

# Root conditioning in periodontology — Revisited

Tarun Nanda,  
Sanjeev Jain<sup>1</sup>,  
Harjit Kaur<sup>1</sup>,  
Daljit Kapoor<sup>2</sup>,  
Sonia Nanda<sup>3</sup>,  
Rohit Jain<sup>4</sup>

Departments of Periodontology, and <sup>3</sup>Prosthodontics, Post Graduate Institute of Dental Sciences, Rohtak, Haryana, Department of <sup>1</sup>Periodontology and Oral Implantology, Guru Nanak Dev Dental College and Research Institute, Sunam, Punjab, <sup>2</sup>Department of Periodontology, Gian Sagar Dental College and Hospital, Rajpura, Punjab, <sup>4</sup>Department of Periodontology, Desh Bhagat Dental College and Hospital, Muktsar Sahib, Punjab, India

**Address for correspondence:**

Dr. Tarun Nanda, Post Graduate Institute of Dental Sciences, Rohtak - 124 001, Haryana, India.  
E-mail: dr\_tarun\_nanda@yahoo.co.in

## Abstract

**Objective:** Root surfaces of periodontitis-affected teeth are hypermineralized and contaminated with cytotoxic and other biologically active substances. To achieve complete decontamination of the tooth surfaces, various methods including root conditioning following scaling and root planning are present. The main objective of this article is to throw light on the different root conditioning agents used and the goals accomplished by root conditioning in the field of periodontology. **Materials and Methods:** 20 human maxillary anterior teeth indicated for extraction due to chronic periodontitis were collected and root planned. The teeth were sectioned and specimens were divided into two groups — Group I and II. Group I dentin specimens were treated with EDTA and group II specimens were treated with tetracycline HCl solution at concentration of 10% by active burnishing technique for 3 minutes. The root surface samples were then examined by scanning electron microscope (SEM). **Results:** The results of the study showed that EDTA and tetracycline HCl were equally effective in removing the smear layer. It was observed that the total and patent dentinal tubules were more in number in teeth treated with tetracycline as compared to EDTA group. However, EDTA was found to be much more effective as root conditioning agent because it enlarged the diameter of dentinal tubules more than that of tetracycline HCl. **Conclusion:** Results of in-vitro study showed that both the agents are good root conditioning agents if applied in addition to periodontal therapy. However, further studies are required to establish the in-vivo importance of EDTA and tetracycline HCL as root conditioners.

**Key words:** Ethylene diaminetetraacetic acid, root conditioning, scanning electron microscopy, tetracycline hydrochloride

## INTRODUCTION

The primary etiological factor in periodontal disease is bacterial plaque. This results in an inflammatory lesion in the gingival tissues leading to progressive destruction of the supporting periodontal tissues. Periodontitis-affected root surfaces are hypermineralized and contaminated with cytotoxic and other biologically active substances.<sup>[1]</sup>

The main objective of periodontal therapy is the restoration of the lost periodontium and conversion of

the periodontally affected root surfaces into a substrate, which is biologically hospitable for epithelial and connective tissue cell adherence and attachment.<sup>[2]</sup> Methods to achieve this objective include scaling and root planning, as well as treatment of denuded root surfaces with various chemicals and antimicrobial agents.<sup>[3-5]</sup> It is not possible to decontaminate a periodontitis-affected root surface completely by mechanical means alone mainly because the bacterial toxins are not completely eliminated from the root surface and the instrumented surface will inevitably be covered by a smear layer which contains remnants of dental calculus, contaminated cementum and subgingival plaque which acts as a physical barrier between periodontal tissues and root surfaces and thus inhibiting the formation of new attachment.<sup>[1,3,6]</sup>

Various physical (laser) and chemical root conditioning agents (citric acid, phosphoric acid, tetracycline hydrochloride (HCl), doxycycline HCl, fibronectin, ethylenediaminetetraacetic acid (EDTA), minocycline HCl,

Access this article online	
Quick Response Code:	Website: www.jnsbm.org
	DOI: 10.4103/0976-9668.136183

hydrochloric acid, cohn's factor, sodium deoxycholate etc.) have been tried following root instrumentation, to enhance new attachment.<sup>[7-12]</sup> These agents expose dentin collagen and cementum bound proteins and have been found to elute retained toxins from the altered root surfaces.<sup>[7]</sup> Such treatment enlarges dentinal tubules into which healing connective tissue can enter.<sup>[13]</sup> Thus, root conditioning has been recommended as an adjunct to mechanical root surface debridement.

The aim of the present study was to compare the efficacy of EDTA and tetracycline HCl as root conditioning agents on planed root surfaces.

## MATERIALS AND METHODS

For the present study, 20 human maxillary anterior teeth indicated for extraction due to chronic periodontitis were collected from the patients visiting the Department of Periodontology. The agents used were EDTA (10% with pH 4.7) and tetracycline HCl (10% with pH 2.2). A total number of 40 specimens were prepared from extracted maxillary anterior teeth, which were divided into two groups comprising of 20 specimens in each group.

Group I: Dentin specimens treated with EDTA solution for 3 min

Group II: Dentin specimens treated with tetracycline HCl solution for 3 min.

