

# Hand and Ultrasonic Instrumentation in Combination With Root-Coverage Surgery: A Comparative Controlled Randomized Clinical Trial

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**Background:** The role of vigorous root planing in the surgical treatment of gingival recession was recently questioned. The aim of the present randomized controlled split-mouth clinical study was to compare the effectiveness, in terms of root coverage, of hand and ultrasonic root instrumentation in combination with a coronally advanced flap for the treatment of isolated-type recession defects.

**Methods:** Eleven systemically and periodontally healthy subjects with bilateral recession defects ( $\geq 3$  mm) of similar ( $\leq 1$  mm) depth affecting contralateral teeth were enrolled in the study. Only Miller Class I gingival recession with no deep cervical abrasion or root caries/demineralization were included in the study. Control root exposures were treated with curets, whereas test roots were instrumented with ultrasonic piezoelectric devices. Randomization for test and control treatment was performed by a coin toss immediately prior to surgery. All recessions were treated with a coronally advanced flap surgical technique. The clinical reevaluation was made 6 months after surgery.

**Results:** The two approaches resulted in a high percentage of root coverage (95.4% in the control group and 84.2% in the test group) and complete root coverage (82% in the control group and 55% in the test teeth), with no statistically significant difference between them. Clinical attachment level gains were clinically significant in both groups ( $3.36 \pm 0.92$  mm in the control group and  $2.90 \pm 0.70$  mm in the test group), with no statistically significant difference between them. The increase in keratinized tissue height was statistically significant in both groups ( $0.55 \pm 0.52$  mm in the control group and  $0.36 \pm 0.67$  mm in the test group), with no difference between them.

**Conclusions:** The present study failed to demonstrate any superiority, in terms of root-coverage results, for hand instruments over ultrasonic treatment of the root surface in combination with coronally advanced flap mucogingival surgery. Further studies of longer-term duration and larger sample size could help to establish the superiority of one form of root instrumentation in conjunction with root-coverage surgery. *J Periodontol* 2009;80:577-585.

## KEY WORDS

Gingival recession; hand instrumentation; surgery; ultrasonic.

Gingival recession is defined as an apical shift of the gingival margin with respect to the cemento-enamel junction (CEJ), with exposure of the root surface to the oral environment.<sup>1</sup> The international literature has thoroughly documented that gingival recession can be successfully treated by several surgical procedures,<sup>1,2</sup> irrespective of the technique used, provided that the biologic conditions for accomplishing root coverage are satisfied: no loss of height of interdental soft and hard tissues.<sup>3</sup>

One of the fundamental steps common to all root-coverage surgical procedures is the mechanical instrumentation of the exposed root, which involves the removal of root accretions and cementum down to a smooth and hard surface.<sup>4</sup> Some of the expected goals of root planing (endotoxin removal and smoothening and flattening the root) were recently questioned to be essential in root-coverage surgical procedures.

Until recently, endotoxin was believed to be embedded in, or firmly bound, to cementum.<sup>5-8</sup> Thus, it was believed that extensive cementum removal by scaling and planing the root surface was required to remove endotoxins. Currently, it is understood that endotoxin (lipopolysaccharide)

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is a surface substance that is superficially linked to the cementum<sup>9,10</sup> and calculus and is easily removed by washing, brushing, lightly scaling, or polishing the contaminated root surface.<sup>11-14</sup>

In this regard, the 1996 World Workshop in Periodontics<sup>15</sup> pointed out that intentional cementum removal should not be included in periodontal debridement techniques for the purpose of removing toxic substances from the root surface.<sup>14,16</sup>

Another factor is the importance of surface texture roughness or smoothness in the periodontal healing process. A study<sup>17</sup> was conducted to determine whether periodontal outcomes, in terms of probing depth (PD) reduction and attachment level gain, following conventional periodontal flap surgery were influenced by intentional smoothing or roughening of the root surface after plaque and calculus removal. No differences were demonstrated 6 months after surgery. Thus, it seems that striving for root surface smoothness during periodontal surgery is not necessary.

