Original Article

# Comparative Evaluation Following Non-surgical Periodontal Therapy with Hand and Ultrasonic Instruments in Dentin Hypersensitivity

**Shreya Gajjar*, Rupal Mehta, Surabhi Joshi, Santosh Kumar, Chandani Patel, Sushmita Bhakkand**
Department of Periodontology, Karnavati School of Dentistry, Karnavati University, Gandhinagar, Gujarat, India.

## Abstract

**Aim:** The objectives of the present study are to assess the problem of dentin hypersensitivity after non-surgical periodontal treatment with hand and ultrasonic instrumentation. **Materials and Methods:** For this controlled clinical trial of a "split mouth" design, 15 patients are selected with homologous teeth in the incisor to premolar region and probing depth (PD) ≤5 mm on the buccal aspect of the teeth. One side (control) is instrumented with hand instruments and the other side (test) with ultrasonic instruments for complete scaling and root debridement. Dentin hypersensitivity is assessed at baseline, after 2 weeks, and the 4 weeks after treatment, with an explorer scratching the root surface and with an air jet. **Results:** The results showed that both periodontal therapies showed the same improvement in the decrease of PD and increase in clinical attachment level. The test group (15 patients) initially presented mean value 4.06 ± 0.70 and at 1 month after treatment, this mean value was reduced to 3.0 ± 0.75. In the control group (15 patients), these values were 4.06 ± 0.79 and 2.80 ± 0.20 before and after treatment, respectively. There were reductions in the sulcus bleeding index during the 4-week follow-up. Hypersensitivity increased statistically only in the control group after stimulation with air and scratch probe test during the 2nd week. After the instrumentation, the occurrence of sensitivity occurred at low levels, and completely disappeared within 4 weeks of evaluation. **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. Only a one change was observed there was increase in sensitivity only in the control group (hand scaling) after stimulation with air and scratch probe test during the 2nd week.

**Keywords:** Dentine hypersensitivity, Periodontal therapy, Ultrasonic scaling.

## Introduction

Dentin hypersensitivity is defined as short, sharp pain arising from exposed dentin in response to external stimuli, which are typically thermal, evaporative, tactile, osmotic, or chemical, and which cannot be described to any other form of dental defect or disease.[1] Dentinal hypersensitivity (DH) is one of the most commonly encountered clinical problems. It mostly affects patients in their 20s–40s, and the severity can increase due to an increase in periodontal disease, gingival recession, or erosive exposure;[2] it can decrease due to the generation of secondary dentin.[3]

Although the accurate mechanism of dentin hypersensitivity has yet to be identified, it is explained by the hydrodynamic theory suggested by Brannstrom. According to this theory, if the exposed dentin is stimulated, fluid in the dentinal tubule stimulates the baroreceptor; thus causing a neural signal and a painful sensation.[4] Therefore, dentin hypersensitivity can be treated by interrupting neural response for pain stimuli or blocking the exposed dentinal tubules.[3] A typical nervous transmission controller is potassium, with strontium salts, oxalates, calcium phosphate, fluorides, formaldehyde, and glutaraldehyde acting as tubule plug. Glass ionomer, composite resin, and dentin adhesive act as the dentin sealer; other methods include laser and mucogingival plastic surgery.[5] These treatments can be performed both at home and in office.

Radicular sensitivity occurs in approximately half of patients after scaling and root planing therapy. Both manual and

**Access this article online**

**Website:** www.jrad.co.in

**DOI:** https://doi.org/10.53064/jrad.2021.12.4.18

**Address for correspondence:** Shreya Gajjar, Department of Periodontology, Karnavati School of Dentistry, Karnavati University, Gandhinagar, Gujarat, India. Email: skgajjar18@gmail.com

**Received:** Apr, 13, 2021; **Accepted:** May, 23, 2021; **Published:** Jun. 29, 2021



**How to cite this article:** Gajjar S, Mehta R, Joshi S, Kumar S, Patel C, Bhakkand S. Comparative Evaluation Following Non-surgical Periodontal Therapy with Hand and Ultrasonic Instruments in Dentin Hypersensitivity. J Res Adv Dent 2021;12:4:78-82.

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.[6] However, ultrasonic instruments can reduce the instrumentation time and cause a decreased removal of tooth structure.[7,8] Regardless of the type of instrumentation, the occurrence of gingival recession following periodontal treatment is a common finding.[9]

Normally, the intensity of tooth sensitivity increases during the 1st week after non-surgical periodontal treatment and then appears to decrease.[10] 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.[11] This becomes important when it allows the inclusion of strategies to cause less discomfort to patients.

