International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: SJIF: 5.995
Available Online at www.journalijcar.org
Volume 7; Issue 2(F); February 2018; Page No. 10007-10009
DOI: http://dx.doi.org/10.24327/ijcar.2018.10009.1675

Research Article

COMPARATIVE EVALUATION OF SMEAR LAYER REMOVAL EFFICACY USING SMEAR CLEAR, GLYDE FILE PREP, CITRIC ACID AND EDTA - A SCANNING ELECTRON MICROSCOPY STUDY

Siva Prakash Reddy[1*]., Chukka Rakesh Reddy[2]., Narender Reddy Marukala[3]., Malati Devi B[4]., Mohammed Wasim Bari. L[5] and Sai Dudekula[6]

[1]Department of Conservative Dentistry and Endodontics, AMES Dental College and Hospital, Raichur
[2,3]Department of Conservative Dentistry and Endodontics, SVS Institute of Dental Sciences, Mahabubnagar
[4]Department of Pedodontics and Preventive Dentistry, Sri Balaji Bental College, Telangana
[5]Department of Conservative Dentistry and Endodontics, CKST dental college, Tirupati
[6]Department of Conservative Dentistry and Endodontics, Navodaya dental college, Raichur

A R T I C L E I N F O

Article History:
Received 14th November, 2017
Received in revised form 6th December, 2017
Accepted 18th January, 2018
Published online 28th February, 2018

Key words:
20% Citric acid; 17% EDTA; Glyde File Prep; Irrigation; Smear Clear; Smear layer.

A B S T R A C T

Objective: The objective of this study was to compare the efficacy of four decalcifying agents: Smear clear TM (Sybron Endo), Glyde FILE PREP (Dentsply maillefer), freshly prepared 20% Citric acid and freshly prepared 17%EDTA on smear layer removal using Scanning Electron Microscope.

Materials and Methods: Sixty extracted, non carious single rooted human premolar teeth were collected. Root canals were prepared up to Protaper F3 size. The samples were randomly divided into 4 experimental groups of 15 teeth each. Group 1- 1ml of freshly prepared 17% EDTA rinsed for 1 minute alternatively with 2ml of 3% Sodium hypochlorite between each instrument. Group 2- 1ml smear clear rinsed for 1 minute alternatively with 2ml of 3% Sodium hypochlorite between each instrument. Group 3- 1ml Glyde File Prep and 2ml of 3% Sodium hypochlorite are alternatively used between each instrument. Group 4- 1ml 20% Citric acid rinsed for 1 minute alternatively with 2ml of 3% Sodium hypochlorite between each instrument. The smear layer removal of all groups at the apical, middle, and coronal thirds was observed under the thermal field emission scanning electron microscope.

Results: The effect of smear layer removal by Smear clear was better than that of citric acid and freshly prepared 17% EDTA and Glyde File Prep in coronal and middle third. At the apical third freshly prepared 17% EDTA effectively removed smear layer than Smear clear, Glyde File Prep and 20% Citric acid.

Conclusion(s): All decalcifying agents could effectively, but not completely, remove the smear layer, especially in the apical third. The decalcifying agents were more effective in the coronal and middle thirds than in the apical third.

INTRODUCTION

Success of endodontic treatment depends on complete elimination of microorganisms from the root canal system and the prevention of re-infection. To achieve this objective, root canals should be thoroughly cleaned & shaped, before root canal obturation using mechanical instrumentation, supplemented with cupious irrigation and intracanal medicaments.[1]

The smear layer is formed on dentinal walls during root canal preparation, which contains both organic and inorganic components.

Corresponding author:* **Siva Prakash Reddy
Department of Conservative Dentistry and Endodontics, AMES Dental College and Hospital, Raichur

The smear layer structure can be divided into 2 zones: the first, which is 1–2 μm thick, is attached to the surface of the root canal wall; and the second, which is forced into the dentinal tubules to a depth of 40 μm, forms smear plugs.[2] The presence of smear plug hinders root canal irrigants and the obturation material entering into dentinal tubules,[3,4,5] which increases the risk of bacterial infection and microleakage.[6,7]

This smear layer consist of both organic and inorganic substance that consist of microbial debris, odontoblastic process and necrotic debris. Smear layer presence increases the microflora and the inorganic toxins. It also decreases the sealing ability and increases the microbial reproduction.[8] NaOCl is routinely used to dissolve an organic substance in the smear layer, whereas decalcifying agents such as ethylene diamine tetra acetic acid (EDTA), SmearClear, Citric acid, and Glyde File Prep can be used to remove inorganic substance.