Root convexity is another factor that might influence the clinical outcome of root-coverage procedures. On the basis of their experience, various investigators<sup>18-22</sup> stressed the importance of flattening the root to enhance the outcome of the root-coverage procedures. A recent study<sup>23</sup> that compared root curvature before and after mechanical instrumentation suggested that vigorous root planing did not significantly modify root curvature; it only reduced the mesio-distal dimension (3%) and flattened the root surface (6%) slightly. Thus, the role of vigorous root planing in the surgical treatment of gingival recession is questionable.

Very few studies have compared different mechanical treatments of the root surface during mucogingival surgical procedures. A controlled clinical study<sup>24</sup> compared three root-treatment modalities in combination with the laterally positioned flap: root planing with curets, scaling and polishing, and root conditioning with sodium hypochlorite. Three months after treatment, no statistically significant difference was demonstrated among the three groups for any of the considered clinical parameters. A more recent, controlled randomized clinical study<sup>25</sup> compared two mechanical treatments associated with the coronally advanced flap (CAF): root planing with curets versus polishing with a rubber cup and prophylaxis paste. The study concluded that root planing with curets was not necessary when shallow recessions caused by traumatic toothbrushing were treated in patients with high standards of oral hygiene.

To the best of our knowledge, no study comparing hand and ultrasonic root instrumentation in mucogingival surgery has been reported in the literature. Conversely, studies<sup>26,27</sup> have been conducted to compare

the effectiveness of manual (curets) and ultrasonic devices in the removal of plaque, bacteria, calculus, and endotoxins; both instrumentations were shown to be equally efficient and produced the same clinical results in terms of PD reduction, bleeding on probing, and subgingival microflora modification. Nevertheless, advantages have been associated with manual instruments (smoother and harder surfaces that are more biocompatible)<sup>26</sup> and ultrasonic devices (minor loss of root substance, less soft tissue damage, including unintentional curettage, less operator skill required, and less time consuming).<sup>26</sup>

The aim of the present randomized controlled split-mouth clinical study was to compare the effectiveness, in terms of root coverage, of hand (control group) and ultrasonic (test group) instrumentation in combination with a CAF for the treatment of isolated-type recession defects.

## MATERIALS AND METHODS

### *Patient and Site Selection*

Eleven subjects, four males and seven females (aged 18 to 40 years; mean age, 31.6 years), were enrolled in the study. Power analysis indicated that with 11 subjects, the study would have >85% power to detect a 1-mm difference in recession depth between the two groups (SD = 0.70). The patients were selected from individuals referred to the University of Bologna Dental School between December 2005 and October 2006. The patients agreed to participate in this study and gave their written informed consent on an Institutional Review Board consent form. All participants met the study inclusion criteria: Miller Class I isolated recession defects ( $\geq 3$  mm in depth) of similar depth (the difference in recession depth should be  $\leq 1$  mm) in the contralateral quadrant of the upper jaw; presence of identifiable CEJ (presence of a step  $< 1$  mm at CEJ level and/or presence of a root/crown abrasion, but with an identifiable CEJ, were accepted);  $\geq 1$  mm keratinized tissue height apical to the root exposure; periodontally and systemically healthy; no contraindications for periodontal surgery and not taking medications known to interfere with periodontal tissue health or healing; and no periodontal surgery on the involved sites. Subjects smoking  $> 10$  cigarettes/day were excluded. Recession defects associated with deep ( $\geq 1$  mm) cervical abrasion, demineralization/caries, or restoration and teeth with evidence of pulpal pathology were not included. Molar teeth were also excluded.

### *Study Design*

The study was a single-center, double-masked, randomized controlled clinical trial with a split-mouth design comparing ultrasonic to hand root instrumentation for the treatment of gingival recession with a CAF. In the control group, the exposed root surfaces

were treated with curets,<sup>†</sup> whereas the test group was treated with an ultrasonic piezoelectric device (A point<sup>§</sup>).

The study protocol involved a screening appointment to verify eligibility, followed by initial therapy to establish optimal plaque control and gingival health conditions, surgical therapy, a maintenance phase, and a postoperative evaluation 6 months after the surgery.

### Randomization

The experimental procedure was performed using the split-mouth design. Immediately prior to surgery, bilateral defects were randomly assigned, by coin toss, to the test group (ultrasonic root instrumentation) and the control group (curet root instrumentation). Although the root instrumentation treatment was randomized, the control side was always treated first.

