treatment presented with an improvement in the measured clinical parameters, as compared with baseline. No statistical differences ($p > 0.05$) were observed in the assessed periodontal indices among the study sites between the four groups for either treatment.

Conclusions: Under our experimental conditions, this clinical study demonstrates that mechanized root planing with power-driven instruments, as effective as the usual procedures (hand and sonic instruments), represents a satisfactory and alternative means of nonsurgical root therapy.

Key words: hand instruments; periodontal therapy; periodontitis; power-driven instruments; ultrasonic device

Accepted for publication 6 May 2003

The essential characteristic in the treatment of periodontal diseases is the mechanical removal of bacterial deposits and calculus (Waerhaug 1978, Badersten et al. 1981, Lindhe et al. 1984).

Periodontal root debridement is a vitally important component of surgical and nonsurgical pocket therapy. It is the key factor that influences the success of most procedures aimed at gaining periodontal attachment on previously infected root surfaces. The traditional practice of removing supragingival plaque, calculus build-up and subgingival calcifications by manual instruments, such as curettes, has prevailed. Badersten et al. (1981) were the first to show no differences between the effects of manual instrumentation and an ultrasonic technique. Subsequent studies (Breininger et al. 1987, Leon & Vogel 1987, Oosterwaal et al. 1987) also demonstrated no significant differences in terms of the removal of subgingival calculus and plaque.

Manual scaling and root planing can often be difficult and time-consuming due to the complex and unfavourable root morphology when working blindly at deep pocket sites (Ramfjord et al. 1987). Therefore, it led to the development of power-driven mechanical instruments. Torfason et al. (1979), Badersten et al. (1984) and Loos et al. (1987) demonstrated in a series of clinical studies that root debridement with hand instruments, ultrasonic and sonic scaler devices resulted in comparable clinical outcomes. Numerous studies (Biagini et al. 1988, Schwarz et al. 1989, Ritz et al. 1991, Gantes et al. 1992, Jotikasthira et al. 1992, Yukna et al. 1997) confirmed these results.

Hand instrumentation is used by many clinicians in conjunction with power-driven scalers, yet power-driven scalers have been used by many practitioners as the primary method of root instrumentation because the advantages of using power-driven scalers appear to outweigh the disadvantages. Many practitioners are choosing to spend more time on ultrasonic instrumentation and consequently less time on manual scaling.

In addition to the time advantage, a reduction in physical effort with sonic and ultrasonic devices also speaks in favour of the use of mechanically powered instruments. Most dentists who perform periodontal nonsurgical and surgical therapies with hand instruments are familiar with cramps in hand, arm and shoulder musculature, which may occur despite proper techniques. The use of ultrasonic and sonic devices instead of hand instruments reduces the physical stress of the operator (Drisko & Lewis 1996, Drisko 1998).

Because periodontal debridement requires a certain level of skill, time and endurance, it seems appropriate to choose an easy-handling instrumentation technique that allows one to achieve a highly efficient and time-saving removal of plaque and calculus, with less effort on behalf of the clinician.

The aim of the present study was to evaluate the clinical effectiveness, after 3 and 6 months, of the mechanical root planing system: Perioplaner® & Periopolisher® (Mikrona®, Hawe-Neos, Switzerland) alone or combined with other usual root planing methods (hand instrumentation that still represent the gold standard, the minimal goal that any new instrument must reach; and ultrasonic scalers), for periodontal debridement using a split-mouth design.

Material and Methods

Twenty systemic healthy patients (10 Caucasian females and 10 males, mean age 50.3, SD 6.4, range 40–69 years, four smokers) were recruited for the present study. All patients suffered from generalized moderate-to-severe adult periodontitis. They presented at least two sites with probing depth $\geqslant$4 mm per multi-rooted teeth, and at least three sites with probing depth $\geqslant$4 mm for all remaining teeth, per quadrant.