Using desensitizing toothpaste is a convenient, cost-effective, easy-tool, and non-invasive method. To date, various desensitizing toothpastes containing potassium, strontium, stannous fluoride, arginine, or sodium calcium phosphosilicate have been developed worldwide. However, it is well known that all exposed dentine are not sensitive and the term DH has been used over the decades by the clinicians. Some authors have substituted the word "dentine" and added the site, such as cervical or root, resulting in various other terminologies (e.g. cervical sensitivity/hypersensitivity) to describe the same clinical condition.

The purpose of this study will be to compare the dentin hypersensitivity following non-surgical periodontal therapy with hand and ultrasonic instruments and also enables the operator to decide the best non-surgical periodontal therapy for the patients.

## Materials and Methods

A total of 15 individuals were recruited and referred to the Department of Periodontics, Karnavati School of Dentistry, Uvarsad, Gandhinagar, Gujarat. 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. The patient's who required non-surgical periodontal therapy in atleast two quadrant were inluded in the study. These quadrants should present two contralateral and homologous teeth in the incisor to premolar region with probing depth (PD) ≥5 mm and bleeding on probing on the buccal surface and study duration is of 1 month. The patient was recalled after 2 weeks and 4 weeks and dentin hypersensitivity will be evaluated.

### Inclusion criteria

- Patients diagnosed age between 20 and 50 years to with generalized chronic periodontitis, requiring non-surgical periodontal treatment in at least two quadrants
- The quadrants were present on two contralateral and homologous teeth in the incisor to premolar region with PD ≤5 mm and bleeding on probing on the buccal surface
- Patients who have not undergone any periodontal therapy in the past 6 months.

### Exclusion criteria

- Smokers, pregnant women and lactating mothers, and diabetic patients were excluded from the study
- Performance of any treatment for dentin hypersensitivity in the past 3 months previous to the study
- Participants with hypersensitive teeth with a mobility >1 or with teeth with extensive or defective restorations (including prosthetic crowns), teeth suspected of having pulpitis, or teeth with caries or cracked enamel or used as abutments for removable partial dentures.

### Study design

It was a prospective split mouth study in which 15 patients will be selected, who were diagnosed with chronic generalized periodontitis and meet the inclusion and exclusion criteria of the study protocol. The subjects will be selected randomly with no discrimination of sex, caste and religion, or socioeconomic status. After obtaining the informed consent, study procedures was performed. Sites were decided by toss of coin method.

#### *Control group*

Scaling and root planing with hand instruments.

#### *Test group*

Scaling and root planing with ultrasonic scaler. The clinical parameters evaluated are sulcus bleeding index (Muhlemann and Son, 1971), probing pocket depth, and relative clinical attachment level (CDL). All parameters were measured using a periodontal North Carolina probe type (Hu-Friedy™, Chicago, IL, USA) before periodontal treatment (baseline) and after 2 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 to cover the entire vestibular surface.

After 10 min, the second test was performed using an air syringe. An air blast was directed onto the root surface for 1 s. 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. The patient was recalled after 2 weeks and 4 weeks and dentin hypersensitivity will be evaluated. One side (control) is instrumented with hand instruments and the other side (test) with ultrasonic instruments for complete scaling and root debridement. Dentin hypersensitivity is assessed at baseline, after 2 weeks, and the 4 weeks after treatment, with an explorer scratching the root surface and with an air jet.

### Statistical analysis

For determination of overall inference, Student's *t*-test and one-way ANOVA were applied for analyzing intragroup comparison and intergroup comparison.

### Patient follow-up

The patient is recalled after 2 weeks and 4 weeks and dentin hypersensitivity will be evaluated.

## Results

In this study, 15 patients were selected aged between 20 and 50 years and two contralateral and homologous teeth in the incisor to premolar region were randomly divided into control group (scaling and root planing with hand instruments) and test group (scaling and root planing with ultrasonic scaler). No patient was excluded during the study.

The clinical parameters were recorded at baseline, 2 weeks, and 4 weeks after the treatment. Both periodontal therapies showed the same improvement in the decrease of PD and increase in CAL (Tables 1 and 2) (Graph 1 and 2). The test group (15 patients) initially presented mean value 4.06 ± 0.70 and at 1 month after treatment, this mean value was reduced to 3.0 ± 0.75. In the control group (15 patients), these values were 4.06 ± 0.79 and 2.80 ± 0.20 before and after treatment, respectively. There were reductions in the sulcus bleeding index during the 4-week follow-up (Table 3) (Graph 3). 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 and probe during the 2nd week (Table 4 and 5) (Graph 4 and 5).