### Initial Therapy and Clinical Measurements

Following the screening examination, all subjects received a session of prophylaxis, including instruction in proper oral hygiene measures, scaling, and professional tooth cleaning with a rubber cup and a low-abrasive polishing paste. A coronally directed roll technique was prescribed for teeth with recession-type defects to minimize toothbrushing trauma to the gingival margin. Surgical treatment of the recession defects was not scheduled until the patient could demonstrate an adequate standard of supragingival plaque control.

All measurements were carried out by a single masked examiner (MM) at baseline and 6 months after the surgeries. MM did not perform the root instrumentation or the surgeries and was unaware of the treatment assignment. Prior to the study, the examiner was calibrated to reduce intraexaminer error ( $\kappa > 0.75$ ) and to establish reliability and consistency.

Full-mouth plaque score (FMPS) and local plaque score were recorded as the percentage of total surfaces (four aspects per tooth) with plaque.<sup>28</sup> Bleeding on probing was assessed dichotomously at a force of 0.3 N with a manual pressure-sensitive probe.<sup>||</sup> Full-mouth bleeding score (FMBS) and local bleeding score were recorded as the percentage of total surfaces (four aspects per tooth) with bleeding on probing.

The following clinical measurements were taken at the mid-buccal aspect of the study teeth 1 week before the surgery and at the 6-month follow-up: gingival recession depth (RD), measured from the CEJ to the most apical extension of the gingival margin; PD, measured from the gingival margin to the bottom of gingival sulcus; clinical attachment level (CAL), measured from the CEJ to the bottom of the gingival sulcus; and height of keratinized tissue (KTH), the

distance between the gingival margin and the mucogingival junction. All measurements were performed using a manual probe and were rounded up to the nearest millimeter.

### Treatment of the Root Surfaces

The treatment of test and control root surfaces was performed, prior to the start of surgery, by an expert periodontist (NMS) who was not the surgeon. That portion of the root corresponding to buccal attachment loss (gingival recession + buccal PD) was instrumented.

**Control group.** The exposed root surface was treated with curets. The time needed to obtain a hard, smooth root surface was recorded with a chronometer. No attempt was made to flatten the root. Immediately after instrumentation, the root surface was washed for 60 seconds with a saline solution.

**Test group.** The exposed root surface was treated with an ultrasonic piezoelectric device for the same amount of time that the curet was used in the contralateral defect. The ultrasonic point was moved in apical–coronal and mesial–distal directions to instrument the entire root exposure. Immediately after instrumentation, the root surface was washed for 60 seconds with a saline solution.

### Surgical Technique

All surgeries were performed by an expert periodontist (GZ) who was masked to the completed root treatment. Control (Fig. 1) and test (Fig. 2) surgeries were performed during the same appointment.