Exclusion criteria were patients who had had antibiotic therapy in the last 2 months; or underwent any previous and recent periodontal treatment; physically handicapped subjects and/or with mental disorders, who cannot assume proper plaque control care.

After completion of the initial screening, each patient was informed about his periodontal status and the clinical study and agreed to participate by signing a consent form.

Baseline examination

All clinical measurements were recorded by an experienced periodontist (J. B. M.) with respect to plaque score (plaque index (PlI), Silness & Löe 1964) according to Ramfjord's (1967) assessment, bleeding on probing (papillary bleeding index (PBI), Saxer & Mühlemann 1975), probing pocket depths (PPDs), probing attachment level (PAL) (using a custom-made thermoformic plastic stent for both jaws, in order to assess, more accurately, the periodontal attachment level changes in time (Clark et al. 1987)) and the number of moderate and deep pockets (NDPs, NMPs). The periodontal examination was performed using a periodontal probe (PCPUNC 15-Hu-Friedy, Chicago, IL, USA).

The mean number of sites per teeth treated was found to be 4.8, 4.7, 4.2 and 4.3 for the quadrants I, II, III and IV, respectively, with a total number of 2204 sites for a total number of teeth of 490.

Permission for this study was obtained from the Ethical Committee of the University Hospital, at Louvain-en-Woluwe (Brussels).

Therapy

Instruments used

Three types of instrumentation were used in this comparative study:

Ultrasonic scaler (universal insert no. 1 with the Suprasson-P500® handle, Satelec, Bordeaux, France). The performance setting used was 7 over a maximum of 10.

Hand instruments (Ceramicolor, Ash, Dentsply, PA, USA). Sickle scalers CK6 and 204 S, universal curettes, hoes and Hirschfeld files were used. All instruments were reground after each working cycle with an Arkansas stone (SS4E, Hu-Friedy, Chicago, IL, USA).

The reciprocating root planing system: Perioplaner® & Periopolisher® (Mikrona). This system comprises two different contra-angulated handpieces. The Perioplaner® works with a serrated oscillating stroke of 0.4 mm and has to be operated between 2000 and 4000 rpm. Curette-shaped inserts are used on the approximal surface and can be retained in eight different positions. The hoescaler-shaped self-adjusting inserts can be used on all buccal, lingual and palatal root surfaces (Fig. 1). These

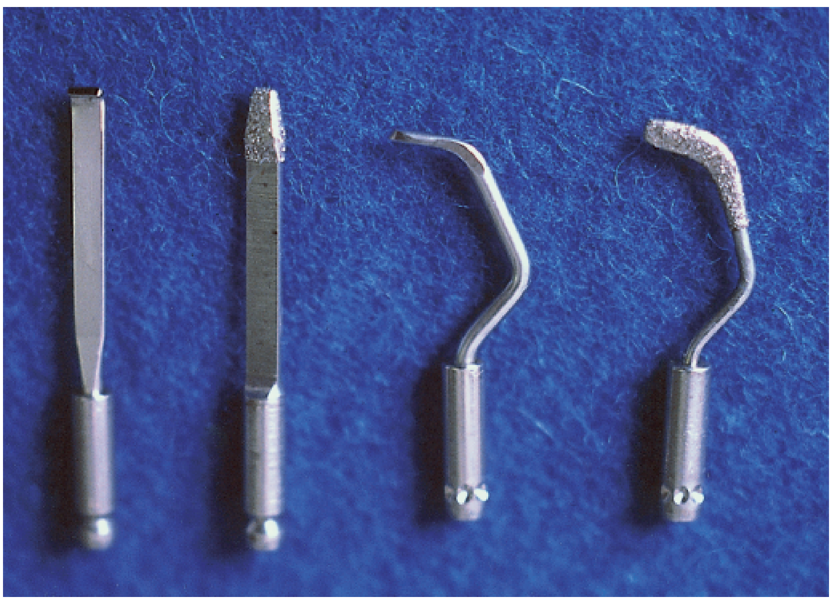

Fig. 1. The Perioplaner® hoescaler- and curette-shaped inserts (from left to right, first and third) and the Periopolisher® diamond-coated pear-shaped and golf-club-like inserts (from left to right, second and fourth).