EDTA is the most commonly used decalcifying agent. SmearClear is composed of water, EDTA salts and surfactants. Citric acid, an organic acid, at concentrations ranging from 1%–50% has been used to remove the inorganic substance of the smear layer.[9,10]

Demineralizing agents such as ethylene diamine tetra acetic acid (EDTA) & its variants are used in liquid or gel form (smear clear, Glyde file prep) and citric acid have been recommended as adjuvants in root canal therapy.[11, 12] These are highly biocompatible and are commonly used in personal care products. In addition to their cleaning ability, chelators may detach biofilms adhering to root canal walls. Thus this study was conducted to evaluate & compare their efficacy at coronal, middle & apical thirds.

MATERIALS AND METHODS

Sixty extracted single-rooted, non carious human premolar teeth were collected. After removing the calculus and periodontal ligament, the teeth were stored in 0.1% thymol solution. The samples were randomly divided into 4 experimental groups of 15 teeth each.

Preparation of the Root Canal

The teeth were decoronated to standardize the root length at 15 mm. ISO #10 K-files (Dentsply Tulsa, Tulsa, OK) were inserted into root canals until the files were just visible at the apical foramina at 4x magnification under a surgical microscope (Meoller-WedelInternational, Wedel, Germany). The working lengths (WLs) were established by deducting 1 mm from this point.

Root canals were prepared with the crown-down technique by using ProTaper nickel-titanium rotary instruments (Dentsply Maillefer, Ballaigues, Switzerland) according to the manufacturer's manual. All samples were prepared to F3 size. Canals were enlarged apically with a ProTaper size 30, 0.09 taper instrument. After each file, 1 mL of chelating agent was used for 1 minute alternatively 2 mL of 3%NaOCl was irrigated for 1 minute. The root canals were rinsed with 5 mL distilled water and then dried with paper points. The amount of fluid used for all the samples was the same.

Finally the root canals were rinsed with their respective irrigants in each sample group &final rinse was done with 5ml of 3% sodium hypochlorite. Sterilized cotton pellets were placed in the root canal orifices and longitudinal grooves were made on the buccal and lingual surface on each root by using a carbide disc at low speed without penetrating the canal. Osteotome was used to split the teeth along the grooves into two halves. The samples were sent for Scanning Electron Microscopy analysis.

In the thermal field emission scanning electron microscope, the samples were observed at the apical third (3 mm from the apex), middle third (7 mm from the apical), and coronal third (11 mm from the apical) by a double-blind test. Examiner scored the smear layer removal according to the following criteria used for scoring the smear layer.

Each field was graded from 0 to 4 as follows

0 = No presence of smear layer and smear plugs; no smear layer on the surface of the root canals. All dentinal tubules were clean and opened.

1 = No smear layer seen but mild smear plugs; no smear layer on the surface of the root canals, small amount of smear plug in some dentinal tubules.

2 = No smear layer but moderate amount of smear plugs; No smear layer on the surface of the root canals. Most of the dentinal tubules had smear plug.

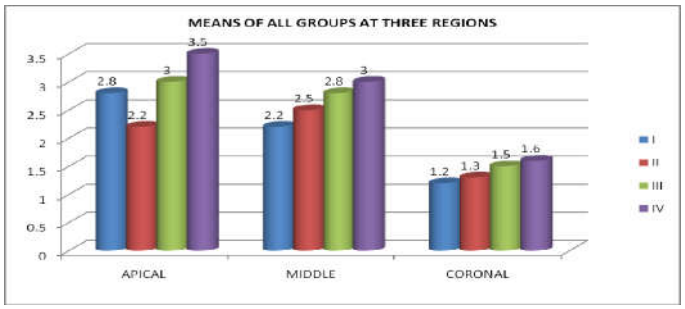
3 = Moderate smear layer seen; moderate amount of smear layer covered the surface of the root canals; only few dentinal tubules were opened.