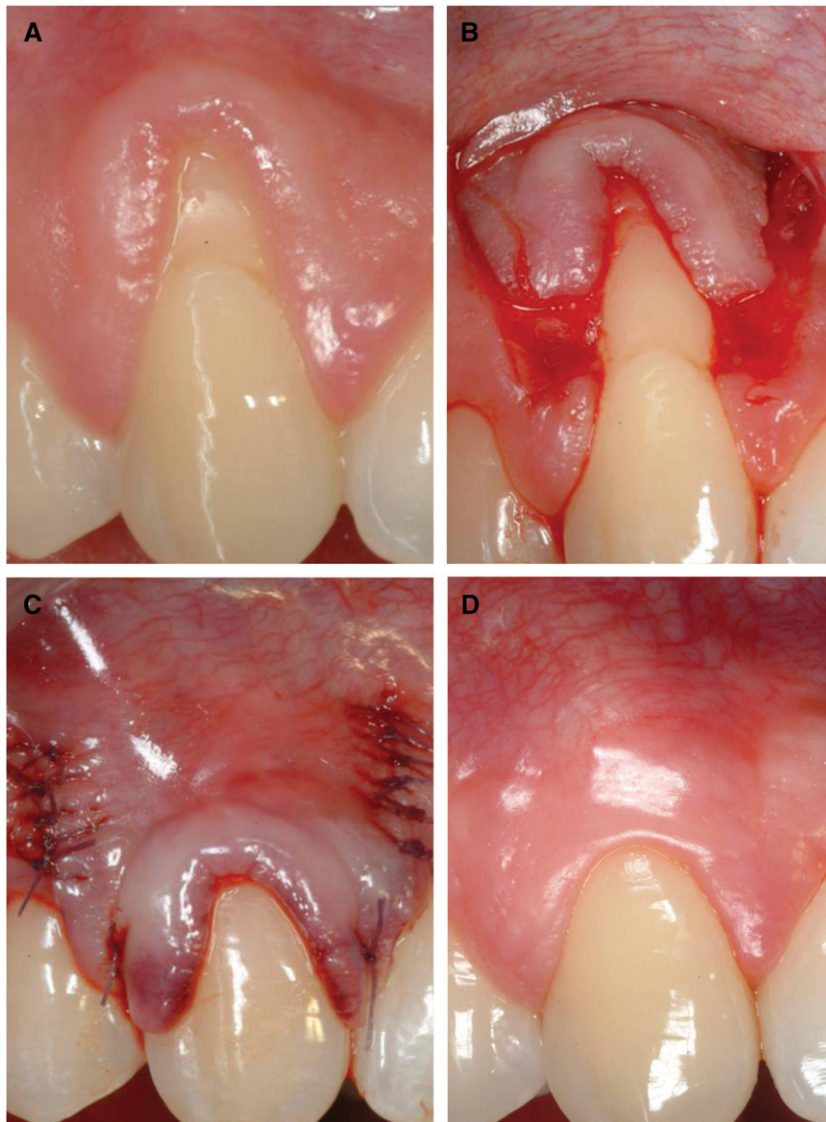
The surgical technique used was the CAF with a trapezoidal incision described by De Sanctis and Zucchelli<sup>29</sup> in 2007. The flap consisted of two horizontal incisions (3 mm in length), mesial and distal to the recession defect located at a distance from the tip of the anatomic papillae equal to the depth of the recession plus 1 mm, and two beveled oblique, slightly divergent incisions starting at the end of the horizontal incisions and extending to the alveolar mucosa.

The resulting trapezoidal-shaped flap was elevated with a split-full-split approach in the coronal–apical direction: the surgical papillae between the horizontal incisions and the probeable sulcular area apical to the root exposure were elevated split thickness, keeping the blade almost parallel to the root. The soft tissue apical to the root exposure (the residual keratinized tissue) was elevated full thickness by inserting a small periosteum elevator into the probeable sulcus and proceeding in an apical direction, exposing 3 to 4 mm of bone apical to the bone dehiscence. This

† Mini Five, L-M, Planmeca Oy, Helsinki, Finland.

§ EMS, SA, Nyon, Switzerland.

|| PCP-INC 15 probe tip, Hu-Friedy, Chicago, IL, equipped with a Brodonic spring device, Dentramar, Waalwijk, The Netherlands.



**Figure 1.**

Control site: CAF with hand root instrumentation **A)** A canine with deep gingival recession (5 mm). **B)** A trapezoidal flap was elevated with a split-full-split approach. **C)** The flap was sutured coronal to the CEJ. **D)** Complete root coverage was seen at the 6-month reevaluation.

was done to include the periosteum in the thickness of the central portion of the flap covering the avascular root exposure. The releasing vertical incisions were elevated split thickness, keeping the blade parallel to the bone plane, thus leaving the periosteum to protect the underlying bone in the lateral areas of the flap. Apical to bone exposure, flap elevation continued split thickness and concluded when the flap could be moved passively in the coronal direction. All muscle insertions in the thickness of the flap were eliminated to permit coronal advancement of the flap. This was accomplished by keeping the blade parallel to the external mucosal surface. Coronal mobilization of the