inserts were reground after each working cycle. The Periopolisher® handpiece operates at 10,000 rpm and works with a continuous sinusoidal stroke of 0.6 mm. The diamond-coated (100 μm grain size), golf-club-like inserts, locked in eight possible positions in the contra-angulated handle, were used for approximal surfaces, and pear-shaped self-adjusting diamond-coated (100 μm grain size) ones for buccal, palatal and lingual sites (Fig. 1).

Table 1. Allocation of quadrants to the treatment mode

QI	QII	QIII	QIV	Patient's number				
D	A	B	C	6	7	10	13	14
A	B	C	D	2	3	4	12	20
B	C	D	A	5	11	17	18	19
C	D	A	B	1	8	9	15	16

The upper right quadrant (QI), the upper left quadrant (QII), the lower left quadrant (QIII) and the lower right quadrant (QIV) were treated at random with the manual treatment (A), the ultrasonic insert followed by the Periopolisher® system (B), the Perioplaner®–Periopolisher® system (C) or the ultrasonic insert alone (D). The patients of the first row (6, 7, 10, 13, 14) were randomly assigned to the treatment sequence D, A, B, C, etc.

Experimental procedure

Oral hygiene instructions were provided for each patient. They were instructed to use the Bass technique, brush twice a day and use interdental proximal brushes once daily. The patients enrolled in the study underwent the proposed periodontal treatment under local anaesthesia (xylestesin, Espe, Seefeld, Germany) at 1-week intervals, and they were randomly assigned to a specific sequence of therapy with various periodontal instruments:

- the ultrasonic scaler alone, with a recorded mean working time of 2 min/tooth (referred to as US).
- the ultrasonic scaler followed by the Periopolisher® instrument, with its diamond-coated inserts (referred to as US-POL). The mean recorded working time was 1 min/tooth.
- the hand instruments (referred to as MANUAL) with a mean working time of 3 min/tooth.
- the Perioplaner® inserts, followed by the Periopolisher® ones (referred to as PPL-POL).
- (mean working time: 2 min/tooth for the Perioplaner® and 1 min/tooth for the Periopolisher®).

The quadrants have been allocated at random to four various groups of treatment as shown in Table 1.

The whole treatment was performed by an experienced periodontist (P. R. O.) who was already familiarized with the new mechanical system (Perioplaner®–Periopolisher®).

The patients were recalled on a 1 (for PlI scores), 3 and 6 months (including a thorough charting) basis for re-evaluation and the same periodontal parameters were recorded.

Statistical analysis

The Friedman test (using the SAS system: SAS/STAT®-User's Guide, version 6, 4th edition, Cary, NC, USA: SAS Institute Inc., 1989) was performed to compare the effect of the various treatments, controlling for patients, with respect to the periodontal parameters analysed: PlI, PBI, number of deep and moderate pockets (NDPs/NMPs), as well as the NDPs/NMPs for which a clinical attachment level change was found (Friedman's Q is here a χ^2 test with 3 df).

Moreover, the significance of changes in time (compared with baseline values), and the time effect on the different treatments, with respect to all the investigated parameters was analysed by means of a repeated measures analysis of variance (MANOVA).

The impact of the various methods of treatment in general on the changes in probing depth and in probing attachment level (for moderate and deep pockets) was examined by means of a one-way ANOVA (with treatment as fixed effect). p-values $\leqslant 0.05$ were considered statistically significant.

Results

Plaque scores (PlI) (Table 2)

At the beginning of the study, the mean PlI score was 2.0. This value was significantly reduced to 0.7, 6 months after root treatment, corresponding to a percentage of 65%.