4 = Heavy smear layer; complete root canal wall covered by a homogenous or heavy non- homogenous smear layer, no opening of the dentinal tubules.

The data collected were analysed using 'T test' and Two way ANOVA test.

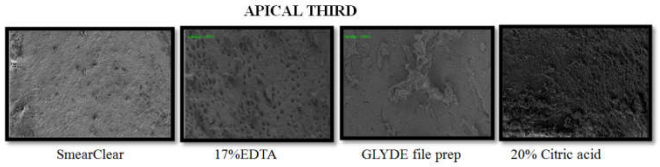
RESULTS

The means of smear layer analysis were calculated in each group at apical, middle and coronal third and two way ANOVA test was performed. The results obtained are discussed in the following table



Comparsion of all groups at three regions with two way ANOVA

Scanning Electron Microscopy Images



DISCUSSION

It is a well-known that the success of endodontic treatment depends on the canal system being thoroughly cleansed and disinfected, before three-dimensional obturation of this space.[13] Crumpton et al reported that the smear layer was efficiently removed by using 1mL of chelating agent for 1 minute, followed by 3 mL of NaOCl as the final irrigant.[10]

However, the application of EDTA for more than 1 minute or in volumes greater than 1 mL led to the erosion of the root canal wall. [12] For this reason, in the present study, 1 mL of 17% EDTA was applied for 1 minute.

In the present study the chelating agents used were freshly prepared 17% EDTA, Smear clear (Sybron Endo, Orange CA), Glyde File Prep, Smear clear and 20% citric acid. It is well known that 17%EDTA is the most commonly used decalcifying agent. EDTA chemically softens the root canal dentin and dissolves the smear layer as well as increases dentin permeability. EDTA reacts with the calcium ions in root dentine and forms soluble calcium chelates.

Smear Clear (Sybron Endo, Orange CA) is an EDTA solution recently introduced to the market that consists of 17% EDTA, cetrimide, a quaternary ammonium bromide and a special surfactant. The introduction of the surfactant seems to reduce the contact angle of the EDTA solution when placed on the dentin surface and enhances cleaning efficacy.

Glyde File Prep is a combination of EDTA and carbamide peroxide specifically formulated to provide cleansing of the root canal preparation and facilitate shaping the root canal. Glyde File Prep allows for cleansing action that facilitates easy removal of vital pulp tissue and necrotic pulp tissue when the gel is used with sodium hypochlorite irrigation solution, effervescence occurs through the release of oxygen from the carbamide peroxide. This action allows for pulp tissue, dentinal shavings and debris to float out.

Glyde File Prep also encourages lightening of the tooth if discoloration exists from non vitality. The use of sodium hypochlorite with the gel promotes internal bleaching of the tooth. This process is enhanced by the release of oxygen from the carbamide peroxide.

Citric acid is a chelating agent that reacts with metals to form non-ionic soluble chelate. Citric acid, a weak organic acid with relatively low cytotoxicity is used as an aqueous acidic solution. Citric acid is also marketed and used in various concentrations, ranging from 1% to 50%. Citric acid is used for 2 to 3 minutes at the end of instrumentation and after NaOCl irrigation.

Di Lenardet al. reported no or a negligible difference in smear layer removal obtained by citric acid and EDTA Wayman et al showed that the use of 10% citric acid and 2.5% NaOCl is a very effective approach for the smear layer removal.9 So citric acid was used as a chelating agent in comparison with EDTA and its modifications.

The results obtained at the coronal third are that all the agents were able to remove the smear layer however the mean values of Smear clear (1.2) was better than the others followed by freshly prepared 17% EDTA (1.3), Glyde File Prep (1.5) and 20% citric acid(1.6).

The results obtained at the middle third are that the mean values of Smear clear (2.2) had better results in removing the smear layer followed by 17% EDTA (2.5), GLYDE File Prep (2.8) and 20% citric acid (3.0) respectively with the values.