## Discussion

The instrumentation of root surfaces is essential part of the treatment of periodontal disease and further procedures, when effective, promotes periodontal health by removing plaque, calculus, and endotoxin. It is considered as primary phase of any periodontal treatment. 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 and Pelliccioni (1988)[12] and Khosravi *et al*. (2004),[13] in which both techniques were reported as effective in removing bacterial endotoxin and promoting improvements in clinical periodontal parameters.

Recording of sulcus bleeding index is an important parameter for the evaluation of the presence and cause of gingival inflammation. In this study, for both therapies, decreases in sulcus bleeding score were observed.

Both of the therapies showed 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

**Table 1: Comparison of pocket PD at baseline, at 2 weeks, and at 4 weeks in test and control groups**

| Variable | Time | Groups | | *P*-value |
|---|---|---|---|---|
| | | Control | Test | |
| Pockets PD | Baseline | 4.06±0.79 | 4.06±0.70 | 1.0 |
| | 2 weeks | 3.13±0.74 | 3.80±0.94 | 0.04* |
| | 4 weeks | 2.80±0.20 | 3.0±0.75 | 0.48 |
| *P*-value | | 0.001* | 0.002* | |

(*): Indicates statistically significance at $P \leq 0.5$, PD: Probing depth, test applied Student's *t*-test and one-way ANOVA

**Table 2: Comparison of CAL at baseline, at 2 weeks, and at 4 weeks in test and control groups**

| Variable | Time | Groups | | *P*-value |
|---|---|---|---|---|
| | | Control | Test | |
| CAL | Baseline | 2.53±0.51 | 2.73±0.59 | 0.33 |
| | 2 weeks | 2.33±0.61 | 2.73±0.59 | 0.08 |
| | 4 weeks | 1.53±0.51 | 1.80±0.67 | 0.23 |
| *P*-value | | 0.001* | 0.001* | |

(*): Indicates statistically significance at $P \leq 0.5$, test applied Student's *t*-test and one-way ANOVA, CAL: Clinical attachment level

**Table 3: Comparison of sulcus bleeding index at baseline, at 2 weeks, and at 4 weeks in test and control groups**

| Variable | Time | Groups | | *P*-value |
|---|---|---|---|---|
| | | Control | Test | |
| Sulcus bleeding index | Baseline | 2.46±0.74 | 2.40±0.50 | 0.77 |
| | 2 weeks | 1.60±0.63 | 1.80±0.56 | 0.36 |
| | 4 weeks | 1.26±0.45 | 1.40±0.50 | 0.45 |
| *P*-value | | 0.001* | 0.001* | |

(*): Indicates statistically significance at $P \leq 0.5$, test applied Student's *t*-test and one-way ANOVA

**Table 4: Comparison of sensitivity test (Air) at baseline, at 2 weeks, and at 4 weeks in test and control groups**

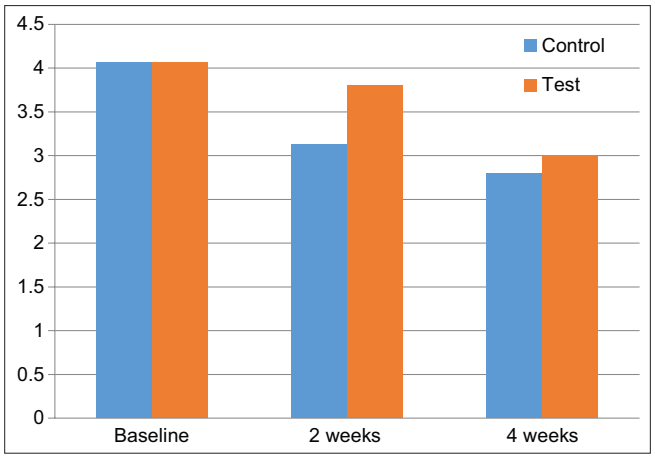
| Variable | Time | Groups | | *P*-value |
|---|---|---|---|---|
| | | Control | Test | |
| Sensitivity test (Air) | Baseline | 0.20±0.41 | 0.20±0.41 | 1.0 |
| | 2 weeks | 1.13±0.63 | 0.46±0.63 | 0.008* |
| | 4 weeks | 0.13±0.35 | 0.06±0.25 | 0.55 |
| *P*-value | | 0.001* | 0.06 | |