Bleeding on probing (PBI) (Table 3)

We can observe that gingival inflammation has been clearly reduced mostly due to the patients' proper plaque control care.

All therapies resulted in similar clinical improvement with respect to PBI. The mean patient bleeding scores were reduced (69%, 60%, 66.7% and 65.5% for the MANUAL, US+POL, PPL+POL and US groups, respectively) from the initial value to the 6-month re-evaluation (MANOVA test).

On comparing all groups within the same time period (3 and 6 months), we did not note any significant differences

Table 2. Results for plaque index (PlI) before and after therapy (means and (standard deviations)) and reduction of PlI (in %)

	Baseline	Month 1	Month 3	Month 6
PlI	2.0 (0.5)	1.2 (0.6)/40%**	0.9 (0.5)/55%**	0.7 (0.5)/65%**

**$p \leqslant 0.01$ (significant difference between baseline and re-evaluation) (MANOVA: ANOVA for repeated measurements).

Table 3. Papillary bleeding index (PBI) changing in means and (standard deviations) between baseline and re-evaluation and reduction of PBI (in %) from the initial value to the 6-month re-evaluation

PBI	Baseline	Month 3	Month 6	PBI (%)
MANUAL	2.9 (0.6)	1.5 (0.6)**	0.9 (0.6)**	69
US-POL	3.0 (0.6)	1.7 (0.6)**	1.2 (0.5)**	60
PPL-POL	3.0 (0.6)	1.4 (0.7)**	1.0 (0.6)**	66.7
US	2.9 (0.7)	1.5 (0.6)**	1.0 (0.7)**	65.5

**$p \leqslant 0.01$ (intra-group significant difference between baseline and re-evaluation) (MANOVA: ANOVA for repeated measurements).

between these groups for the mean scores of PBI (Friedman's test).

Table 4. Number of deep pockets (NDPs) relative changes in means and (standard deviations) between baseline and re-evaluation of NDPs (in %) from the initial number of deep pockets (IDPs) to the 6-month re-evaluation (Mo 6) [NDP_{0-6}: (IDP – Mo6)/(IDP) × 100]

NDP	Baseline (IDP)	Month 3	Month 6	NDP_{0-6} (%)
MANUAL	10.4 (7.5)	2.5 (3.2)**	0.9 (3.6)**	91
US-POL	9.9 (7.7)	1.9 (2.5)**	0.6 (3.7)**	94
PPL-POL	9.7 (6.8)	2.8 (3.5)**	1.2 (3.4)**	87
US	11.9 (8.2)	2.8 (3.5)**	1.4 (2.7)**	84

**$p \leqslant 0.01$ (intra-group significant difference between baseline and re-evaluation) (MANOVA: ANOVA for repeated measurements).

NDPs ⩾ 6 (Table 4)

Baseline values of initial deep PDs decreased in time for the four different methods. Also using, in that case, repeated measures of ANOVA, we could demonstrate a major decrease of NDP in the course of time but no significant differences between the four treatment modalities within the same period of time (Friedman's test), and no time effect on treatment in general (MANOVA test).

Table 5. Number of moderate pockets (NMPs) relative changes in means and (standard deviations) between baseline and re-evaluation and reduction of NMPs (in %) from the initial number of moderate pockets (IMPs) to the 6-month re-evaluation (Mo 6) [NDP_{0-6} : (IDP – Mo6)/(IDP) × 100]

NMP	Baseline (IMP)	Month 3	Month 6	NMP_{0-6} (%)
MANUAL	16.0 (6.4)	11.0 (8.3)**	6.2 (6.8)**	61
US-POL	18.0 (6.2)	9.0 (6.0)**	6.6 (1.5)**	63
PPL-POL	18.4 (7.3)	11.3 (8.2)**	6.6 (7.7)**	64
US	16.5 (5.5)	10.7 (7.1)**	5.7 (6.6)**	65

**$p \leqslant 0.01$ (intra-group significant difference between baseline and re-evaluation) (MANOVA: ANOVA for repeated measurements).

