NON-SURGICAL PERIODONTAL TREATMENT: CLINICAL AND MICROSCOPIC EVALUATION

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Palavras-chave: Periodontite. Microscopia Eletrônica de Varredura. Estruturas de Apoio Dentário.

RESUMO

Objetivo: Comparar a eficácia de duas terapias combinadas não-cirúrgicas periodontais a partir de uma análise da superfície dentária tratada usando microscopia ótica (MO) e microscopia eletrônica de varredura (MEV). **Métodos**: Trinta pacientes foram selecionados com doença periodontal moderada a severa e indicando pelo menos uma peça para extração devido ao mau prognóstico. Foi realizado um estudo clínico com desenho duplo-cego, randomizado, com boca dividida. Duas modalidades de tratamento combinadas foram comparadas: Cavitron Bobcat® + completamento com Gracey Curettes (G1); EMS® + conclusão com curetas de Gracey (G2). O tratamento foi realizado até que uma superfície lisa fosse obtida e nenhum cálculo residual estivesse presente, o que foi verificado por uma sonda periodontal. As peças extraídas foram analisadas por MO e MEV. As variáveis periodontais foram: índice de placa (IP), sangramento à sondagem (SS), profundidade de sondagem da bolsa (PSB), nível de inserção clínica (NIC), recessão gengival (RG) antes e 3 e 6 meses. O tempo operatório (TO) para cada método também foi analisado. Os resultados foram comparados por ANOVA seguido do teste de Tukey, estabelecendo o valor de significância em p<0,05. **Resultados**: PI, SS, PSB e NIC apresentaram desempenho semelhante nos dois grupos. O RG, determinado em mm, foi para G1 (0,31) e para G2 (0,46). TO, em minutos por dente, foi para G1 (3,21) e para G2 (3,12). **Conclusão**: Ambas as modalidades de tratamento favoreceram a resolução da doença periodontal. Ultrassom piezoelétrico combinado com curetas Gracey produziu maiores recessões gengivais. As superfícies analisadas por MO e MEV não apresentaram variações quantitativas ou qualitativas estatisticamente significativas.

Keywords: Periodontitis. Scanning Transmission Electron Microscopy. Tooth Supporting Structures.

ABSTRACT

Objective: To compare the effectiveness of two combined non-surgical periodontal therapies from an analysis of the treated tooth surface using optical microscopy (OM) and scanning electron microscopy (SEM). **Methods:** Thirty patients were selected with moderate to severe periodontal disease and indicating at least one piece for extraction due to poor prognosis. A clinical study with a split-mouth, randomized, double-blind design was performed. Two combined treatment modalities were compared: Cavitron Bobcat™ + completion with Gracey Curettes (G1); EMS™ + completion with Gracey curettes (G2). The treatment was performed until a smooth surface was obtained and no residual calculus was present, which was verified by a periodontal probe. The extracted pieces were analyzed by OM and SEM. Periodontal variables were: plaque index (PI), bleeding on probing (BP), probing pocket depth (PPD), clinical insertion level (CIL), gingival recession (GR) were observed before treatment, 3 and 6 months later. The operative time (OT) for each method was also analyzed. The results were compared by ANOVA followed by the Tukey test, setting the significance value at p<0.05. **Results:** PI, DP, PPD and CIL performed similarly in both groups. GR, determined in mm, was for G1 (0.31) and for G2 (0.46). OT, in minutes per tooth, was for G1 (3.21) and for G2 (3.12). **Conclusion:** Both treatment modalities favored the resolution of periodontal disease. Piezoelectric ultrasound combined with Gracey curettes produced greater gingival recessions. The surfaces analyzed by OM and SEM did not show statistically significant quantitative or qualitative variations.

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INTRODUCTION

Bacteria are one of the main etiological agents of periodontal diseases determined by the presence of biofilm and closely related to the host in terms of its response profile. [1]

The objective of periodontal therapy is elimination of a large number of bacteria and their degradation products to allow, in the short term, resolution of the installed pathology and the control of periodontal infection. [2,3]

The responsibility of microorganisms in the initiation and progression of gingival and periodontal diseases has been demonstrated in several studies. [4-6]

There are currently several methodologies for therapies that can be used individually or combined to achieve a change in the bacterial ecosystem and thus allow the treatment of hard and soft periodontal tissue. [7-9]

The present study evaluated the behavior of clinical periodontal parameters and microscopic variables of hard tissues (dental surfaces) subjected to two types of combined conservative periodontal treatments.