(*): Indicates statistically significance at $P \leq 0.5$, test applied Student's *t*-test and one-way ANOVA

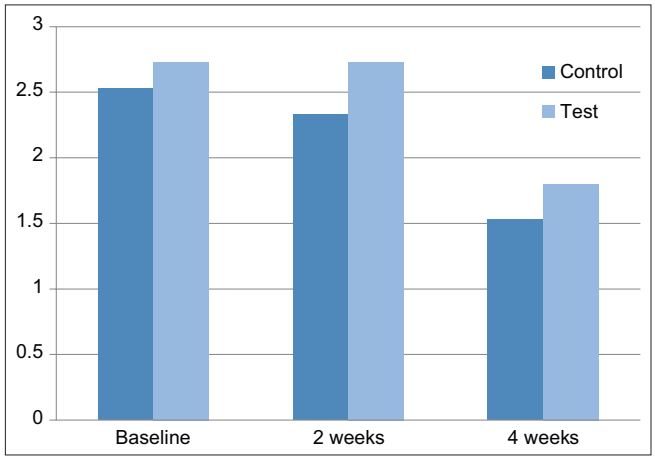
**Table 5: Comparison of sensitivity test (probe) at baseline, at 2 weeks, and at 4 weeks in test and control groups**

| Variable | Time | Groups | | *P*-value |
|---|---|---|---|---|
| | | Control | Test | |
| Sensitivity test (probe) | Baseline | 0.46±0.51 | 0 | 0.02* |
| | 2 weeks | 0.93±0.70 | 0.26±0.45 | 0.005* |
| | 4 weeks | 0.20±0.41 | 0 | 0.07 |
| *P*-value | | 0.03* | 0.01* | |

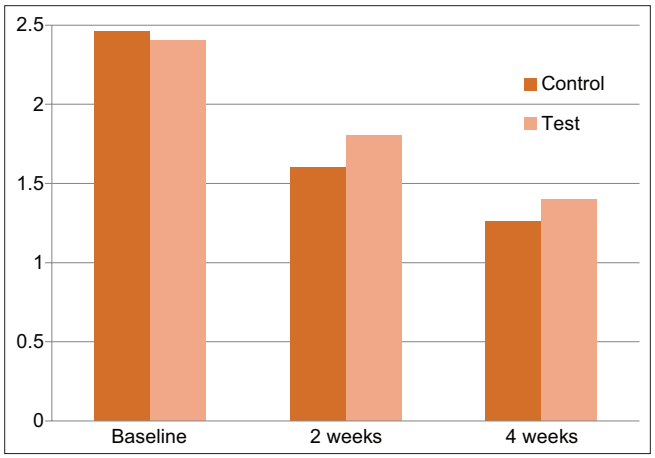
(*): Indicates statistically significance at $P \leq 0.5$, test applied Student's *t*-test and one-way ANOVA