NMPs $3 < n \leqslant 5$ (Table 5)

The most important decrease occurred between the 1st and the 3rd month and a slight additional reduction was observed thereafter.

The same remarks can be outlined for all treatments. No statistically significant inter-group differences could be found (Friedman's test).

Table 6. Probing pocket depth (PPD) absolute changes in means and (standard deviations) between baseline and re-evaluation and reduction of PPDs (in %) from the initial number of probing pocket depths (IPPDs) to the 6-month re-evaluation (Mo 6) [$IPPD_{0-6}$: IPPD – Mo 6] (mm)

PPD	Baseline (IPPD)	Month 3	Month 6	$IPPD_{0-6}$ (mm)
MANUAL	4.8 (0.5)	3.9 (0.4)**	3.3 (0.6)**	1.5
US-POL	5.0 (0.6)	4.0 (0.7)**	3.3 (0.6)**	1.7
PPL-POL	4.9 (0.6)	4.0 (0.6)**	3.2 (0.5)**	1.7
US	4.9 (0.5)	3.8 (0.5)**	3.3 (0.5)**	1.6

**$p \leqslant 0.01$ (intra-group significant difference between baseline and re-evaluation) (MANOVA: ANOVA for repeated measurements).

PPDs (Table 6)

The absolute changes in PD are illustrated in Table 6. At the first follow-up visit (3rd month), an important improvement ($p < 0.01$) towards baseline (initial probing depth (IPPD)) was recorded for the four treatments. Between the 3rd and the 6th month, a significant reduction could also be found for all groups.

No significant differences have been noted between the four groups within each time period (ANOVA test).

Table 7. Probing attachment level (PAL) absolute changes in means and (standard deviations) between baseline and re-evaluation and reduction of PALs (in %) from the initial number of probing attachment levels (IPALs) to the 6-month re-evaluation (Mo 6) [$IPAL_{0-6}$: IPAL – Mo 6] (mm)

PAL	Baseline (IPAL)	Month 3	Month 6	$IPAL_{0-6}$ (mm)
MANUAL	9.7 (0.8)	8.7 (0.6)**	8.2 (0.7)**	1.5
US-POL	9.6 (0.9)	8.7 (0.7)**	8.4 (0.6)**	1.2
PPL-POL	9.5 (0.8)	8.5 (0.8)**	8.0 (0.8)**	1.5
US	9.7 (0.8)	8.6 (0.6)**	8.1 (0.7)**	1.6

**$p \leqslant 0.01$ (intra-group significant difference between baseline and re-evaluation) (MANOVA: ANOVA for repeated measurements).

PALs (Table 7)

The absolute changes in PAL over time are depicted in Table 7. In comparison with baseline, important gains in attachment level were recorded ($p < 0.01$) for the four therapies. Between the 3rd and the 6th month, a lesser reduction could also be found for all groups. However, no significant inter-group differences could be drawn within each time period (ANOVA test). From the initial PAL (IPAL) values, the gain in attachment was 1.5, 1.2, 1.5 and 1.6 mm for the MANUAL, US+POL, PPL+POL and US groups, respectively.

Probing attachment level for deep pockets (PALDPs) (Tables 8, 9 and Fig. 2)

A major increase of the mean NDPs with a clinical attachment gain ⩾ 1 mm (PAL2DP3 and PAL1DP3) was observed between baseline and the 3rd month for all groups. However, between the first and the second evaluation (the 3rd and the 6th month), the statistical

Table 8. Probing attachment level for deep pockets (PALDPs) relative changes in means and (standard deviations) between baseline and re-evaluation

