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Comparative Evaluation of the Root Surfaces on Applying Four Different Root Conditioning Agents- An Ex-Vivo Study

Dr. VeenadhariniGundapaneni[1], Dr.Manpreet Kaur[2], Dr. Rahul VC Tiwari[3], Dr.Vinay Vadvadgi[4], Dr. HarjotKaur[5], Dr Priyanshi kankriya[6], Dr. HeenaTiwari[7]

[1]Senior Lecturer, Department of Periodontics, St. Joseph dental college, Duggirala, Eluru. gvdharini@gmail.com;
[2]BDS, Guru Nanak Dev Dental CollegeAndResearchInstitute, Sunam, Punjab.kaurmanpreet281991@gmail.com;
[3]OMFS, FOGS, PhD Scholar, Dept of OMFS, Narsinhbhai Patel Dental College and Hospital, Sankalchand Patel University, Visnagar, Gujarat,384315. drrahulvctiwari@gmail.com;
[4]Reader, Department of Periodontics, Rural Dental College, Pravara Institute of Medical Sciences, LONI, Maharashtra. periodontist29@gmail.com;
[5]B.D.S, Guru Nanak Dev Dental College &Research Institute, Sunam, Punjab, India;
[6]MDS, Senior lecturer, Department of Conservative Dentistry and Endodontics, Pacific Dental College, Udaipur, Rajasthan.priyanshi.kankriya16111992@gmail.com;
[7]BDS, PGDHHM, MPH Student, ParulUniveristy, Limda, Waghodia, Vadodara, Gujrat, India.drheenatiwari@gmail.com

Corresponding Author:
Dr. VeenadhariniGundapaneni, Senior Lecturer, Department of Periodontics, St. Joseph dental college, Duggirala, Eluru. gvdharini@gmail.com

ABSTRACT
Introduction: Different materials and agents have been introduced for removing the smear layer and bacterial endotoxins from the root surface. Hence in the present study we aim to evaluate four different root conditioning agents on the root surfaces.
Material and methods: Eighty freshly extracted human single rooted single canal teeth with periodontal involvement were selected for this study. Following the extraction, the teeth were thoroughly washed and root planing was done using gracey curettes. The teeth were decoronated using carborundum discs. The teeth were divided longitudinally by a water cooled high speed fissure bur. Apical thirds of all teeth were resected and remaining root was vertically sectioned longitudinally through the root canal. All pulpal tissue was thoroughly removed.A total of 80 specimens were prepared and divided into four groups.
Results: On examining the root surfaces it became clear that maximum smear layer was seen on the root surface rinsed with saline and the cleanest surface was the one cleaned with MTAD followed by doxycycline which was then followed by 17% EDTA.
Conclusion: Because of more persistent effectiveness on early root conditioning (chelating effect in less than one minute of applying), MTDA and Doxycycline are preferable root conditioner agents which could be used in regenerative periodontal therapies.
Key words: Root conditioning, root surfaces, citric acid, tetracycline or EDTA.

INTRODUCTION
The aim of periodontal therapy is predictable regeneration of the periodontium in areas previously affected by periodontal disease[1]. Root surfaces are potentially at risk for hypermineralization as well as contamination by different strains of bacteria and their endotoxins [2]. Root surface contamination or infection can potentially change the

consequences of regenerative periodontal therapies and therefore for achieving optimal appropriate outcome the modification and disinfection of the contaminated root surfaces are necessary [3]. The most minimally invasive procedures for removing the bacterial deposits, accretions and endotoxins from the exposed root surface are scaling and root planning that removes the calculus below the gum line and cleans the root surface which allows the healing process to begin [4]. However, the potential limitations of scaling and root planning have been also described. First, by using this treatment, complete decontamination of the root surfaces affected by periodontitis seems to be impossible. In fact, scaling and root planning provides only a temporary solution to the periodontal disease. Moreover, it has been shown that these methods are less effective in deeper pockets in which removing the calculus is more difficult [1].

