Abstract

Introduction: Periodontal disease is considered a public health problem and may lead to serious complications for general health of patient. The main therapeutic procedure is scaling and root planing, which can be performed by a variety of techniques and instruments.

Objective: The aim of the present study was to evaluate the removal of calculus, produced artificially, by using a conventional ultrasonic tip and a diamond – CVD tip.

Method: The calculus was produced with artificial sawdust and glue-based cyanoacrylate and distributed in twenty areas following standardization on two plates of acrylic resin (chemical activated), holding 10 samples per plate. Standards/samples were divided by lot into two simple groups, being A (treated with conventional tip) and B (treated with CVD tip).

Results: The treatment in Group A, promoted an average area of 20.48 ± 4.20 mm² free of artificial calculus which is significantly higher (p <0.05) than the area removed in Group B (15.37 ± 5.29 mm²).

Conclusion: The results showed that the conventional tip presented higher results than CVD tip for efficacy in the removal of calculus.

Keywords
Periodontal; Disease; Root; Descontamination; Ultrasound.
Introduction
Periodontal disease is considered a public health problem and may lead to serious complications for the general health of patient [1] One of the major signs of improvement of periodontal inflammation is decreased pocket depth, which influences the penetration of periodontal probe according to Armitage et al., 1977 [2]

The main therapeutic procedure is scaling and root planing, which can be performed by a variety of techniques and instruments. Hunter et al., 1984 [3] concluded that manual scraping is more effective in removing residual calculus and produced a smoother surface than the ultrasonic instrument; Riesco and Campos Júnior, 1995 [4] observed that both treatments are effective in decontaminating the root surface.

The use of ultrasonic instruments was propagated due to the reduction of clinical time and greater ease of access to deep pockets and furcation areas, according to Leon and Vogel, 1987 [5] Ribeiro et al., 2004 [6] who conducted a systematic review of the literature on manual and ultrasonic instrumentation and describe among others the following studies: Oosterwaal et al.,1987 [7] compared the instrumentsations, manual and ultrasonic in bags of 6 to 9 mm, and found that both were equally effective in decreasing the number of colony units; Boretti et al.,1995 [8], stated that the use of instrumentation showed a reduction in time with the use of ultrasonic devices around 49%. Hunter et al., 1984 [3]; Garnick and Dent, 1989 [9] said that even studies demonstrating the effectiveness of both instrumentations in the removal of biofilm and calculus instrumentation performed with ultrasound device allows better access to deep pockets and furcation areas; Dragoo, 1992 [10] evaluated the effectiveness of instrumentation when using conventional ultrasonic horns and curettes, and concluded that the ultrasonic tip modified to be thinner than the conventional and that the curette, he could get closer to function purse background effectiveness of scraping on all sides of the tooth when compared to conventional and hand tools.

Recently appeared on the market ultrasonic tips with diamonds on the surface known as CVD tips (Chemical Vapor Deposition). These, when installed on the ultrasound machine, guarantee the wear surface obtained with the oscillatory motion of the same [11].Within this context, the objective of this study was to evaluate the effectiveness in removing calculations, produced artificially by the use of ultrasonic tips of the conventional type and diamond (CVD).

Materials and Methods
This study was experimental type in vitro held at University Center Cesmac (CESMAC).The sample consisted of twenty standard areas (7x3mm), ie, (21mm²) artificial calculation also distributed on two plates of acrylic resin chemically activated (acrylic resins), carrying 10 samples per plate. Samples were obtained according to the methodological steps.

Manufacture of plates in acrylic resins
Formerly a polished glass plate (15x7X1cm) for dental use was submitted to the molding process with condensation silicone (Optosil Comfort, Heraeus - Germany), dipping to against silicone plate.

After conform to the setting time of the silicone recommended by the manufacturer, was obtained mold from the glass plate (Figure 1, A).

Figure 1: Making the board in chemically activated resin. A) template on glass plate of silicon; B) resin end plate.
Then he manipulated acrylic resins (Dencrilon, Dencril Plastic Ltda. - São Paulo VIP Flash, type 2 class I - VIPI Ind Exp And Imp Dental Products Ltd. - São Paulo) in sufficient quantity to fill the mold. The resin, still in a fluid state, was poured against mold under constant vibration, using a vibrator for plaster (Blue Dental and Medical Equipment - São Paulo). The vibrator use aimed to minimize the formation of bubbles.

He waited to final setting of acrylic resins to remove it completely from the mold and thereby finally obtain the desired plate. Then they were repeated steps to obtain the second plate.