MATERIALS AND METHODS

A clinical and microscopical study was performed using optical microscopy and scanning electron microscopy. The sample consisted of 30 systemically healthy individuals. Inclusion criteria were patients with a diagnosis of moderate to severe periodontitis[10] with a loss of insertion of 4 to 7 millimeters in proximal faces that had not received periodontal treatment in the last two years and at least one specimen with indication of exodontia.

Individuals with systemic pathologies of known risk for periodontal disease were excluded from the study.

The variables that were taken were: plaque index (PI), bleeding on probing (BP), gingival recession (GR), probing pocket depth (PPD), clinical insertion level (CIL), time per tooth (TPT), a qualitative analysis of the surfaces treated (30 specimens in the mesial face in proximity to the LAC) by scanning electron microscopy and a quantitative analysis of residues after basic therapy by optical microscopy.

The quadrants receiving the treatments were divided into right and left, and the different treatments were assigned randomly by lot (one type of treatment for the right and another for the left).

The experimental design consisted of a split-mouth and double-blind inspection. Dental faces were taken as the unit of analysis, except for the working time, which was expressed in minutes per tooth. All periodontal clinical variables were analyzed before treatment and 6 months after treatment.

The quadrants were constituted as follows:

Treatment 1: Magnetorestrictive ultrasonic instrumentation (Cavitron™ Bobcat, TFI-10 tip) + root and scaling with conventional Gracey curettes (Hu-Friedy™ 7/8, 11/12 and 13/14); **Treatment 2**: Piezoelectric ultrasonic instrumentation (EMS™, Perio-tip) + R and A with conventional Gracey curettes (Hu-Friedy™ 7/8, 11/12 and 13/14).

The measuring instrument used was a Marquis periodontal probe (Hu-Friedy™ cp-12 screening color-coded probe).

Treatment of dental surfaces was performed by an experienced periodontist who considered the scaling finished when the dental surface was smooth and without any continuous solution on inspection with the periodontal probe (Hu-Friedy™ cp-12 screening color-coded probe). The teeth were treated and later extracted for analysis by optical microscopy (OM) and scanning electron microscopy (SEM).

Treatment of the samples for analysis by optical microscopy

Marking the gingival margin of the hopeless teeth: The extracted teeth were washed with sodium hypochlorite solution and water. Subsequently, they were immersed in a solution of 1% methylene blue for 2 minutes and finally washed in a stream of water for 3 minutes. They were observed by optical microscopy with a magnification of 6.3–12.5 with a cell count grid of 10×10 mm. All the dental faces were analyzed. In order to quantify the amount of residual calculus, the following equation was extracted from the available literature, [11] which uses in the numerator the total number of grids with calculus, and in the denominator the number of grids counted, with this result multiplied by 100, determining the total percentage of residual calculus found for each surface analyzed.

Treatment of the samples for analysis by scanning electron microscopy and its subsequent interpretation

Samples were washed with glutaraldehyde solution (2.5%), ethanol dehydration in increasing percentages (70, 85, 95 and 100%) and fixation with osmium tetroxide. Sputtering was performed with gold on aluminum wad. To obtain a standard pattern, positive (no calculus) controls were observed in third molars with cement not exposed to the light of the periodontal pocket, while the negative control was teeth affected by periodontal disease observed with

cement exposed to the light of the periodontal pocket. The observations were made on 30 specimens (15 of each therapeutic modality) in the mesial faces in proximity to the enamel cementum junction (LAC). Three examiners calibrated according to the positive and negative control patterns, and analyzed the samples of each treatment without informing which ones belonged to each one. Magnifications of 100× and 500× were used. We used a qualitative scale of measurement described in the literature. [12,13]

Cement surface analysis range:

A – Completely smooth surface without porosity and without loss of tooth substance.
B – Observable roughness and local areas confined to the cementum not showing evidence of porosity.
C – Surface porosity with a minimum width and depth.
D – Porosity with deep holes and high slopes with instrumentation into the dentin. Cementum is completely removed in large areas.

Permission for this study was obtained from the Ethics Committee of the School of Dentistry of the UNR.

Statistical analysis

Statistical analysis of the clinical variables was based on a one-way ANOVA with a Tukey test. The value to obtain statistical significance was set at $p < 0.05$.

The ranges of values for the analysis of the surfaces observed by SEM determined for the three examiners and their distributions were calculated using a Kruskal–Wallis test.

RESULTS

The results are expressed in separate tables (Tables 1,2,3 and 4) according to the clinical or microscopic evaluation as appropriate.