PALDP	PAL2DP3	PAL2DP6	PAL1DP3	PAL1DP6	PAL0DP3	PAL0DP6
MANUAL	6.1 (6.4)**	1.9 (2.1)**	2.9 (2.7)**	3.1 (2.2)	0.9 (1.0)*	4.8 (5.3)**
US-POL	4.8 (4.5)**	1.5 (2.2)**	4.4 (3.8)**	3.6 (3.1)	1.2 (2.7)*	5.2 (5.3)**
PPL-POL	4.5 (3.2)**	1.8 (2.5)**	3.5 (2.9)**	3.9 (3.3)	1.7 (2.1)*	4.0 (4.2)**
US	6.6 (5.1)**	2.0 (2.4)**	4.5 (4.2)**	5.0 (3.3)	0.8 (1.5)*	5.0 (5.3)**

PAL2DP3: Number of deep pockets (NDPs) with a probing attachment level (PAL) gain ⩾2 mm for at the 3rd month.
PAL2DP6: NDPs with a PAL gain ⩾2 mm for at the 6th month.
PAL1DP3: NDPs with a PAL gain = 1 mm for at the 3rd month.
PAL1DP6: NDPs with a PAL gain = 1 mm for at the 6th month.
PAL0DP3: NDPs with no PAL gain at the 3rd month.
PAL0DP6: NDPs with no PAL gain at the 6th month.
Mo = month.
*$p \leqslant 0.05$ (intra-group significant difference between baseline and re-evaluation) (MANOVA: ANOVA for repeated measurements).
**$p \leqslant 0.01$ (intra-group significant difference between baseline and re-evaluation) (MANOVA).

Table 9. Percentage of changes in probing attachment level for deep pockets (PALDPs) after 6 months from the initial values of NDPs (IDPs) to the 6-month re-evaluation $\{PALDP_{0-6} = 100 - (IDP - PALDP6)/IDP\}$

PALDP	$PAL2DP_{0-6}$ (%)	$PAL1DP_{0-6}$ (%)	$PAL0DP_{0-6}$ (%)
MANUAL	20	32	48
US-POL	15	35	50
PPL-POL	19	40	41
US	16	42	42

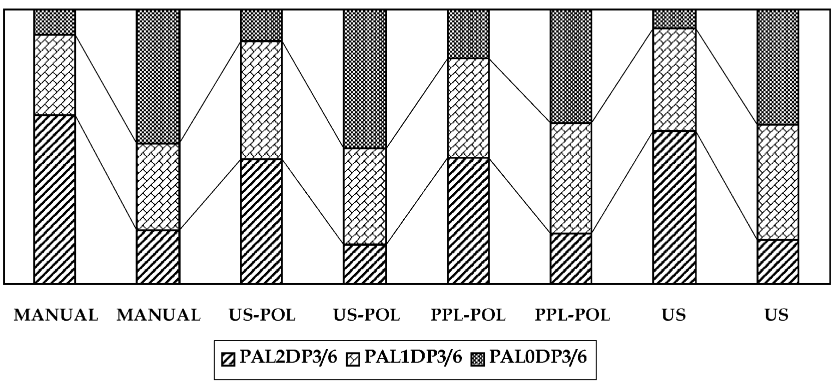

Fig. 2. Probing attachment level for deep pockets (PALDPs) relative changes between baseline and re-evaluation. PALDP3/6 represents probing attachment level for deep pockets at the 3rd and the 6th month re-evaluations.

results revealed a major decrease of the mean NDPs with a clinical attachment gain ⩾2 mm (PAL2DP6) in favour of both categories of deep pockets (PAL1DP6 and particularly PAL0DP6) (Tables 8, 9 and Fig. 2.) (MANOVA test).

However, under our experimental conditions, all groups were found to have an equivalent efficiency with respect to this particular parameter (Friedman's test), with no time effect found on the different measures of PALDP (MANOVA test) (Table 9).