This is also true for the posterior teeth which are difficult to reach for mechanical root surface debridement. In order to overcome this difficulty, root conditioning could be considered as an adjunct to mechanical debridement [5]. Different materials and agents have been introduced for removing the smear layer and bacterial endotoxins from the root surface; many application times have been tested ranging from 0.5 to 10 min, and most of the studies have found the best results during 3 to 4 min of application [6].

A systematic review related to the subject was published by Mariotti [7] who concluded that the use of citric acid, tetracycline or EDTA to modify the root surface provides no benefit of clinical significance to regeneration in patients with chronic periodontitis. On the other hand, the author also states that since most of the included study designs are not fully developed, a definite conclusion should be taken into account [7]. There is still a remarkable controversy concerning the need to use chemical agents; this justifies the search for parameters that can support the selection for this procedure in periodontal treatments. In addition, knowing the effect of these agents in different time periods could be helpful for selecting the best application time.

MATERIALS AND METHODS

Eighty freshly extracted human single rooted single canal teeth with periodontal involvement were selected for this study. Following the extraction, the teeth were thoroughly washed and root planing was done using gracey curettes. The teeth were decoronated using carborundum discs. The teeth were divided longitudinally by a water cooled high speed fissure bur. The teeth considered were mainly mandibular incisors.Apical thirds of all teeth were resected and remaining root was vertically sectioned longitudinally through the root canal. All pulpal tissue was thoroughly removed.A total of 80 specimens were prepared and divided into four groups.

Group 1: Control Group (saline)
Group 2: MTAD (Mixture of tetracycline, acid and detergent)
Group 3: EDTA (17%)
Group 4: Doxycycline (10%)

The application of the agents was done using cotton pellets which were changed every 30 sec to make sure there was even spread. After coating the root surfaces, they were washed in distilled water to terminate all reactions.

SEM Evaluations:

The specimens were dehydrated using an ascending concentration of ethyl alcohol.Dried specimens were mounted on scanning electron microscope stubs witha gold sputtering unit (SCD050, BalTec Cheshire UK).Mounted Specimens were evaluated using SEM.(JSM8A, JEOL, Tokyo,Japan), by grouping them in four groups each having 20 samples.Following results were computed.

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RESULTS

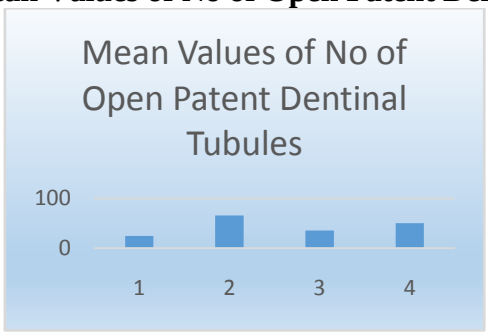
From the above table it is clear that, the maximum number of open tubules were seen in Group II (MTAD) and minimum were seen in Group I(Saline). Group IV was found superior to Group III. Table 1

Table 1: Comparison of the four root conditioning agents.

	Saline	MTAD	EDTA	Doxycycline
Number of Patent Dentinal Tubules	10-40	40-80	20-60	30-70
Mean and SD Deviation	24.5 2.0	65.8 12.0	35.8 8.0	50.5 10.6

On examining the root surfaces it became clear that maximum smear layer was seen on the root surface rinsed with saline and the cleanest surface was the one cleaned with MTAD followed by doxycycline which was then followed by 17% EDTA. Graph 1.

Graphs 1: Mean Values of No of Open Patent Dentinal Tubules



DISCUSSION

To select the best therapeutic conditioning material for contaminated root surfaces, we compared the effectiveness of different materials applied in different time periods. Regarding the linear and consistent trend of the changes in the parameters, the use of MTAD, followed by doxycycline which was then followed by 17% EDTA was preferable.

The proper effectiveness of MTAD has been previously shown. In a study applying MTAD gel for 4 minutes after scaling and root planning removed the root surface smear layer and had the best result in adherence and growth of the PDL cells. In addition to the contact time, it has been shown that the curative effects of MTAD quickly become apparent so that it can remove the smear layer in less than 1 minute [9]. Moreover, MTAD can reduce the micro-hardness of the dentin by 17.33% to 29.48%, and this effect is considerably greater than other active and control solutions [10,11]. Thus, on the basis of our result and in comparison with the previous findings, the application of MTAD, even alone, had the maximum results in root conditioning. In fact, the natural pH along with the capability to remove the root surface smear layer makes the use of MTAD highly beneficial in clinical practice.