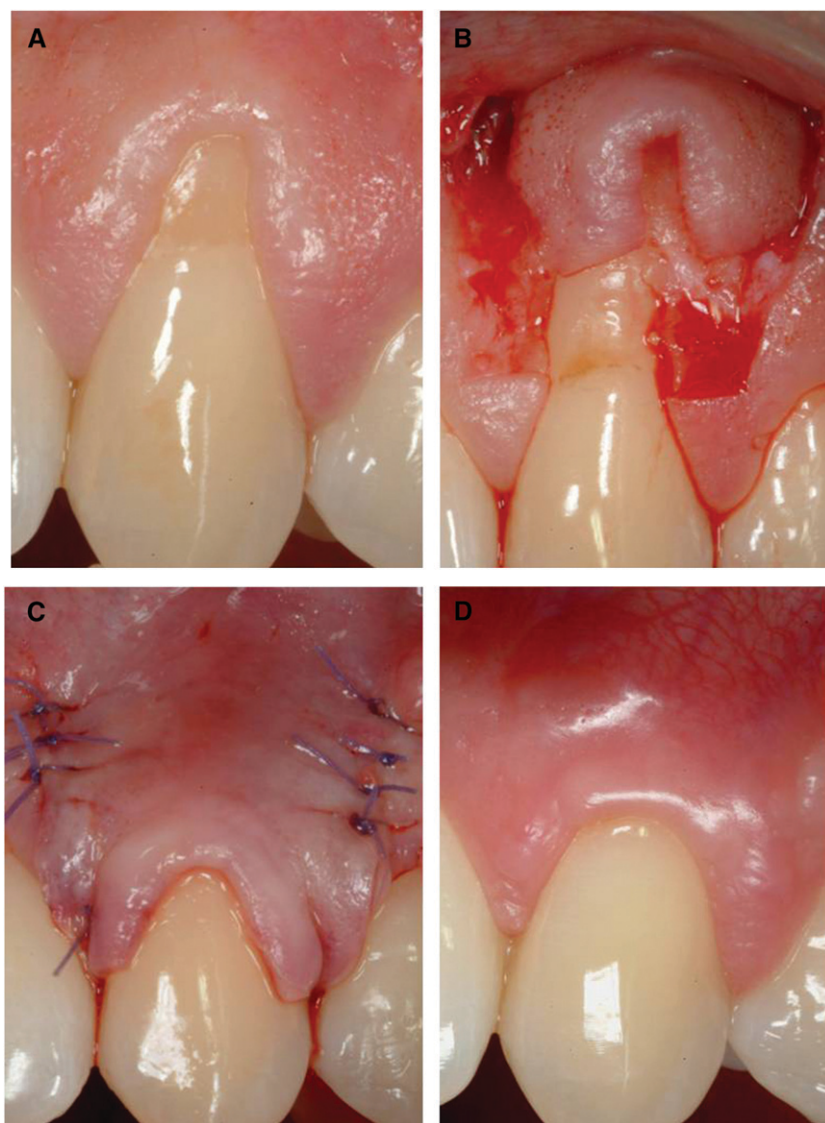
flap was considered adequate when the marginal portion of the flap was able to passively reach a level coronal to the CEJ of the tooth with the recession defect. The flap should be stable in its final coronal position without the sutures.

The facial soft tissue of the anatomic interdental papillae coronal to the horizontal incisions was deepithelialized to create connective tissue beds to which the surgical papillae of the CAF were sutured. Suturing<sup>¶</sup> (6-0) of the flap started with two interrupted periosteal sutures at the most apical extension of the vertical releasing incisions; it proceeded coronally with other interrupted sutures, each of them directed, from the flap to the adjacent buccal soft tissue, in the apical–coronal direction. This was done to facilitate coronal displacement of the flap and to reduce the tension on the last coronal sling suture. The sling suture permitted stabilization of the surgical papillae over the interdental connective tissue beds and allowed for a precise adaptation of the flap margin over the underlying convexity of the crown. No periodontal dressing was applied.

#### **Post-Surgical Infection Control**

Postoperative pain and edema were controlled with ibuprofen. Patients received 600 mg at the beginning of the surgical procedure and were instructed to take another tablet of 600 mg 6 hours later. Subsequent doses were taken only if necessary to control pain. Patients were instructed not to brush the teeth in the treated area but to rinse with chlorhexidine solution (0.12%) three times a day for 1 minute. The sutures were removed 14 days after surgery. Plaque control in the surgically treated area was maintained by rinsing with chlorhexidine for 2 additional weeks. Thereafter, patients were reinstructed in mechanical tooth cleaning and used an ultrasoft toothbrush and a roll technique for 1 month. Chlorhexidine rinse was used twice a day during this period. After this month, the patients used a soft toothbrush and chlorhexidine rinse once a day. All patients were recalled for prophylaxis 2 and 4 weeks after suture removal and once every 2 months until the final examination (6 months).

