

# DENTIN HIPERSENSITIVITY FOLLOWING NON-SURGICAL PERIODONTAL THERAPY WITH HAND OR ULTRASONIC INSTRUMENTS

Hipersensibilidade dentinária após terapia periodontal não cirúrgica com instrumentos manuais ou ultrassônicos

Laíse Silva Gaspar<sup>1</sup>, Ana Luísa Teixeira Meira<sup>2</sup>, Alexandre Jesuino<sup>3</sup>, Sandro Bittencourt<sup>4</sup>, Andrea Nóbrega Cavalcante<sup>5</sup>, Érica Del Peloso Ribeiro<sup>5</sup>

<sup>1</sup> *Specialist in Radiology and Imagin CEBEO*

<sup>2</sup> *MSc in Periodontology EBMSp*

<sup>3</sup> *Specialist in Periodontics ABO-BA*

<sup>4</sup> *Assistant teacher EBMSp*

<sup>5</sup> *Assistant teacher FOUFBA and EBMSp*

Recebimento: 18/01/18 - Correção: 20/02/18 - Aceite: 27/02/18

## ABSTRACT

Periodontal instrumentation aims to remove plaque and calculus from the root surface. Both manual and ultrasonic instruments have been used for such decontamination; however, establishing a healthy periodontium can result in adverse effects, such as dentin hypersensitivity. Objective: To evaluate the effects of hand or ultrasonic instrumentation on dentin hypersensitivity in patients undergoing non-surgical periodontal treatment. For this controlled clinical trial of a "split mouth" design, 14 patients were selected with homologous teeth in the incisor to premolar region and probing depth  $\geq 5$  mm on the buccal aspect of the teeth. One side (control) was instrumented with hand instruments and the other side (test) with ultrasonic instruments. Dentin hypersensitivity was assessed on baseline and during the 4 weeks after treatment, with a periodontal probe scratching the root surface and with an air jet. The patient's response was detected by a visual analog scale of 10 cm. There was no statistical difference between the effectiveness and the occurrence of hypersensitivity between the proposed therapies. After the instrumentation the occurrence of hypersensitivity occurred at low levels, and disappeared completely at 4 weeks of evaluation. In the first week, there was a statistically significant increase in hypersensitivity in the control group after stimulation with air. The air jet stimulus, in comparison to scratching caused more discomfort during the hypersensitivity evaluation after the both treatments on the 1st, 2nd and 3rd weeks. Based on these conditions, this study demonstrated that there was no difference in dentin hypersensitivity following ultrasonic or hand instrumentation.

**UNITERMOS:** Dentin sensitivity, Dental scaling, Ultrasonic. R Periodontia 2018; 28: 13-18.

## INTRODUCTION

Periodontal therapy, whose main objective is the elimination of infection and maintenance of a health periodontium, depends on the effective removal of bacterial deposits from the tooth surface (Tammaro *et al.*, 2000). In this context, radicular instrumentation has a key role in periodontal therapy (Ribeiro *et al.*, 2004). Both manual and ultrasonic instruments are reported in the literature as capable of cleaning the root surface, being equally effective

in removing biofilm and dental calculus and in the elimination of bacterial endotoxins (Garnick, 1989; Checchi & Pelliccioni, 1998; Obeid *et al.*, 2004). However, ultrasonic instruments can reduce the instrumentation time and cause a decreased removal of tooth structure (Leon & vogel, 1987; Ritz *et al.*, 1991; Zappa *et al.*, 1991; Gantes *et al.*, 1992; Jacobson *et al.*, 1994). Regardless of the type of instrumentation, the occurrence of gingival recession following periodontal treatment is a common finding (Badersten *et al.*, 1984). Thus, the establishment of a healthy periodontium may result in

undesired side effects, such as dentin hypersensitivity. Dentin hypersensitivity has been defined as a short, sharp and painful response to some external stimulus applied to the exposed dentin, and is a frequent and important complaint of patients after periodontal treatment (Von Troil *et al.*, 2002).