According to our results, the use of tetracycline can be the second choice for root conditioning. Different studies have evaluated and compared the efficacy of doxycycline with other materials such as citric acid [12-15] According to the findings of Grover et al., the number of patent tubules present in the citric acid and EDTA test groups was significantly higher than those in the tetracycline hydrochloride test group. However, in their study the average diameter of the patent tubules was greater in the doxycycline hydrochloride group compared with the saline and EDTA groups [4].

Shetty et al. also showed that the proportion of patent dentinal tubules was significantly higher in the tetracycline HCl group (74%) compared to minocycline (48.3%), doxycycline (42%) and citric acid (52%). The number of patent tubules was also higher in the tetracycline group compared to minocycline and doxycycline and the difference was statistically significant [16]. In fact, it can be concluded that with regard to root conditioning, tetracycline can be a good choice regarding its effects on the dentin smear layer removal and tubule exposure. Because of its efficacy against suspected causative microflora, anti-enzymatic properties, as well as antibiotic impacts, the use of this agent is preferred to other antibiotics [17,18].

Our results showed that applying doxycycline increased the tubular diameter in less than one minute and the tubular space after 3 minutes. However, a previous study suggested that the application time should be limited to 2-3 minutes [18-20] since long etching time of 3 minutes and above could impair periodontal healing 19]. Doxycycline is able to enhance fibrin clot adhesion by exposing collagen matrix [20,22] and it enhances fibroblast chemotaxis and binding leading to a more stable initial clot formation. [21-25]

Contrary to our study Chahal et al. [22] reported that removal of smear layer by tetracycline and citric acid is better than doxycycline and the percentage of patent tubules and their diameter were lower in the doxycycline group. This finding could be attributed to the lower pH of tetracycline HCl (pH 1.8) and citric acid (pH 1) as compared to doxycycline (pH 2.2).

CONCLUSION

Because of more persistent effectiveness on early root conditioning (chelating effect in less than one minute of applying), MTDA and Doxycycline are preferable root conditioner agents which could be used in regenerative periodontal therapies.

REFERENCES

1. Lowenguth RA, Blieden TM. Periodontal regeneration: Root surface Demineralization. Periodontol 2000. 1993;1:54–68. [PubMed] [Google Scholar]

2. Blomlof JP, Blomlof LB, Lindskog SF. Smear removal and collagen exposure after non-surgical root planing followed by etching with an EDTA gel preparation. J Periodontol. 1996;67:841–845. [PubMed] [Google Scholar]

3. Hanes PJ, O'Brien NJ, Garnick JJ.A morphological comparison of radicular dentin following root planingand treatment with citric acid or tetracycline HCl. J ClinPeriodontol. 1991;18:660–668. [PubMed] [Google Scholar]

4. Grover HS, Yadav A, Nanda P. A Comparative Evaluation of the Efficacy of Citric Acid, Ethylene Diamine Tetra Acetic Acid (EDTA) and Tetracycline Hydrochloride as Root Biomodification Agents: An In Vitro SEM Study. J Periodontol Implant Dent. 2011;3:73–78. [Google Scholar]

5. Balos K, Bal B, Eren K. The effects of various agents on root surfaces (a scanning electron microscopy study) NewslIntAcadPeriodontol. 1991;1:13–16. [PubMed] [Google Scholar]

6. Amaral NG, Rezende ML, Hirata F, et al. Comparison among four commonly used demineralizing agents for root conditioning. A scanning electron microscopy. J Appl Oral Sci 2011;19:469–475. [PMC free article] [PubMed] [Google Scholar]

7. Mariotti A. Efficacy of chemical root surface modifiers in the treatment of periodontal disease. A systematic review. Ann Periodontol 2003;8:205–226. [PubMed] [Google Scholar]

8. Gamal AY, Mailhot JM. The effects of EDTA gel conditioning exposure time on periodontitis-affected human root surfaces: surface topography and PDL cell adhesion. J IntAcadPeriodontol. 2003;5:11–22. [PubMed] [Google Scholar]