<sup>¶</sup> Vicryl, Johnson & Johnson, Woluwe, Belgium.



### Figure 2.

Test site: CAF with ultrasonic root instrumentation. **A)** A canine with deep gingival recession (4 mm). **B)** A trapezoidal flap was elevated with a split-full-split approach. **C)** The flap was advanced and sutured coronal to the CEJ. **D)** Complete root coverage was seen at the 6-month reevaluation.

### Data Analysis

A statistical application software<sup>#</sup> was used for the statistical analysis. Descriptive statistics are expressed as mean  $\pm$  SD.

Complete coverage was assessed after 6 months by evaluating the position of the gingival margin and whether the CEJ was covered. The percentage of root coverage after 6 months was calculated using the following formula:  $([\text{baseline RD} - 6\text{-month RD}] / \text{baseline RD}) \times 100$ .

General linear models were fit, and multiple-regression analysis of variance for repeated measures with a split-plot design was used to evaluate the existence of

any significant difference between the techniques with regard to RD, CAL, PD, and KTH, time, and the interaction between technique and time. In case of significance, the Bonferroni *t* test was applied as a multiple comparison test.

The McNemar test was used to evaluate differences between techniques with regard to complete root coverage.

### RESULTS

Following the initial oral hygiene phase and at the post-treatment examination, all subjects showed low frequencies of plaque-harboring tooth surfaces (FMPS <20%) and bleeding gingival units (FMBS <15%), indicating a good standard of supragingival plaque control during the study period.

Control teeth included five cuspids, three lateral incisors, and three premolars. Test teeth were six cuspids, two lateral incisors, and three premolars.

The average time needed for root instrumentation was  $54.2 \pm 4.1$  seconds (range: 48 to 60 seconds). The narrow standard deviation indicates that the gingival defects treated were quite homogeneous in terms of the clinical hardness of the exposed root surfaces.

Healing was uneventful for all treated cases.

The RD data (before and 6 months after treatment) for each patient included in the study are shown in Table 1. The descriptive statistics for the clinical parameters measured at baseline and 6 months after surgery for both groups, as well as the mean differences within and between groups, are shown in Table 2.

At baseline, there were no statistically significant differences between the two groups for any of the considered clinical parameters, indicating that the randomization process was effective.

### Six-Month Clinical Outcomes

**RD.** The results of fitting a general linear statistical model relating RD to techniques, time, and the interaction between techniques and time showed a high  $R^2$  statistic, indicating that the model is highly significant and explains 95.6% of the variability in RD. A significant relationship was found for time ( $F = 391.8$ ;  $P < 0.01$ ), but not for the type of technique used ( $F =$

<sup>#</sup> SAS, version 6.09, SAS Institute, Cary, NC.

**Table 1.**  
**RD (in mm) of Each Patient at Baseline and 6 Months Post-Surgery**

Patient	Control (curets)		Test (ultrasonics)	
	Baseline	6 Months	Baseline	6 Months
1	3	0	3	0
2	4	1	4	1
3	3	0	3	0
4	3	0	4	0
5	5	0	4	0
6	4	0	4	0
7	5	0	5	2
8	3	0	3	1
9	3	0	4	1
10	4	1	4	0
11	3	0	4	2

**Table 2.**  
**Clinical Parameters (mm; mean  $\pm$  SD) at Baseline and 6 Months Post-Surgery**

Parameter	Control Group (curets)	Test Group (ultrasonics)	Difference (control-test)
<b>RD</b>			
Baseline	3.64 $\pm$ 0.80	3.82 $\pm$ 0.60	NS
6 months	0.18 $\pm$ 0.40	0.64 $\pm$ 0.80	NS
Difference	3.54 $\pm$ 0.82*	3.18 $\pm$ 0.75*	NS
<b>CAL</b>			
Baseline	4.72 $\pm$ 0.78	4.90 $\pm$ 0.54	NS
6 months	1.36 $\pm$ 0.50	2.0 $\pm$ 0.63	NS
Difference	3.36 $\pm$ 0.92*	2.90 $\pm$ 0.70*	NS
<b>PD</b>			
Baseline	1.09 $\pm$ 0.09	1.09 $\pm$ 0.30	NS
6 months	1.18 $\pm$ 0.40	1.36 $\pm$ 0.50	NS
Difference	0.18 $\pm$ 0.40	0.27 $\pm$ 0.64	NS
<b>KTH</b>			
Baseline	1.63 $\pm$ 0.67	1.72 $\pm$ 0.64	NS
6 months	2.18 $\pm$ 0.60	2.09 $\pm$ 0.54	NS
Difference	0.55 $\pm$ 0.52*	0.36 $\pm$ 0.67*	NS