***Table 1**: Bleeding on probing, plaque index, gingival recession, probing pocket depth and clinical insertion level evaluated before and after 6 months post treatment.*

	Before treatment	Post treatment at 6 months
HS	70.60	31.90
IP	2.43	1.21
RG	3.09	3.43
PS	4.80	2.70
NIC	4.05	2.85

Analysis of dental surfaces by scanning electron microscopy (100×–500×)

The images (Figures 1 and 2) obtained by SEM were presented to the examiners for each mode of treatment at random at the lowest magnification (100×) and highest magnification (500×) on the left and right sides of the screen, respectively.

***Table 2**: Variables behavior: plaque index, bleeding on probing, gingival recessions, probing pocket depth, clinical insertion level and time spent per tooth, evaluated at 6 months after therapy.*

n =30	PI (Reduction in %)	BP (Reduction in %)	GR (Increase in mm)	PPD (Reduction in mm)	CIL (Gain in mm)	TPT (Minutes)
TREAT. 1 Cavitrón™ + Gracey curettes	44.60(CI 95% 40.17–48.83)	45.51(CI 95% 42.16–51.73)	0.31*(CI 95% 0.12–0.61)	1.09(CI 95% 0.88–1.31)	0.70(CI 95% 0.67–1.28)	3.21(CI 95% 2.90–5.16)
TREAT. 2 EMS™ + Gracey curettes	46.7 (CI 95% 41.42–53.98)	47.40 (CI 95% 44.24–50.56)	0.46* (CI 95% 0.20–0.77)	1.32 (CI 95% 1.12–1.52)	0.69 (CI 95% 0.45–0.83)	3.12 (CI 95% 3.05–4.94)

Tukey test. Significance level $p<0.05$
** Statistical significance among the different treatments (p=0.01)*

***Table 3**: Evaluation by optical microscopy of the residues post-periodontal therapy. Expressed by the percentage remaining on the tooth surface studied. (Negative control surfaces of untreated teeth).*

Untreated Control Parts	89% (CI 95% 85–94)
Treatment 1 Cavitrón™ Bobcat + Gracey curettes	16.3 % (CI 95% 12–18.4)
Treatment 2 Minipiezón EMS™ + Gracey curettes	15.8 % (CI 95% 12.2–17.8)

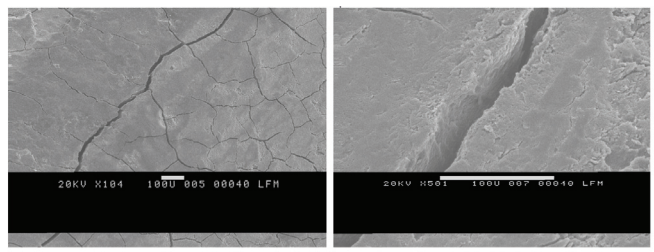

***Figure 1**: Image of the cement surface obtained from SEM after scaling and root planning performed with Treatment 1 (Cavitron® + R and A instrumentation with conventional Gracey curettes) Magnification of 100× and 500×*

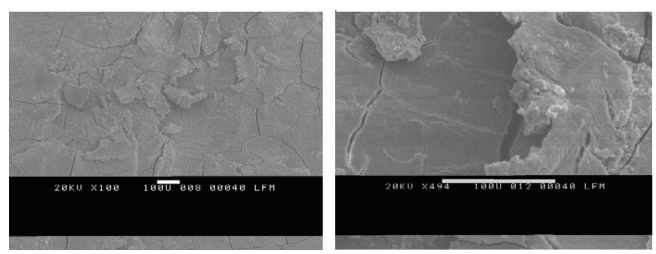

***Figure 2**: Image of the cement surface obtained from the SEM after the maneuvers of scaling and root planning performed with Treatment 2 (Instrumentation EMS® + R and A with conventional Gracey curettes) Magnification of 100× and 500× (REVISOR B)*

***Table 4**: Frequency results of the examiners' observations on the specimens analyzed by SEM*

	A	B	C	D
Treatment 1 Cavitrón™ + Gracey curettes	0.19	0.71	0.08	0.02
Treatment 2EMS™ + Gracey curettes	0.11	0.66	0.2	0.03

Note: Kruskal–Wallis test. Significance level p <0.05. Value of p=0.006

DISCUSSION

The present study demonstrates an improvement and acceptable control of the periodontal tissues in response to the treatment modalities.