9. Calt S, Serper A. Time-dependent effects of EDTA on dentin structures. J Endod.2002; 28:17–19. [PubMed] [Google Scholar]

10. Scelza MF, Pierro V, Scelza P, et al. Effect of three different time periods of irrigation with EDTA-T, EDTA and citric acid on smear layer removal. Oral Surg Oral Med Oral Pathol Oral RadiolEndod. 2004;98:499–503. [PubMed] [Google Scholar]
11. Zehnder M, Schicht O, Sener B, et al. Reducing surface tension in endodontic chelator solutions has no effect on their ability to remove calcium from instrumented root canals. J Endod. 2005;31:590–592. [PubMed] [Google Scholar]
12. Madison JG, Hokett SD. The effect of different tetracyclines on the dentin root surface of instrumented, periodontally involved human teeth: A Comparative Scanning Electron Microscope study. J Periodontol. 1997;68:739–745. [PubMed] [Google Scholar]
13. 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;64:689–693. [PubMed] [Google Scholar]
14. Labhan R, Fahrenbach WH, Clark SM, et al. Root dentin morphology after different modes of citric acid and tetracycline hydrochloride conditioning. J Periodontol. 1992;63:303–309. [PubMed] [Google Scholar]
15. Parashis AO, Mitsis FJ. Clinical evaluation of the effect of tetracycline root preparation on guided tissue regeneration in the treatment of class II furcation defects. J Periodontol. 1993;64:133–136. [PubMed] [Google Scholar]
16. Shetty B, Dinesh A, Seshan H. Comparative effects of tetracyclines and citric acid on dentin root surface of periodontally involved human teeth: A scanning electron microscope study. J Indian SocPeriodontol. 2008;12:8–15. [PMC free article] [PubMed] [Google Scholar]
17. Kao RT, Takei HH, Cochran DL, et al. Periodontal Regeneration and Reconstructive Surgery and Host Modulation In: Carranza FA, Newman MG, Glickman I. Clinical periodontology, 12th Edition. 2015.611,48 :611,48. [Google Scholar]
18. Penmatsa T, Varma S, Mythili , et al. Effect of various concentrations of tetracycline hydrochloride demineralization on root dentin surface: A scanning electron microscopic study. J Pharm Bioallied Sci. 2003;5:48–53. [PMC free article] [PubMed] [Google Scholar]
19. Blomlof J, Jansson L, Blomlof L, et al. Long time etching at low pH jeopardizes periodontal healing. J ClinPeriodontol. 1995;22:459–463. [PubMed] [Google Scholar]
20. Preeja C, Janam P, Nayar BR. Fibrin clot adhesion to root surface treated with tetracycline hydrochloride and ethylenediaminetetraacetic acid: A scanning electron microscopic study. Dent Res J. 2013;10:382–388. [PMC free article] [PubMed] [Google Scholar]
21. Terranova VP, Franzetti LC, Hic S, et al. A biochemical approach to periodontal regeneration: Tetracycline treatment of dentin promotes fibroblast adhesion and growth. J Periodontal Res. 1986;21:330–337. [PubMed] [Google Scholar]
22. Chahal GS, Chhina K, Chhabra V, et al. Effect of citric acid, tetracycline, and doxycycline on instrumented periodontally involved root surfaces: A SEM study. J Indian SocPeriodontol. 2014;18:32–37. [PMC free article] [PubMed] [Google Scholar]
23. Wen CR, Caffesse RG, Morrison EC, et al. In vitro effects of citric acid application techniques on dentin surfaces.J Periodontol. 1992;63:883–889. [PubMed] [Google Scholar]
24. Cavassim R, Leite FR, Zandim DL, et al. Influence of concentration, time and method of application of citric acid and sodium citrate in root conditioning. J Appl Oral Sci. 2012;20:376–383. [PMC free article] [PubMed] [Google Scholar]
25. Bhushan K, Chauhan G, Prakash S. Root Biomodification in Periodontics - The Changing Concepts. J Dent Oral Care Med. 2016;2:105–113. [Google Scholar]