Some pathophysiological mechanisms behind dentin hypersensitivity have been discussed, but remain poorly understood. The hydrodynamic theory, of fluid movement in dentinal tubules, seems to be the most widely accepted (Brännström, 1963). Radicular sensitivity occurs in approximately half of patients after scaling and root planing therapy. Normally, the intensity of tooth sensitivity increases during the first weeks after non-surgical periodontal treatment and then appears to decrease (Von Troil *et al.*, 2002). Despite being a question of great clinical relevance, the literature lacks studies assessing the occurrence of root hypersensitivity as an adverse effect after different types of non-surgical instrumentation (Canakçi & Canakçi, 2007). This becomes important when it allows the inclusion of strategies to cause less discomfort to patients. Therefore, the aim of this study was to evaluate the effects of manual or ultrasonic instrumentation on dentin hypersensitivity in patients undergoing non-surgical periodontal treatment.

## METHODS

### Patient Selection

A total of 14 individuals were recruited, and referred to the Integrated Clinic at the Bahiana School of Dental Medicine and Public Health (EBMSP), Salvador, Bahia, Brazil. These patients were informed about the risks and benefits of the study and signed their informed consent for participation in research, which was duly approved by the Ethics Committee of this institution, under protocol number 02/2009. Inclusion criteria for participation were: patients diagnosed with chronic or aggressive periodontitis, according to the American Academy of Periodontology (2001) classification, requiring non-surgical periodontal treatment in at least two quadrants. These quadrants should present two contralateral and homologous teeth in the incisor to premolar region with probing depth  $\geq$  5 mm and bleeding on probing on the buccal surface.

Subjects were excluded due to the presence of systemic illness or medication use (six months preceding the research), which could influence the response to periodontal treatment, performance of periodontal treatment including subgingival instrumentation in the six months preceding the study, performance of treatment for dentin hypersensitivity in the three months previous to the study, presence of periapical or pulpal changes, being under orthodontic treatment, smoking

and pregnancy.

### Study design

This clinical, controlled and randomized study was conducted in a split-mouth manner. The clinical evaluation of periodontal parameters was performed by a properly calibrated professional (PD-0,83/CAL-0,87) (AJ). Periodontal treatment was performed by another professional (ALTM), guaranteeing the blind nature of the study. Randomization was done by lot with a coin, for choosing the quadrant to receive manual or ultrasonic instrumentation, which were both performed in the same session.

### Clinical Evaluation

The clinical parameters evaluated were: plaque index - PI16, bleeding on probing - BOP (Muhlemann & Son, 1971), gingival index - GI (Ainamo & Bay, 1975), gingival recession - GR, probing depth - PD, and clinical attachment level - CAL. All parameters were measured using a periodontal North Carolina probe type (Hu-Friedy™, Chicago, IL, USA) before periodontal treatment (baseline) and after 1, 2, 3 and 4 weeks.

Dentin hypersensitivity was first determined with a scratch test using a periodontal probe. On testing, the probe was held perpendicular to the root surface and run vertically and horizontally in order to cover the entire vestibular surface. After stimulation, the patient was asked to score their discomfort, according to a visual analogue scale (VAS) of 0 to 10 cm (0 represents the complete absence of pain and 10 an unbearable pain). After 10 minutes, the second test was performed using an air syringe. An air blast was directed onto the root surface for 1 second. The syringe was held perpendicularly at 2 - 3 mm from the root surface. During the test, the tooth was isolated with polyester strips and the examiner's hand covered the neighboring teeth. After this stimulation, the patient was asked to score the discomfort again.

### Treatment

The individuals were instructed regarding causes and consequences of periodontal disease as well as prevention techniques, including the sulcular brushing technique and flossing. The retention factors of plaque (caries cavities, excess supragingival restorations and calculus) were removed during the initial visits. Clinical parameters were initially assessed 30 days after initial therapy.

The quadrants were randomly assigned and a total of 28 teeth were examined and treated. One side was treated with Gracey curettes (Hu-Friedy™ - Chicago, IL, USA) - control group and the other side with ultrasonic instruments (Profi II

Ceramic™, Dabi Atlante - Ribeirão Preto, São Paulo, Brazil) - the test group, using the tip for subgingival instrumentation Perio Sub (Dabi Atlante®). During this research, the volunteers were instructed to use the usual toothpaste and also do not use any mouthwash.