Probing attachment level for moderate pockets (PALMPs) (Tables 10, 11 and Fig. 3)

Between baseline and the 3rd month, an increase of the mean NMPs with a clinical attachment gain ⩾1 mm (PAL2MP3 and PAL1MP3) was noted whatever treatment was applied (Table 10). At the 6th month assessment, a notable decrease of the mean NDPs with a clinical attachment gain ⩾2 mm (PAL2DM6) and a less important reduction of the mean NMPs with a clinical attachment gain = 1 mm (PAL1MP6) was observed in favour of the third class (PAL0DM6) (Tables 10, 11 and Fig. 3).

No statistically significant intergroup differences were highlighted in general (Friedman's test) without any time effect found on the different values of PALMP (MANOVA test) (Table 11).

Once more, under our clinical conditions, all treatments were found to have an equivalent efficiency inducing changes in PALMP in general, with no time effect found on the different measures of PALMP.

Discussion

Our study compared four different techniques using the split-mouth design. The main comparable trials that we have been able to find in the literature are the trials of Badersten et al. (1981, 1984), Oosterwaal et al. (1987), Loos et al. (1987), Laurell & Petersson (1988) and Laurell (1990). These authors have shown that periodontal healing after instrumentation with hand instruments, ultrasonic devices or sonic scalers was found to be similar.

This trial did not demonstrate any difference between root planing using manual instruments or stripping of the root surface using ultrasonic instrumentation. As well as comparing manual and power-driven techniques, we also analysed mechanized root planing using the Periopolisher® system combined with ultrasonic devices, or the Perioplaner®/Periopolisher® system. We did not find any difference between the various forms of treatment.

This shows that correct debridement of the root surface is similar, irrespective of the method used. The choice between the various nonsurgical techniques available should be made on the basis of personal experience or preference; any other consideration would not be based on proper analysis.

The reduction in the NDPs and NMPs obtained by using the various forms of root treatment was recorded. This type of endpoint (number of pockets) is more explicit; in particular, it made it possible to identify the persistence of pockets ⩾6 mm, despite a reduction of between 84% and 94% in the number of such pockets at 6 months. The differences between forms of treatment were not statistically significant. The reduction in

Table 10. Probing attachment level for moderate pockets (PALMPs) relative changes in means and (standard deviations) between baseline and re-evaluation

PALMP	PAL2MP3	PAL2MP6	PAL1MP3	PAL1MP6	PAL0MP3	PAL0MP6
MANUAL	6.6 (4.5)**	1.1 (1.8)**	7.6 (3.6)**	6.2 (4.1)	3.8 (3.6)**	10.7 (4.5)**
US-POL	4.7 (3.0)**	1.5 (1.6)**	7.7 (4.9)**	5.8 (3.9)	3.5 (2.5)**	8.6 (4.8)**
PPL-POL	5.5 (3.4)**	1.8 (2.2)**	8.7 (4.5)**	5.5 (2.9)	4.2 (2.9)**	11.1 (5.9)**
US	4.1 (2.8)**	1.0 (1.9)**	7.6 (3.9)**	6.0 (3.4)	4.6 (3.8)**	9.3 (3.9)**

PAL2MP3: Number of moderate pockets (NMPs) with a probing attachment level (PAL) gain $\geqslant 2$ mm for at the 3rd month.
PAL2MP6: NMPs with a PAL gain $\geqslant 2$ mm for at the 6th month.
PAL1MP3: NMPs with a PAL gain = 1 mm for at the 3rd month.
PAL1MP6: NMPs with a PAL gain = 1 mm for at the 6th month.
PAL0MP3: NMPs with no PAL gain at the 3rd month.
PAL0MP6: NMPs with no PAL gain at the 6th month.
**$p \leqslant 0.01$ (intra-group significant difference between baseline and re-evaluation) (MANOVA: ANOVA for repeated measurements).