NS = not statistically significant.

\* Statistically significant ( $P < 0.05$ ).

3.6; not statistically significant [NS]). In the control group, RD decreased by  $3.54 \pm 0.82$  mm, representing an average root coverage of 95.4%. RD decreased by  $3.18 \pm 0.75$  mm in the test group, which represents

an average root coverage of 84.2%. Complete root coverage was achieved in nine control (82%) and six test (55%) defects. The difference was not statistically significant (difference 18.8%; 95% confidence interval: 18.86% to 47.23%;  $P = 0.42$ , NS).

**CAL.** The results of fitting a general linear model showed a high  $R^2$  statistic, indicating that the model is highly significant and explains 94.6% of the variability in CAL. A significant relationship was found for time ( $F = 321.7$ ;  $P < 0.01$ ), but not for the type of technique used ( $F = 5.4$ , NS). In particular, a CAL gain of  $3.36 \pm 0.92$  mm and  $2.90 \pm 0.70$  mm was measured in the control and test groups, respectively.

**KTH.** The results of fitting a general linear model showed that the model is significant and explains 74.3% of the variability in KTH. A significant relationship was found for time ( $F = 12.5$ ;  $P < 0.01$ ), but not for the type of technique used ( $F = 1.1$ , NS). A significant increase in KTH was observed in both groups ( $0.55 \pm 0.52$  mm in the control group and  $0.36 \pm 0.67$  mm in the test group), with a similar rate of increase ( $P = NS$ ).

**PD.** The results of fitting a general linear model showed no statistically significant differences for time or technique.

## DISCUSSION

The present study failed to demonstrate any superiority in terms of root-coverage results for hand instrumentation with curets compared to ultrasonic treatment of the root surface, associated with CAF mucogingival surgery. Both procedures achieved statistically and clinically significant improvements in root coverage, with no statistically significant difference between them. These data favor ultrasonic treatment because it is easier to perform, is less time consuming, and is associated with less root substance loss.<sup>16</sup> In a calibration exercise (our unpublished data) conducted before the present study, 10 roots were treated with curets until a smooth and hard surface was obtained, and the homologous contralateral roots were instrumented with an ultrasonic device for the same amount of time. In each case, the root treated with an ultrasonic device would have required hand instrumentation to reach the same "smoothness and hardness" obtained on the roots treated only with curets. This indicates that ultrasonic instrumentation does not change the root surface characteristics as much as hand instrumentation and indirectly confirms the greater root structure loss associated with the use of curets. The importance of vigorous root planing in mucogingival procedures was recently questioned because it is not necessary to remove the endotoxins,<sup>9,10</sup> lightly bound on the root, and it is not effective in reducing the convexity of the root.<sup>23</sup> The present study seems to corroborate this

hypothesis because a statistically and clinically significant gain in clinical attachment was achieved in the gingival defects subjected to ultrasonic instrumentation, with no difference with respect to the control gingival recessions. The fact that the PD remained shallow in all defects treated with an ultrasonic device further indicated a good clinical relationship between the root and the covering soft tissues, despite less root structure loss. Further studies of longer-term duration and with a larger sample size are needed to confirm such successful clinical results at 6 months.