The dentin samples were rubbed with saturated cotton pellets of the test solutions by "Active Burnishing Technique" with the help of tweezers for 3 min, which were changed every 30 s so as to maintain a steady concentration. After acid treatment the area was rinsed for 2 min with distilled water. The samples were viewed under

scanning electron microscope at  $\times 1500$  magnification. The micrographs were taken and were evaluated for:

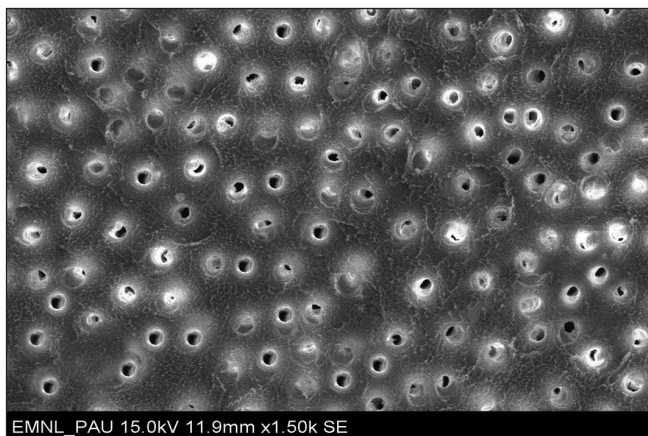
- Efficacy of removal of smear layer.
- Total number of dentinal tubules present per specimen.
- Number of patent dentinal tubules from the total number of tubules present.
- Diameter of randomly selected 10 patent dentinal tubules was measured using a digital vernier caliper with 0.03 mm accuracy.

## RESULTS

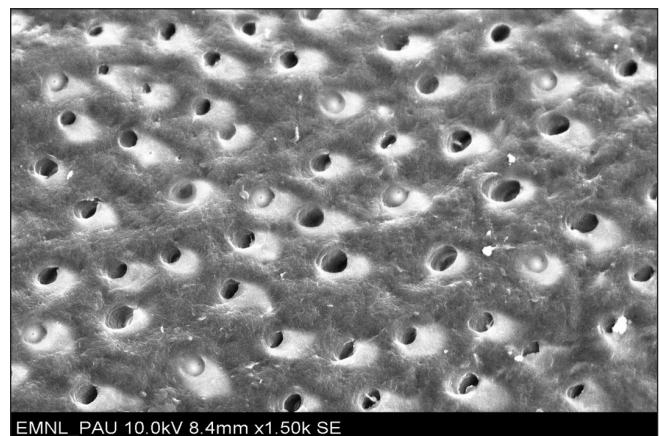
In both the experimental groups, the efficacy in removal of smear layer was near total except for few areas which were covered by debris, the difference between the two groups being statistically insignificant. It was also observed that the total number and number of patent dentinal tubules in the experimental group II were more when compared to the experimental group I, the difference being statistically highly significant ( $P < 0.05$ ) [Figure 1]. In case of the diameter of selected ten patent dentinal tubules, the results of group I was more when compared to the experimental group II and came out to be statistically highly significant ( $P < 0.05$ ) [Figure 2].

## DISCUSSION

Root surface conditioning by topical application of acidic solutions have been demonstrated to remove not only root instrumentation smear layer, but also any remaining root surface contaminants.<sup>[14]</sup> Demineralization of the root surface with root conditioning agents have been associated with uncovering and widening of the dentinal tubules with exposure of dentin collagen, thereby providing a matrix which supports migration and proliferation of cells involved in periodontal wound healing resulting in



**Figure 1:** Morphology of root surface treated with tetracycline hydrochloride at  $\times 1500$  magnification



**Figure 2:** Morphology of root surface treated with ethylene diaminetetraacetic acid at  $\times 1500$  magnification

enhanced connective tissue cell attachment to the root surfaces.<sup>[2]</sup>

In the present study, the concentration of both EDTA and tetracycline HCl was fixed as 100 mg/ml keeping into consideration the observation of various studies. Isik *et al.* in their study used different tetracycline HCl concentrations of 0, 10, 25, 50, 75, 100, 125 and 150 mg/ml for root conditioning and found that concentration between 50 mg/ml and 150 mg/ml showed a statistically significant opening of dentinal tubules.<sup>[15]</sup>

The solution was applied using “Active Burnishing Technique” in the present study. It has been observed by various studies that a burnishing technique resulted in a chemical/mechanical action that enhances the removal of chemically loosened inorganic material and surface debris, exposing the underlying root surface to the demineralization action of fresh acid solution. This may ultimately achieve an optimal degree of demineralization within a short period of time, in comparison to other application modes.<sup>[7,14,16]</sup>

Efficacy in removal of smear layer in both the groups (10% EDTA and 10% tetracycline HCl) was near total and equivalent. Our results were consistent with the findings of Isik *et al.*, Mythili and Ahamed, Lafferty *et al.* who used similar concentrations and found similar results.<sup>[11,13,15]</sup> Treatment with tetracycline HCl resulted in a higher number and potency of dentinal tubules as compared to EDTA. This difference was probably due to lower pH of tetracycline HCl (pH = 2.2) compared to EDTA (pH = 4.7), so higher concentration of EDTA may be required to achieve the comparable results.<sup>[17]</sup>

