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Original Study

Effect of final irrigation protocols on push out bond strength of a root canal sealer to dentin

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ABSTRACT

Aim:

The aim of the study was to evaluate the effect of different final irrigation protocols on the push-out bond strength of an epoxy resin sealer to the tooth dentin.

Materials And Method:

Thirty single-rooted teeth were collected. The canals were shaped using a rotary system. The final diameter was established using a #5 Gates-Glidden drill. For final irrigation 5.25% NaOCl solution was used followed by 17% EDTA. The sample was divided into three groups according to final irrigant using NaOCl, curcumin or grape seed extract. The canals were finally obturated with AH Plus sealer. Push out bond strength was measured under UTM. Data was statistically analysed by ANOVA and Post-hoc Tukey HSD method.

Results:

NaOCl/EDTA/NaOCl group showed significantly superior bond strength values in comparison to other groups as final irrigating regimen.

Conclusion:

The group with 5.25% NaOCl combined with EDTA showed the most efficient solution.

***Keywords:** Irrigation, Push out bond strength, AH plus, Root canal sealer*

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INTRODUCTION

Cleaning and disinfection are very crucial factors that determine the success of endodontic treatment.[1,2] During and after the use of different instrument we use different chemical substance for cleaning and disinfecting the root canal. NaOCl is considered as gold standard for final irrigation because of the ability of dissolving organic tissue and efficient antimicrobial property.[3]

Till date many final irrigation protocols has been introduced. The final irrigation protocol and the irrigant used may affect the bond strength of final restoration and also may affect prognosis of the treatment. Turmeric is a yellow color powder which is derived from the root of Curcuma. The turmeric is yellow in color because of the presence of a pigment named curcumin. Curcumin contains medicinal and anti-inflammatory properties. Curcumin is used as a medicine, spice, and colouring substance in South Asian households.[4] Curcumin is insoluble in water. Curcumin has demonstrated anti-inflammatory properties, bactericidal activity, particularly against Gram-positive species.[5]

Grape seed extract is naturally occurring antioxidant. It contains proanthocyanidin complexes that have free radical scavenging ability. It is a medicinal plant which possess antimicrobial, antioxidant and immune-modulatory properties with minimum toxic/side effects.[6,7]

The ‘smear layer’ forms on intraradicular dentin during root canal preparation and shaping. It is an irregular amorphous layer of inorganic and organic substances.[8]

With advent of the advance irrigating solution there is a need to verify the influence of different irrigating solutions as the ending irrigation protocol on the push out bond strength of the intraradicular dentin. Therefore, a study was purposed aiming to assess the influence of various final irrigation protocols, associated with NaOCl during chemo-mechanical preparation on push-out bond strength of an epoxy resin root canal sealer to dentin.

MATERIALS AND METHODS

Sample preparation

Thirty single-rooted anterior teeth with straight root canal and mature root apex were collected. The teeth were cleaned and stored until use. After Access cavity was preparation. A 15 K-file was used to confirm the patency of the canals and to determine the total working length of the root canals. The standard working length was recognised at 1 mm less than the apical foramen for all the samples. The sample was divided into 3 groups with each group with sample size of 10 were allocated.

The preparation was done by using Hero Shaper rotary instruments (Micromega). During preparation 1 mL of 5.25% NaOCl solution was used as irrigating solution and EDTA as the auxiliary chemical substance. For achieving a standard preparation, #5 Gates-Glidden bur was upto full length until there was no resistance. For smear layer removal, 17% EDTA was applied for 3 min. As final irrigant, Group 1- 1 mL of 3% NaOCl, Group-2 curcumin solution and Group-3 grape seed extract as an adjunct were used. Sealing the canals also allowed an effective reverse flow of the irrigant. The canals were obturated with gutta-percha in down pack motion with AH Plus sealer. The samples were kept on gauze pads at 37°C at 100% relative humidity for a week for final setting of the sealer.

Assessment of push out bond strength

The teeth were horizontally segmented with a slow-speed, water-cooled diamond saw. The teeth were sectioned 1 mm thick for every root third (i.e., coronal, middle, and apical). For standardising the samples, the coronal and the last apical sections were rejected. A total no of four discs from the middle and apical thirds were evaluated.

A standard load was placed on the filling material by means of a plunger of size 1.30 mm in diameter. Loading was executed in a universal testing machine at a crosshead speed of 1 mm/ min positioned upright to the long axis of the teeth until the bond failure occurred. The measured values were noted, and statistical analysis was done.

Statistical analysis

The obtained Data from all the group were analysed using ANOVA and Post-hoc Tukey HSD method ($p < 0.001$)

RESULTS

Group 1- (NaOCl/EDTA/NaOCl) revealed significantly greater bond strength values in comparison to other groups as final irrigating regimen. The group 2 and group 3 where curcumin and grapeseed extract were used respectively as final irrigation solution showed no significant differences.

DISCUSSION

The push out bond strength determines the endurance of dislodgement of the obturated material when applied to the intra radicular dentine. Endodontic literature reports the efficient combination of NaOCl and EDTA as final irrigating solution. In the current study the superior push out bond strength was achieved in the group 1. The Highest bond strength value was shown by group 1 NaOCl with adjunct use of EDTA. The protocol might have made further exposure of the dentinal tubules and probably allowed greater sealer particle penetration into the dentinal tubules.

Lower bond strength values were observed in the group 2 curcumin group. Curcumin does not have the tissue dissolving ability and its absence of proteolytic action, makes the dentinal surface of the root canal more hydrophilic.[9] This makes the unfavourable environment for AH Plus which is hydrophobic in nature. This affects the penetration of sealant and decreased bond strength.[10] The other factor that have interfered in the bond strength is the organic components of smear layer which was not removed.

Group 3- grape seed extract solution showed no significant difference as a final irrigating solution. There was no additional effect on the bond strength values measure.[11] No inert solution was used in between the irrigating solutions. This might have influenced a chemical smear layer with the chances of blocking the dentinal tubules and allow less penetration of sealer into them, thus resulting in lower bond strength values.[12-15] Pane et al. evaluated the various final irrigation protocols with root filling materials on pushout bond strength.[16] The different sizes, specimen orientation, and different root canal diameters were might make a difference in the results. In this study it was found that even slightest of root curvature results imperfect perpendicular load application which was similar to the other studies. Load profiles highly influences the orientation. In various studies, the effects of punch diameter were evaluated and concluded that the diameter was 90%.

In this study, teeth with curved roots were excluded and the root canal standardisation was done by using #5 GG drill to remove the bias. To obtain a similar standard the instrumentation was intended to obtain the same root canal diameter in all root thirds and eliminate its taper. The same punch size for all specimens was used in the present experimental specimen. Samples of coronal thirds were discarded for this reason. The quite large standard deviations observed in result can be associated with other variables related to the dentin pattern and the age of the tooth.[17-18] The obturation was done with down packing technique which might have resulted in the better infiltration of the sealer within the dentinal tubules. Better sealer infiltration into the dentinal tubules decreases the voids in the final restoration and a homogenous mass is achieved which increases the push out bond strength.

CONCLUSION

Within the constraints of the study, it was established that the group with 5.25% NaOCl combined with EDTA proved to be the best solution for the final irrigation

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Conflicts of interest - Nil

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