Conversely, it must be considered that the defects treated in the present study were selected among those not presenting deep abrasion or demineralization/caries in the clinically exposed root surface. In these clinical situations, which were excluded from the study but are very frequent in daily practice, it cannot be ruled out that hand instrumentation, by removing the softened/demineralized root structure, is able to create a more biocompatible<sup>26</sup> surface for coverage with the soft tissue. In the present study, only 55% of the recessions treated with ultrasonic instrumentation were completely covered, compared to 82% of the hand-treated gingival recessions. Based on our clinical experience, even in non-carious cervical lesions associated with gingival recessions, the root surface becomes softer the closer it is to the CEJ; thus, it can be speculated that in this critical area (close to the CEJ), ultrasonic instrumentation is less effective in preparing the root for coverage with soft tissues. When treating gingival recessions, especially in patients with esthetic demands, the most important outcome is the percentage of complete root coverage, i.e., the number of treated defects with the soft tissue margin at the level of the CEJ.<sup>30,31</sup> In the present study, of the 11 treated cases, nine control gingival recessions and only six test defects were completely covered with soft tissue. Very often, the most coronal millimeter/s of the root exposure is the only visible part of the recession when the patient smiles; therefore, the post-therapy persistence of even a shallow recession may be an esthetic problem for the patient. Furthermore, a lack of statistical significance between groups in a trial designed to demonstrate superiority does not mean that the two treatment techniques are equivalent.<sup>32</sup> In the present study, a lack of significance in the percentage of complete-root coverage between the two groups might be due to the limited sample size and/or the relatively short postoperative follow-up period.

An advantage of ultrasonic treatment is that it is less traumatic for the soft tissue. This is very important when root instrumentation is performed prior to raising the flap, as reported in mucogingival surgery. The portion of the root corresponding to RD, as well as that related to buccal PD, has to be instrumented.<sup>1,2</sup> In the

presence of thin residual buccal keratinized tissue with a low height apical to the exposed root, the risk for trauma by curets during the root-planing procedure is very high. Thus, unintentional curettage<sup>33,34</sup> might be responsible for some loss of keratinized tissue apical to the root exposure and consequently for reduced stability of the CAF. This trauma could be even more detrimental in the presence of deeper buccal PD associated with root exposure, as happens with plaque-induced gingival recession. Conversely, the use of thin ultrasonic devices could be effective in root debridement without traumatizing the soft tissues.<sup>35</sup> The hypothesis about using different modalities (ultrasonic versus hand) of root treatment in plaque- or trauma-induced gingival recessions deserves further investigation.

The root-coverage outcomes achieved in the present study are comparable to those reported in other CAF studies,<sup>29,36</sup> in which a very similar surgical technique was used. Conversely, the present root-coverage results are superior to those reported in other controlled randomized studies,<sup>19-22,37,38</sup> in which CAF was used as a control root-coverage surgical procedure. The reasons for the differences can only be speculated on. A possible explanation can be found in the surgical technique. In the present study, the soft tissue apical to the root exposure (including the keratinized tissue) was elevated full thickness by inserting the periosteum elevator in the probeable sulcus. This preserved a maximum thickness of the soft tissue where it is critical for root coverage. On the contrary, in studies<sup>19-22,37,38</sup> reported in the literature, an intrasulcular incision was performed apical to the root exposure. This might thin the soft tissue covering the avascular root surface and be responsible for the worse root-coverage outcomes. Another possible explanation for the better results is the strict entry criteria of the present study: only Miller Class I gingival recessions with no deep cervical abrasion or root demineralization were included.

Another finding of the present study was the statistically significant increase in KTH in both groups. This increase was lower than that reported in a previous study,<sup>29</sup> in which the same surgical approach was used to treat a single type of recession defect. This difference may be ascribed to the short follow-up period (6 months) of the present study. Previous studies on the CAF indicated that a statistically and clinically significant increase in KTH was observed after 1 year,<sup>29,39,40</sup> which continued to increase for  $\geq 5$  years<sup>40</sup> because of the tendency of the mucogingival line to regain its genetically determined position.

## CONCLUSIONS

Hand and ultrasonic root instrumentation, in combination with CAF, for the treatment of the isolated-type

of recession defect were equally effective in terms of root coverage and CAL gain at 6 months post-surgery. Complete root coverage was achieved in 82% of the defects treated by hand and 55% of the ultrasonic-treated defects, with no statistically significant difference between them. More expanded and longer-terms studies are advocated to confirm such results and to evaluate the efficacy of ultrasonic treatment for demineralized/softened root surfaces.

### ACKNOWLEDGMENT

The authors report no conflicts of interest related to this study.

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