The results obtained at the apical third are that the mean values of freshly prepared 17% EDTA (2.2) is more effective in removing the smear layer when compare to other chelating agents followed by Smear clear(2.8), GLYDE File Prep (3.0) and 20% citric acid (3.5) respectively.

Glyde is slightly viscous in nature which is inhibiting it to reach to the complete length of apical 3rd so removal of smear layer is comparatively less when compared to the freshly prepared 17% EDTA liquid.

Addition of surfactant to smear clear solution reduces surface tension. Reducing surface tension of endodontic solution improved their dentin wetting ability of the solution by reducing the contact angle and hence enhanced cleaning efficacy when compared to other solutions in the study in removing the smear layer in coronal and middle third of the root canals.

CONCLUSION

1. The 4 decalcifying agents could effectively, but not completely, remove the smear layer, especially in the apical third.
2. The 4 decalcifying agents were more effective in the coronal and middle thirds than in the apical third.
3. The effect of smear layer removal of Smear clear was better than that of citric acid and freshly prepared 17% EDTA and Glyde File Prep in coronal and middle third.
4. At the apical third freshly prepared 17% EDTA effectively removed smear layer than Smear clear, Glyde File Prep and 20% Citric acid.

Refrences

1. Bystrom A, Sundqvist G. Bacteriologic evaluation of the efficacy of mechanical root canal instrumentation in endodontic therapy. *Scand J Dent Res*. 1981; 89:321-8.
2. Jeen-Nee Lui et al. Effect of EDTA with and without surfactants or ultrasonics on removal of smear layer. *J. Endod.* 2007; 33: 472-5.
3. L.F. Machado-Silveiro, S. González-López and M. P. González-Rodríguez Decalcification of root canal dentine by citric acid, EDTA and sodium citrate. IEJ: 2004; 365-9.
4. D. R. Violich& N. P. Chandler. The smear layer in endodontics – a review. *Int Endod J.* 2010 43, 2-15.
5. Gianluca Plotino, Alessio Giansiracusa, Enrica Pietrangeli, Dina Al Sudani, Nicola Maria Grande, and Valerio Milana.A SEM study of canal cleanliness after a new nickel-titanium rotary instrumentation technique. *Ann Stomatol* (Roma). 2011; 2: 19-22.
6. Abou-Rass M, Piccinino MV. The effectiveness of four clinical methods on the removal of root canal debris. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 1982; 54:323-8.
7. Berutti E, Marini R. A scanning electron microscopic evaluation of the debridement capability of sodium hypochlorite at different temperatures. *J Endod*; 1996; 22:463-6.
8. Panighi MM, Jacquot B. Scanning electron mocroscopic evaluation of ultrasonic debridement comparing sodium hypochlorite and EDTA. *J Endod;* 1995; 21:272-6.
9. Krishnaprasad S, Satish SV, Krishna RK, Mohsin R, Basavanagowda, Snehalatha P. Effect OF EDTA, Etidronic Acid, Phytic acid and Er:YSGG laser on calcium loss of root dentin using Atomic Absorption Spectrophotometer. -An *IN VITRO* Study. *J. appl. dent. med. sci.* 2016. Vol 2. Issue 4.
10. Yang SF, Rivera EM, Walton Re, Baumgardner KR. Canal debridement: effectiveness of sodium hypochlorite and calcium hydroxide as medicaments. *J Endod.* 1996; 22:521-5.
11. Andersen M, Andreasen JO, Andreasen FM. In vitro solubility of human pulp tissue in calcium hydroxide and sodium hypochlorite. *J Endod*. 1992; 8:104-8.
12. Rodig T, Hulsmann M, Kahlmeier C. Comparison of root canal preparation with two rotary NiTi instruments: ProFile .04 and GT Rotary. *Int Endod J*. 2007; 40:553-62.
13. Cheung GS, Liu CS. A retrospective study of endodontic treatment outcome between nickel-titanium rotary and stainless steel hand filing techniques. *J Endod.* 2009; 35:938-43.