**Data analysis**

Initially, exploratory analysis was performed to verify the homogeneity of variances and to determine whether the experimental errors have a normal distribution (parameters of the analysis of variance). Only PD and CAL fit the parameters of the ANOVA after data transformation (CAL - reverse; PD - square). In these variables, inferential statistical analysis was performed by analysis of variance in a split-plot, and the portion was represented by the “treatment” (two levels: test and control) and the subplot was represented by “time” (two levels: initial and final). The data were analyzed with the SAS

9.1 (SAS Institute, Cary, NC, USA) with significance level set at 5%. The other variables were analyzed using nonparametric tests (Wilcoxon and Friedman). This analysis was conducted in BioEstat, version 5.0, with a significance level of 5%.

**RESULTS**

A total of 14 individuals were enrolled in the trial (13 female and 01 male), aged between 28 and 58 years. No patient was excluded during the study. The sample was also characterized by 5 ethnic mulatto and 9 melanoderma patients. Both periodontal therapies showed the same improvement in the decrease of PD and increase in CAL (Table 1). The test group (14 patients) initially presented 30.9% of sites with PD ≥ 5 mm and at 1 month after treatment this percentage was reduced to 17.4%. In the control group (14 patients), these values were 38.7% and 22.9% before and after treatment, respectively. There were reductions in the PI and GI parameters during the four week follow-up (Table 2).

The patients in this study did not present dentin sensibility before periodontal treatment. After the instrumentation, the occurrence of sensitivity occurred at low levels, and completely disappeared within 4 weeks of evaluation. Hypersensitivity increased statistically only in the control group after stimulation with air during the first week (Table 3).

**TABLE 1. DESCRIPTION OF PD, CAL AND GR (MEAN AND STANDARD DEVIATION OF FULL MOUTH VALUES IN MM) BEFORE AND 4 WEEKS AFTER TREATMENT.**

Variable response	Time	Groups		
		Test	Control	
PD (mm)	Baseline	3.2 (0.6)	3.4 (0.6)	A
	4 Weeks	2.8 (0.4) a	3.0 (0.5) a	B
CAL	Baseline	3.4 (0.7)	3.6 (0.7)	A
	4 Weeks	3.1 (0.6) a	3.2 (0.6) a	B
GR	Baseline	0.2 (0.3)	0.1 (0.2)	B
	4 Weeks	0.3 (0.3) a	0.2 (0.3) a	A

Different letters represent statistical significance (upper compare times and lower compare treatments) ANOVA on split plots (PD and CAL), Wilcoxon and Friedman (GR).

**TABLE 2. DESCRIPTION OF PLAQUE AND GINGIVAL INDICES (FULL MOUTH) AT BASELINE AND 4 WEEKS AFTER PERIODONTAL TREATMENT (MEDIAN).**

Variable response	Time				
	Baseline	W 1	W 2	W 3	W 4
PI	75.1	22.9	11.2	9.8	6.6
	A	AB	BC	C	C
GI	60.8	12.7	5.5	3.25	1.6
	A	AB	BC	C	C

Different letters represent statistical significance; Friedman.

**TABLE 3. DESCRIPTION OF THE STIMULATION TESTS WITH AIR AND SCRATCH ONLY IN THE CHOSEN TEETH FROM TEST AND CONTROL GROUPS (MEDIAN).**

Grupos	Sensitivity test	Time					
		Baseline	W 1	W 2	W 3	W 4	
Test	Probe	0 Ba	0 Ba	0 Ba	0 Aa	0 Aa	A
	Air	0 Aab	2 Aa	1.5 Aab	0.5 Ab	0 Ab	
Control	Probe	0 Ba	0.5 Ba	0 Ba	0 Aa	0 Aa	A
	Air	0 Ab	2.5 Aa	1 Aab	0.5 Ab	0 Ab	

Different letters represent statistical significance, Friedman compares times (lower letters), Wilcoxon compares probe x air and test x control (upper letters).