**Standard limits of artificial calculus area**

For the standardization of the area that received artificial calculus concocted was a Teflon mask measuring 14x6cm. This mask had 10 standard holes 21mm² (7x3mm) with depth of 1.5mm and equidistant spaces between the holes. The diagram below (Figure 2) discriminates against other measures of Teflon mask.

When ready, the mask was placed on the acrylic resin plate being attached/stabilized thereto by means of adhesive tapes (Color Ribbon Adelbrás - Brazil). Then, each well was painted with red permanent marker (CD Marker Marker Faber-Castell S.A- SP) until all holes are painted. Immediately after the mask was separated from the resin plate obtained and thus it is a final feedback holes over all the same (Figure 3).

**Manufacture of artificial calculus**

Each template painted on the plate was initially isolated using adhesive tape (Adelbrás Colored Ribbon - São Paulo). The use of this insulation medium was aimed at preventing the extravasation of cyanoacrylate based glue (Super Bonder® - Precision 5g - Henkel Brazil Ltda - São Paulo) - which is part of the materials used in the Could interfere with the standardization sought (Figure 4 A).

All holes were then filled with a mixture of glue cyanoacrylate and fine-grained sawdust (Figure 4B)
because, according to Penteado et al., 2010 [12], this association has characteristics similar to natural dental calculus.

The form of preparation followed the steps described below for all the holes:

1) was deposited on each template a drop of liquid cyanoacrylate;
2) feedback was visually completely filled with fine sawdust;
3) the sawdust was lightly placed against the glue, using a spatula number 31 (Silver dental products Inc. - SP) and pressed with a glass plate.

This procedure was performed in twenty jigs. Finally, they were pressed with a glass plate held in place for 1 minute for the final setting of the glue (Figure 4 C). After the pressing time made it a light tap of acrylic resins described plate against a countertop surface for removing excess of sawdust.

There was thus obtained the twenty standard artificial calculus, and acrylic resins ten per plate that followed for two different modes of ultrasonic scaling (Figure 4 D).

### Division of experimental groups

The twenty patterns/calculus artificial samples were randomly divided by simple drawing in two groups, namely:

- Group A (n = 10) treated for 30 seconds with ultrasound (Gnatus Jet Sonic US - Gnatus Medical Equipment, Dental Ltda Ribeirão Preto - SP) set in output of 85% and irrigation, using conventional tip.
- Group B (n = 10) treated for 30 seconds with ultrasound (Gnatus Jet Sonic US - Gnatus Medical Equipment, Dental Ltda Ribeirão Preto - SP.) Regulated power 85% and irrigation, using state-CVD.

It is noteworthy that along with these photos was captured the image of a millimeter ruler (Jon Trade Dental Products Ltda- São Paulo) 15 cm (Figure 5). This rule is used to calibrate the analysis public domain program computer image, Image J, which makes the measurement taken in pixels to millimeters.

Randomization was obtained according to the following steps: 1) patterns (n = 20) were numbered using arabic numbers from 1 to 20; 2) in a plastic bag papers numbered from 1 to 20, relating to standards, they were deposited and placed in another bag letters A and B related to specific treatments in each group.

From this point it was taken a number of the first plastic bag and then removed after the treatment A or B which was subjected to sample selected. It sought to thus prevent trends in random groups.

### Efficiency analysis in the calculus of removing artificial

After the model made in the desired pattern was obtained digital snapshots using digital camera Sony Cyber-shot DSC-H10 (Sony Corporation- USA) as standard:

- a) Image quality: JPEG standard, 8.1 megapixel resolution without flash, macro function activated and 2x optical zoom.
- b) Distance object focus: The distance was set at 50 cm using a transparent ruler school (Acrimet Ind Prod Acrylics Metalworkers Ltda - São Paulo).

It is noteworthy that along with these photos was captured the image of a millimeter ruler (Jon Trade Dental Products Ltda- São Paulo) 15 cm (Figure 5). This rule is used to calibrate the analysis public domain program computer image, Image J, which makes the measurement taken in pixels to millimeters.

The initial images were taken to Image J and the average area in the initial square millimeters was obtained after three readings by a single examiner.

After the treatments (Group A and B) new images were taken and again averages were obtained by the same examiner, but now measured the residual calculus area. (Figure 6)

The differences of the final and initial areas determine the free area calculation (effectiveness of scraping) and these were submitted to statistical
evaluation of normality by the Shapiro-Wilk test. They behaved as normal data was followed for analysis of variance (ANOVA a criterion) and post-hoc Tukey test.

Results and Discussion

Figure 7 expresses the medium in square millimeters (mm²) of the free areas calculus. It is observed that the treatment performed in Group A promoted an average area of 20.48 ± 4.20mm² free artificial this calculation being significantly (p <0.05) higher than the removed area in Group B (15.37 ± 5.29mm²).