EDTA was more efficient in opening of dentinal tubules diameter as compared to tetracycline HCl. Although tetracycline HCl has lower pH as compared to EDTA but the results of EDTA came out to be better because etching at lower pH, in addition to dissolving the mineral also dissolves the collagenous matrix and also erodes the surface dentin.<sup>[18,19]</sup> EDTA acting at higher pH (pH 7.75) produced numerous patent dentinal tubules with a diameter of 2-3  $\mu$ .<sup>[20]</sup>

In view of the present findings, further studies are necessary to establish the *in-vivo* importance of EDTA and tetracycline HCl application as root conditioners as an additional step during periodontal therapy, especially in regenerative procedures.

## REFERENCES

- Blomlöf JP, Blomlöf LB, Lindskog SF. Smear removal and collagen exposure after non-surgical root planing followed by etching with an EDTA gel preparation. *J Periodontol* 1996;67:841-5.
- Hanes PJ, O'Brien NJ, Garnick JJ. A morphological comparison of radicular dentin following root planing and treatment with citric acid or tetracycline HCl. *J Clin Periodontol* 1991;18:660-8.
- Jones WA, O'Leary TJ. The effectiveness of *in vivo* root planing in removing bacterial endotoxin from the roots of periodontally involved teeth. *J Periodontol* 1978;49:337-42.
- Terranova VP, Franzetti LC, Hic S, DiFlorio RM, Lyall RM, Wikesjö UM. A biochemical approach to periodontal regeneration: Tetracycline treatment of dentin promotes fibroblast adhesion and growth. *J Periodontol Res* 1986;21:330-7.
- Wirthlin MR, Hancock EB. Chemical treatment of diseased root surfaces *in vitro*. *J Periodontol* 1981;52:694-6.
- Hanes PJ, Polson AM, Frederick GT. Initial wound healing attachments to demineralized dentin. *J Periodontol* 1988;59:176-83.
- Isik G, Ince S, Sağlam F, Onan U. Comparative SEM study on the effect of different demineralization methods with tetracycline HCl on healthy root surfaces. *J Clin Periodontol* 1997;24:589-94.
- Urist MR. Bone histogenesis and morphogenesis in implants of demineralized enamel and dentin. *J Oral Surg* 1971;29:88-102.
- Misra V, Mehrotra KK, Dixit J, Maitra SC. Effect of a carbon dioxide laser on periodontally involved root surfaces. *J Periodontol* 1999;70:1046-52.
- Urist MR, Nogami H. Morphogenetic substratum for differentiation of cartilage in tissue culture. *Nature* 1970;225:1051-2.
- Mythili R, Ahamed BR. Efficacy of tetracycline hydrochloride and doxycycline hydrochloride as a root conditioner – A scanning electron microscopic study. *J Indian Soc Periodontol* 2006;10:227-32.
- Register AA. Bone and cementum induction by dentin, demineralized *in situ*. *J Periodontol* 1973;44:49-54.
- Lafferty TA, Gher ME, Gray JL. Comparative SEM study on the effect of acid etching with tetracycline HCl or citric acid on instrumented periodontally-involved human root surfaces. *J Periodontol* 1993;64:689-93.
- Trombelli L, Scabbia A, Zangari F, Griselli A, Wikesjö UM, Calura G. Effect of tetracycline HCl on periodontally-affected human root surfaces. *J Periodontol* 1995;66:685-91.
- Isik AG, Tarim B, Hafez AA, Yalçın FS, Onan U, Cox CF. A comparative scanning electron microscopic study on the characteristics of demineralized dentin root surface using different tetracycline HCl concentrations and application times. *J Periodontol* 2000;71:219-25.
- Sterrett JD, Murphy HJ. Citric acid burnishing of dentinal root surfaces. A scanning electron microscopy report. *J Clin Periodontol* 1989;16:98-104.
- Madison JG, Hokett SD. The effects of different tetracyclines on the dentin root surface of instrumented, periodontally involved human teeth: A comparative scanning electron microscope study. *J Periodontol* 1997;68:739-45.
- Blomlöf J, Jansson L, Blomlöf L, Lindskog S. Root surface etching at neutral pH promotes periodontal healing. *J Clin Periodontol* 1996;23:50-5.
- Blomlöf L, Jonsson B, Blomlöf J, Lindskog S. A clinical study of root surface conditioning with an EDTA gel. II. Surgical periodontal treatment. *Int J Periodontics Restorative Dent* 2000;20:566-73.
- Lasho DJ, O'Leary TJ, Kafrawy AH. A scanning electron microscope study of the effects of various agents on instrumented periodontally involved root surfaces. *J Periodontol* 1983;54:210-20.

**How to cite this article:** Nanda T, Jain S, Kaur H, Kapoor D, Nanda S, Jain R. Root conditioning in periodontology - Revisited. *J Nat Sc Biol Med* 2014;5:356-8.

**Source of Support:** Nil. **Conflict of Interest:** None declared.