## DISCUSSION

The instrumentation of root surfaces is essential in the treatment of periodontal disease and this procedure, when effective, promotes periodontal health by removing plaque, calculus and endotoxin. In this clinical trial, no statistically significant differences were observed between manual or ultrasonic instruments, when evaluating the clinical benefits of these therapies. These results confirm those of Checchi & Pelliccioni (1988) and Khosravi *et al.* (2004), in which both techniques were reported as effective in removing bacterial endotoxin and promoting improvements in clinical periodontal parameters.

Recording of plaque index and gingival bleeding is an important parameter for the evaluation of the presence and cause of gingival inflammation. In this study, for both therapies, decreases in plaque index and gingival bleeding were observed in association with improvements in the biofilm control performed by patient and monitored by professionals. Similar results were found in a study developed by Aslund *et al.* (2008), in which they compared the effects of two different methods of non-surgical periodontal therapy (scaling with curettes or ultrasonic equipment) on perception of pain and the impact on patients' quality of life. Both of the therapies resulted in improvements in periodontal status, and periodontal treatment had a positive impact on the self-perception of oral health and quality of life of participants.

Non-surgical periodontal treatments proposed in this study were performed by manual or ultrasonic instruments in a single session, comparing their effect on dentin hypersensitivity. Patients evaluated for dentin hypersensitivity showed no difference between the therapies and, moreover, the hypersensitivity produced was mild. This finding may be attributed to the fact that the therapies were performed in a single session (1 hour), and ensuring a more conservative instrumentation. Data support the concept that bacterial endotoxins loosely adhere to the surface of the root cement and do not penetrate into it, and are therefore easily deployed, avoiding wasted time and unnecessary tooth structure removal (Nyman *et al.*, 1988; Sallum *et al.*, 2005). Thus, this more conservative therapy may have prevented more dentin hypersensitivity with the use of curettes, which are instruments capable of producing greater loss of tooth structure (Ritz *et al.*, 1991; Schimidlin *et al.*, 2001). Instrumentation performed with curettes can remove between 20 and 50 micrometers in cement and, thus, promote the exposure of tubules to external stimuli (Wallace & Bissada, 1990). The results of this study may also be related to the lack of difference between the trauma of instrumentation produced by curettes and

ultrasonic device (Alves *et al.*, 2004).

A previous study evaluated the performance of dentin hypersensitivity following periodontal surgical and non-surgical treatments. A total of 56 selected individuals were subjected to four periodontal therapies in a split-mouth scheme, separated by quadrants (scaling and root planing - SRP, modified Widman flap, gingivectomy and flap with osseous resection). The authors concluded that surgical procedures produce more tooth sensitivity than SRP, and that older patients experience less discomfort than younger patients (Muhlemann & Son, 1971). Tamaro *et al.*, (2000) assessed the development of hypersensitivity after periodontal treatment, performed in quadrants at intervals of one week. The hypersensitivity of root surface was found to increase when the procedure of scaling and root planing is performed, while this sensitivity seems to reduce during the observation period, which is consistent with our findings. The authors also related that a meticulous plaque control represents an important factor in reducing hypersensitivity.

Dentin hypersensitivity due to periodontal treatment presents an initial symptom of acute pain caused by rapid contact of external stimuli applied to exposed dentin tubules. In this study, two stimuli were tested: air and scratching the tooth surface. Increased hypersensitivity was observed after root stimulation with air stimuli. Similarly, Tamaro *et al.* (2000) observed a higher dentin hypersensitivity response to the stimulation with air, compared to the stimulus of the scratch on the tooth; where 150 teeth had a positive response to the stimulus with air and 47 teeth to the stimulation of the scratch.