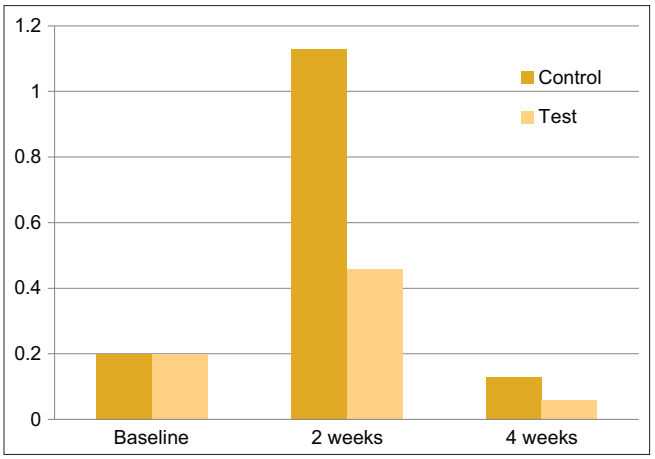

**Graph 1:** Comparison of pocket probing depth at baseline, at 2 weeks, and at 4 weeks in test and control groups



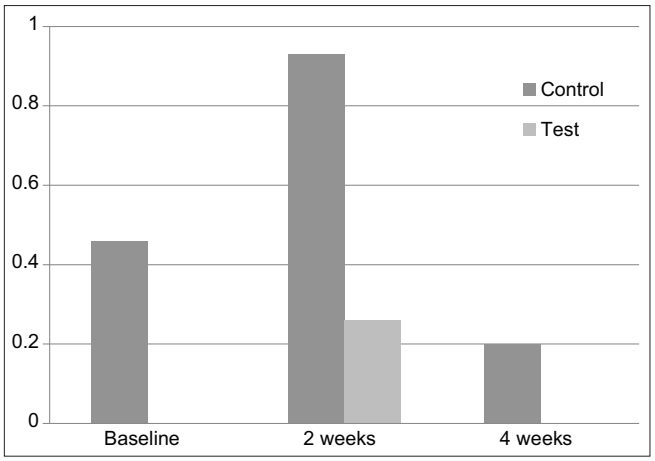

**Graph 2:** Comparison of clinical attachment level at baseline, at 2 weeks, and at 4 weeks in test and control groups




**Graph 3:** Comparison of sulcus bleeding index at baseline, at 2 weeks, and at 4 weeks in test and control groups




**Graph 4:** Comparison of sensitivity test (air) at baseline, at 2 weeks, and at 4 weeks in test and control groups




**Graph 5:** Comparison of sensitivity test (probe) at baseline, at 2 weeks, and at 4 weeks in test and control groups

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 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. Hand-scaling with hand instruments were more conservative therapy that prevented dentin hypersensitivity with the use of curettes, which are instruments capable of producing greater loss of tooth structure.[14]

Instrumentation performed with curettes can remove between 20 and 50 mm in cement and, thus, promote the exposure of tubules to external stimuli.[15] Tammaro *et al*.[16] assessed the development of hypersensitivity after periodontal treatment, performed in quadrants at intervals of 1 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 and scratch test. Similarly, Tammaro *et al*. (2000)[16] 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*.,[10] 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*.[17] 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. 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. In addition, the results of this study are limited to patients who report no discomfort for dentin hypersensitivity before 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. Only a one change was observed that there was increase in sensitivity only in the control group (hand scaling) after stimulation with air and scratch probe test during the 2nd week.

## References


1. Holland GR, Narhi MN, Addy M, Gangarosa L, Orchardson R. Guidelines for the design and conduct of clinical trials on dentine hypersensitivity*. J Clin Periodontol 1997;24:808-13.
2. Gillam DG, Seo HS, Bulman JS, Newman HN. Perceptions of dentine hypersensitivity in a general practice population. J Oral Rehabil 1999;26:710-4.
3. Cummins D. Dentin hypersensitivity: From diagnosis to a breakthrough therapy for everyday sensitivity relief. J Clin Dent 2009;20:1-9.
4. Brännström M. Dentin sensitivity and aspiration of odontoblasts. J Am Dent Assoc 1963;66:366-70.
5. Shiau HJ. Dentin hypersensitivity. J Evid Based Dent Pract 2012;12:220-8.
6. Garnick JJ, Dent J. A scanning electron micrographical study of root surfaces and subgingival bacteria after hand and ultrasonic instrumentation. J Periodontol 1989;60:441-7.
7. 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.
8. Jacobson L, Blomlöf J, Lindskog S. Root surface texture after different scaling modalities. Eur J Oral Sci 1994;102:156-60.
9. Badersten A, Nilveus R, Egelberg J. Effect of nonsurgical periodontal therapy. II. Severely advanced periodontitis. J Clin Periodontol 1984;11:63-76.
10. Von Troil B, Needleman I, Sanz M. A systematic review of the prevalence of root sensitivity following periodontal therapy: Prevalence of root sensitivity following periodontal therapy. J Clin Periodontol 2002;29:173-7.
11. Canakçi CF, Canakçi V. Pain experienced by patients undergoing different periodontal therapies. J Am Dent Assoc 2007;138:1563-73.
12. Checchi L, Pelliccioni GA. Hand versus ultrasonic instrumentation in the removal of endotoxins from root surfaces *in vitro*. J Periodontol 1988;59:398-402.
13. Khosravi M, Bahrami ZS, Atabaki MS, Shokrgozar MA, Shokri F. Comparative effectiveness of hand and ultrasonic instrumentations in root surface planing in vitro. J Clin Periodontol 2004;31:160-5.
14. 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;18:643-7.
15. Wallace JA, Bissada NF. Pulpal and root sensitivity rated to periodontal therapy. Oral Surg Oral Med Oral Pathol 1990;69:743-7.
16. Tammaro S, Wennström JL, Bergenholtz G. Root-dentin sensitivity following non-surgical periodontal treatment: Root dentin sensitivity and periodontal treatment. J Clin Periodontol 2000;27:690-7.
17. Sicilia A, Cuesta-Frechoso 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;36:650-60.