Traditional periodontal treatment aims at removing calculus deposited on the surface of teeth affected by periodontal [13] disease, and several studies [14-16] point out that the use of hand instruments, ultrasonic and rotary during periodontal therapy, aims to make the biocompatible root surface and confirmed that all are advantageous, but each with its specificity.

This study compared, by means of in vitro experimental study, the effectiveness of the scraping of
artificial stones by the use of ultrasonic tips, and conventional CVD.

In vitro studies have some advantages over the in vivo studies, for example, there is a possibility to standardize the amount of dental calculus to be shaved, and they can get a calculation to present the same resistance to instrumentation for all groups that want to evaluate. Another advantage is that it is unnecessary to permit an ethics committee.

In contrast, there are limitations when compared to studies using in vivo models as in vitro studies, there is no way to easily have the same characteristics of the oral environment (pH, buffer capacity, bleeding, pain, etc.) are therefore partially affected direct inferences brought to the understanding of an application in the oral cavity.

The choice of sawdust use with a glue based on cyanoacrylate (Super Bonder®) to simulate artificial calculation is due to the fact that this combination of materials having, in accordance with Penteado et al., 2010 [12] a higher degree of similarity with the natural dental calculus for both tactile sensitivity as to the resistance offered during instrumentation.

It is known that a higher instrumentation can generate greater removal time calculus compared to a shorter time. Therefore, this study sought to eliminate this error by standardizing the time instrumentation. At first, the overtime was obtained through a pilot study, which is tested for a minute, however, it was realized that this time would be excessive because it would remove completely the calculus and the research objective is to leave residual calculus. Therefore, the time was set 30 seconds for each pattern area.

It is in the literature other than the time used in this study. Chan et al., 2000 [17] established that a complete scraping calculus on natural teeth is obtained in three minutes for anterior teeth, however, the authors evaluated all root surfaces of teeth. It is understood, therefore, that if three minutes divided by four sides (mesial, buccal, lingual distal and) gives a value of 45 seconds per side.

Martins et al., 2007 [18] evaluated the time required for scraping root through retail using manual curettes and ultrasonic diamond tips 12 periodontal patients. Using a split-mouth model, they observed an average of 1.07 minutes for each tooth treated with ultrasonic tip diamond and 2.07 minutes for teeth treated by curette. This time used on anterior teeth for ultrasonic horns, it is divided by 4 (the number of faces per tooth) results in 17.15 seconds per side.

As the ultrasonic vibration power is in literature [19] the use of a power equipment III in Dabi. This study used Sonic Jet Gnatus appliance with a power of 85%. Apparently seems difficult to compare the adjustments, however the power Atlantis III Dabi the apparatus refers to a frequency range 80 - 100%, and thus within the same range used in this study.

Divergently the above two studies, Khorasvi et al., 2004 [20] used power of 100% in their study, but they wanted to completely remove the calculus, unlike proposed in this study that aimed to reach the end with residual calculations.

The results of this study revealed that conventional ultrasonic tip was more effective at removing the artificial calculus of the CVD. In the literature there is a lack of scientific studies comparing the effectiveness between the tips. On the other hand, there are studies comparing manual and ultrasonic instrumentation in dental calculus removal and claim no significant differences between them [6, 7]

Gomes, 2008 [21] evaluated the difference in surface roughness between the two ends also used in this study and concluded that there was no difference between the quality of the root surface after scraping with conventional tips or CVD in human teeth. However, another study 19 reports roughness difference in bovine teeth treated with curettage, conventional ultrasound tips and CVD, where the latter showed higher roughness compared to other instruments.
This study was not intended to investigate the surface roughness left wings and even comparisons would be difficult, since it used acrylic resins instead of a root surface.

A review of literature [22] performed comparing studies that evaluated the manual and ultrasonic scaling in furcation regions showed no obvious superiority between the two types of in vivo treatment.

On the other hand, another study [23] showed clinically, the CVD diamond ultrasonic horns were as efficient as the curette surgical periodontal therapy and non-surgical.

Important to note that the clinical time can be a significant factor in choosing a particular treatment to scaling and root planing, since there is no consensus in the literature of the best treatment to be indicated. Thus, a study evaluating the time instrumentation concluded that the use of ultrasonic diamond tip to the economy time of root instrumentation, streamlining the procedure, which may result in less fatigue for the operator and comfort to patient [18].

Conclusion

Thus, it is up to the dentist to choose the treatment that dominates more, to act comfort and efficiency for both the professional and the patient. Within the limitations of this in vitro study, it can be concluded that the conventional ultrasonic tip was above ultrasonic edge CVD for efficacy in removing the artificial stones.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

References