Thus, according to the systematic review performed by Von Troil *et al.* (2002), the intensity of hypersensitivity is significantly reduced over the 1-4 weeks after periodontal therapy. However, if this does not occur, hypersensitivity therapies have been demonstrated to promote this reduction. Based on this knowledge, Sicilia *et al.* (2009) studied the use of the laser diode associated with potassium nitrate gel in patients in periodontal maintenance therapy and found that this combination, applied on sensitive dentin, was effective in reducing dentin hypersensitivity. This result shows that the sensation of pain can be minimized or completely eliminated, providing greater comfort for patients, after periodontal treatment.

The measurement of pain and discomfort is inherently difficult, as it has both physical and psychological aspects. Subjectively, the true character of the pain experienced is not directly accessible to the examiner (Canakçi & Canakçi, 2007). In addition, the results of this study are limited to patients who report no discomfort for dentin hypersensitivity prior to non-surgical periodontal treatment. For this reason, new

studies must be performed with patients presenting more severe disease, previous hypersensitivity and that use other ultrasonic systems.

## **CONCLUSION**

Despite the limitations of the present study, no differences were observed between manual and ultrasonic instrumentation regarding the occurrence of dentin hypersensitivity after treatment.

## **RESUMO**

A instrumentação periodontal tem como objetivo remover biofilme e cálculo dental da superfície radicular. Tanto instrumentos manuais quanto ultrassônicos já foram consolidados como capazes de promover essa descontaminação. Contudo, o estabelecimento de um periodonto saudável pode resultar em efeitos adversos como a hipersensibilidade dentinária. O objetivo do presente estudo foi avaliar os efeitos da instrumentação manual ou ultrassônica sobre a hipersensibilidade dentinária em pacientes submetidos ao tratamento periodontal não-cirúrgico. Para realização deste estudo clínico controlado de "boca dividida" foram selecionados 14 pacientes com dentes homólogos na região de incisivos a pré-molares com profundidade de sondagem  $\geq 5$  mm, na face vestibular. Um lado (controle) recebeu instrumentação com curetas e o outro (teste) instrumentação ultrassônica. A hipersensibilidade dentinária foi avaliada, antes e durante 4 semanas após o tratamento, com uma sonda periodontal arranhando a superfície radicular e com um jato de ar. A resposta do paciente foi detectada por meio de uma Escala Visual Analógica (EVA) de 10 cm. Não houve diferença estatística entre a efetividade e a ocorrência de hipersensibilidade das terapias propostas. Após as instrumentações a ocorrência da sensibilidade ocorreu em níveis leves, e desapareceu completamente na 4ª semana de avaliação. Na primeira semana houve aumento da hipersensibilidade estatisticamente significativa apenas no grupo controle após estímulo com ar. O estímulo do jato de ar em comparação ao estímulo da ranhura causou maior desconforto na avaliação da hipersensibilidade após o tratamento com curetas ou pontas ultrassônicas na 1ª, 2ª e 3ª semanas. Dentro dessas condições, este estudo demonstrou que não ocorreu diferença da hipersensibilidade dentinária produzida pela instrumentação manual e ultrassônica.