Table 11. Percentage of changes in probing attachment level for moderate pockets (PALMPs) after 6 months from the initial values of NMPs (IMPs) to the 6-month re-evaluation $\{PALMP_{0-6} = 100 - (IMP - PALMP6)/IMP\}$

PALMP	$PAL2MP_{0-6}$ (%)	$PAL1MP_{0-6}$ (%)	$PAL0MP_{0-6}$ (%)
MANUAL	6	34	60
US-POL	9	37	54
PPL-POL	10	30	60
US	6	37	57

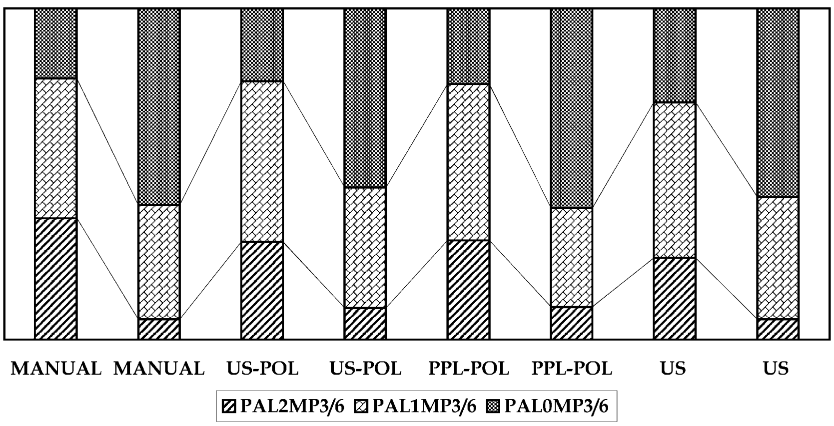

Fig. 3. Probing attachment level for moderate pockets (PALMPs) relative changes between baseline and re-evaluation. PALMP3/6 represents probing attachment level for moderate pockets at 3rd and 6th month re-evaluations.

the number of these pockets was added to the number of pockets <6 mm, which were reduced by between 61% and 65%. The number of pockets reduced is actually the original number plus the NDPs reduced to less than 5 mm.

We were particularly interested in persistence of deep pockets, as pockets $\leqslant 5$ mm generally represent stabilization of periodontitis when maintenance treatment is complied with. Any decision about surgical treatment will be guided by the clinical appearance of these persistent deep pockets (whether they are inflamed or not), and especially by examination of the attachment level.

The results suggest that if any surgery was required, it would be more localized. This has important implications in terms of costs.

With regard to the level of attachment, improvements of 2 mm or more in deep pockets were obtained in only 15–20% of cases for the various forms of treatment, while such improvements in moderate pockets were obtained in only 6–10% of cases. Improvements of about 1 mm in deep pockets were obtained in 32–42% of cases, while such improvements in moderate pockets were obtained in 30–37% of cases. The absence of improvement in attachment was our main finding. A reduction in the depth and/or number of pockets is therefore principally due to reduction in the inflammation, which causes the gingiva to recede.

According to Hänggi et al. (1991) and Renggli (1991), the therapeutic and ergonomic advantages of the Perioplaner®/Periopolisher® system are obviously expressed by a quick-learning procedure, an easier handling and a relatively reduced working time. On the other hand, they found the Periopolisher® inserts very useful in the debridement of furcation and areas of limited access.

Several studies have demonstrated that the greatest changes in PD and PAL occur within the first 3 months following nonsurgical therapy, and that few if any improvements can take place later on, depending on the initial PDs. There seems to be a substantial improvement in the clinical attachment level, mostly in deepest pockets the initial months subsequent to the periodontal treatment, even if it is known that the thorough debridement of deep periodontal pockets is rather difficult to achieve (Badersten et al. 1981, 1984, Pihlstrom & Ortiz-Campos 1981, Ramfjord et al. 1987, Hammerle et al. 1991, Kaldahl et al. 1993).

The clinical results reflect a suitable clinical outcome with the reciprocating instruments similar to the hand instruments. Therefore, on the basis of this study, we could not assert that one method is superior to another, and we can conclude that mechanized root planing with the Perioplaner®/Periopolisher® system, as effective as the common procedures, represents a satisfactory and alternative means of non-surgical root therapy.

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