It is universally accepted that the only effective treatment for the control of periodontal diseases is scaling and root planning, because it is the only one that controls or facilitates the elimination of infection with aerobic and anaerobic bacteria specifically. [14]

It is well known that periodontitis disease is responsible for the greatest amount of tooth loss among industrialized populations. [15,16]

As bacterial infection causes periodontal diseases, it is logical to assume that elimination and control of infection would be the main objective for non-progression of periodontal diseases, reduction of tooth loss and improvement of gingival health in general. [17-19]

Some studies evaluating cement surface alterations after manual, sonic and ultrasonic instrument treatment were not conclusive in demonstrating whether there were differences between non-surgical therapeutic modalities. [2,3,7]

The root surface termination is important for healing after treatment, which is favored by a smooth and polished surface. Another important consideration is the amount of cement removed and the roughness that results as a result of periodontal instrumentation treatment. An in vivo study in which the root surfaces were analyzed with SEM after separate treatment with piezoelectric ultrasonic instruments (Vector™, Enac™ and Gracey curettes) determined that the calculus remnant was similar in all three groups; however, the Vector™ system left softer surfaces with minimal loss of root substance. Although all mechanical instruments (sonic, ultrasonic, rotary or abrasive) were effective compared to curettes, these have disadvantages when compared to the latter in terms of tactile sensitivity and uncontrolled root surface damage. [20]

Manual instrumentation takes more time, is more painful and can cause gingival hemorrhages depending on the ability of the operator. [8,9]

Other methods were the Er: YAG laser [22,31] both in vivo and in vitro, with a similar result verified in terms of removal of the calculus and improvement of clinical parameters; however, observed surfaces in the SEM laser treatment are left with greater roughness compared to curettes. In addition, the working time was twice that required when using curettes. [21]

Several studies analyzed the different alternatives for the treatment of periodontal disease, concluding that the methods – sonic, ultrasonic and mechanical – did not obtain statistically significant differences in clinical parameters compared to curettes; however, the use of sonic instruments reduced the working time. [23-25]

Many practitioners disregard the effectiveness of ultrasonic instruments in deep pockets = 5 mm; however, [26] studies comparing the penetration of the periodontal probe, the EMS™ insert and a Gracey after five curettes in patients with chronic periodontitis in treatment and in individuals in periodontal maintenance therapy showed that for the group with chronic periodontitis, the tip of the EMS™ was more effective than the other instruments; however, in the periodontal maintenance group, the clinical parameters were similar.

Another study [27] compared Periosonic™ versus manual curettes, demonstrating that they were equally effective in reducing the depth of pockets when they were initially = 6 mm; however, the Periosonic™ showed an improvement in clinical insertion with less recession for the pockets with an initial probing depth of = 7 mm.

Regarding clinical and microbiological results after treatment with modified sonic instruments versus curettes, similar results were obtained in the clinical improvement with both methods at 4 and 6 weeks, but not in deep pockets, where less bleeding and reduction of probing depth were observed in the group treated with Gracey curettes. [28]

For the microbiological and clinical parameters, although some studies demonstrate that ultrasonic devices and manual instrumentation therapies did not show significant clinical differences, significant and important differences were obtained at 6 months with a reduction of *Tannerella forsythia* and *Treponema denticola* for the group treated with manual instrumentation. [29]

Attachment loss was observed in several studies comparing the ultrasonic instruments versus the curettes. In both cases, an attachment loss of 0.76 mm was initially produced by the trauma of the instrument, there was no difference between the two methods and there was not a greater reduction for one or the other method compared to the attachment loss improvement. [30,31]

Many of the studies compared some of the sonic and ultrasonic instruments with the curettes; however, few examined combinations of these for the treatment of periodontal disease, as with the present work.

Our working methodology is supported by the combination of mechanical and manual instruments. In the initial stage of the treatment for the removal of calculus deposits with greater adhesion to the cement surfaces, ultrasonic instruments allowed faster treatment, greater comfort for the patient due to a shorter operative time and a decrease in operator fatigue.

In the final stage of the treatment of scaling and root planning, the use of manual instruments such as Gracey curettes allows a greater tactile sensitivity, which returns a treated surface with less roughness, favoring, according to our working hypothesis, a better adaptation of the involved tissues and thus a more effective healing mechanism.

Obeid et al. carried out a similar study with a combination of instruments and analyzed the clinical response, taking as the gold standard the treatment of scaling and smoothing with Gracey curettes. We used ultrasound, ultrasound + Periopolisher™, Perioplaner™ + Periopolisher™ and Gracey curettes only, and we considered the time of work per tooth. There were no significant differences in the clinical outcome, nor did we find significant differences in the present study. [24]

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