**UNITERMOS:** sensibilidade dentinária, raspagem dentária, terapia por ultrassom

## REFERENCES

- 1- Academia Americana de Periodontia. Glossary of Periodontal Terms, 4 ed. Chicago: Academia Americana de Periodontia 2001:44.
- 2- Ainamo J, Bay I. Problems and proposals for recording gingivitis and plaque. *Int Dent J* 1975; 25(4): 229-35.
- 3- Alves RV, Machion L, Casati MZ, Nociti Jr FH, Sallum AV, Sallum EA. Attachment loss after scaling and root planing with different instruments – a clinical study. *J Clin Periodontol* 2004; 31: 12–15.
- 4- Aslund M, Suvan J, Moles DR, D’Aiuto F, Tonetti MS. Effects of two different methods of non- surgical periodontal therapy on patient Perception of pain and quality of life: a randomized controlled clinical trial. *J Periodontol* 2008;79:1031-1040.
- 5- Badersten A, Nilveus R, Egelberg J. Effect of nonsurgical periodontal therapy. II. Severely advanced periodontitis. *J Clin Periodontol* 1984; 11: 63-76.
- 6- Brännström M. A hydrodynamic mechanism in the transmission of painproducing stimuli through the dentine. In: Anderson DJ. (ed). *Sensory Mechanisms in Dentine* 1963; 73–79. Oxford: Pergamon
- 7- Canakçi CF, Canakçi V. Pain experienced by patients undergoing different periodontal therapies. *JADA* 2007;138(12):1563-73.
- 8- Checchi L, Pelliccioni GA. Hand versus ultrasonic instrumentation in the removal of endotoxins from root surfaces in vitro. *J Periodontol* 1988; 59: 398-402.
- 9- Gantes BG, Nilveus R, Lie T, Leknes KN. The effect of hygiene instruments on dentin surfaces: scanning electron microscopic observations. *J Periodontol* 1992; 63: 151–157.
- 10- Garnick JJ, Dent J. A scanning electron micrographical study of root surfaces and subgingival bacteria after hand and ultrasonic instrumentation. *J Periodontol* 1989; 60(8): 441-7.
- 11- Jacobson L., Blomlöf J, Lindskog S. Root surface texture after different scaling modalities. *Scand J of Dent Res* 1994; 102: 156–160.
- 12- Khosravi M, Bahrami ZS, Atabaki MSJ, Shokrgozar MA, Shokri F. Comparative effectiveness of hand and ultrasonic instrumentations in root surface planing in vitro. *J Clin Periodontol* 2004; 31: 160–165.
- 13- Leon LE, Vogel RI. A comparison of the effectiveness of hand scaling and ultrasonic debridement in furcations as evaluated by differential dark-field microscopy. *J Periodontol* 1987; 58: 86-94.
- 14- Muhlemann HR, Son S. Gingival sulcus bleeding--a leading symptom in initial gingivitis. *Helv Odontol Acta* 1971; 15(2): 107-13.
- 15- Nyman S, Westfelt E, Sahed G, Karring T. Role of “diseased” root cementum in healing following treatment of periodontal disease. A clinical study. *J Clin Periodontol* 1988; 15: 464-468.
- 16- 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.
- 17- Ribeiro EDP, Bittencourt S, Zanatta G, Sallum EA, Nociti Jr FH, Casati MZ. Instrumentação manual x ultra-sônica. *R Periodontia* 2004; 14 (3): 13-17.
- 18- Ritz L, Hefti AF, Rateitschak KH. An in vitro investigation on the loss of root substance in scaling with various instruments. *J Clin Periodontol* 1991; 18: 643–647.
- 19- Sallum AW, Alves RV, Damis LF, Bertolini PF, Nociti FH Jr, Sallum EA. Open flap debridement with or without intentional cementum removal: a 4-month follow-up. *J Clin Periodontol* 2005; 32: 1007-10.
- 20- Schmidlin PR, Beuchat M, Busslinger A, Lehmann B, Lutz F. Tooth substance loss resulting from mechanical, sonic and ultrasonic root instrumentation assessed by liquid scintillation. *J Clin Periodontol* 2001; 28: 1058-66.
- 21- Sicilia A, Cuesta-Frechosos S, Suárez A, Angulo J, Pordomingo A, De Juan P. Immediate efficacy of diode laser application in the treatment of dentine hypersensitivity in periodontal maintenance patients: a randomized clinical trial. *J Clin Periodontol* 2009; 36: 650–660.
- 22- Tammaro S, Wennström JL, Bergenholtz G. Root-dentin sensitivity following nonsurgical periodontal treatment. *J Clin Periodontol* 2000; 27: 690–697.
- 23- Von Troil B, Needleman I, Sanz M: A systematic review of the prevalence of root sensitivity following periodontal therapy. *J Clin Periodontol* 2002; 29: 173–177.
- 24- Wallace JA, Bissada NF. Pulpal and root sensitivity rated to periodontal therapy. *Oral Surg Oral Med Oral Pathol* 1990; 69: 743-7.
- 25- Zappa U, Smith B, Simona C, Graf H, Case D, Kim W. Root substance removal by scaling and root planing. *J Periodontol* 1991: 62: 750–754.

Endereço para correspondência:  
E-mail: altmeira@hotmail.com