IF : 4.547 | IC Value 80.26 Volume-6, Issue-3, March - 2017 • ISSN No 2277 - 8160

Original Research Paper Radiology

"A COMPARATIVE ANALYSIS ON ADHESION OF AH PLUS SEALER TO HUMAN ROOT DENTIN, TREATED WITH RC-HELP, 10% CITRIC ACID & 17% EDTA USING ULTRASONIC IRRIGATION"

Ashwini Marukar

Dr K.S.Satishkumar

Dr. Ratnakar P

ABSTRACT

Aim - The aim of this study is to evaluate the adhesion of AH PLUS sealer to human root dentin treated with 17% EDTA,10% citric acid and RC-HELP, using the push-out test.

Materials and Methods - 40 extracted mandibular first premolar teeth were included in the study. The teeth were decoronated using a diamond disc and water spray to obtain standardized 14mm long root segment. Working length was established by inserting K file #15 (Mani) 1 mm short of the apex. The root canals were enlarged using Protaper Ni-Ti instruments (Dentsply, Germany) to size #F2, at the working length. The teeth were divided into four groups according to the final irrigation regimen- Group I : Saline & 3% NaOCl, Group II : Freshly prepared 17% EDTA, Group III : RC-HELP , Group IV: Freshly prepared 10 % citric acid. The canals were dried using corresponding protaper paper points (Dentsply, Malleifer). After mixing the AH plus sealer (Dentsply, Germany), it was applied along the walls of the canals. Gutta-percha protaper master cone # F2 (Dentsply Maillefer) was lightly coated with sealer and inserted to the working length. After setting of the sealer, horizontal sections of 3-mm thickness were cut from 5 mm from the apex of each root. Each root section was then subjected to a compressive load via a universal testing machine and the values were recorded.

Results : Results showed that the control (Group1) presented a lower push–out bond strength value than the experimental groups ($P < 0.05$). 17% EDTA (Group II) as the final irrigant provided the highest mean bond strength followed by RC-HELP (Group III) with and 10%CITRIC ACID(Group IV)

KEYWORDS :

Introduction

Although predictable clinical results have been obtained from the conventional root canal sealer, there has been a continuous research in order to improve the bonding between sealer/root canal wall and sealer/gutta percha.[1] The long-term prognosis of root canal treated teeth is greatly influenced by a well established coronal and apical seal. Many studies have shown to affect the mechanical properties of dentin during and post endodontic root canal therapy. Thus, it would be advantageous if the root canal obturation could reinforce the tooth.[2] Conventional root canal sealers do not behave as a homogenous unit with root dentin.[3] To achieve a classical monobloc concept for sealing and reinforcing the root canal space,it becomes important to analyze the adhesion of newer root canal sealers when treated with different irrigating agents.[2]

A newly introduced resin based AH-PLUS sealer have presented a good performance.[4] Adhesion is one of the very desirable properties of any root canal cement. The core material, adhesive cement and root dentin should form a single cohesive unit in order to achieve a proper seal.[5] Mechanical instrumentation produces smear layer ; an amorphous, relatively smooth layer of microcrystalline debris whose featureless surface cannot be seen with the naked eye.[6] Studies reveal that smear layer harbours bacterias and interefers with the adhesion of root canal sealer to dentin. Therefore, it is advisable to remove this layer by using chelating agents.[7] Chelating agents, used as irrigant ; serves to lubricate the dentinal wall, removes the smear layer and improve the bonding ability of resin-based sealers.[7] Various chemical agents are used as chelating agents. Many factors affect the capability of removing smear layer, such as concentration, gel form/paste form. The use of EDTA solution in Endodontics was proposed by Østby (1957) who recommended its use to assist with the instrumentation of calcified, narrow or blocked canals, because of its ability to foster the chelation of the calcium ions. 10% Citric acid act as a good chelating for removal of smear layer. RC-Prep introduced by Stewart et al. in 1969, contains 15% EDTA, 10% urea peroxide (UP), and glycol. Oxygen is set free by the reaction of RC Prep with NaOCl irrigant so that pulpal remnants and blood coagulates are easily removed.[8]

Literature says that removal of smear layer helps to enhance the adhesion of sealer to root dentin by better penetration of the sealer into the tubules. But,other important factors to be taken into consideration are surface energy of the dentin and hydrophobic/ hydrophilic nature of the sealers.[7]

Ultrasonic irrigation has proved to be an effective mode of removal of bacterias from the root canal. Following are the advantages of passive ultrasonic irrigation-

1. Increased tissue dissolving and dispersion of NaOCl
2. Improved sealing of root canal filling.
3. Could lead to a higher healing rate of endodontic treatment due to more efficient removal of dentine debris and pulp tissue and bacteria from the root canal and better sealing of the root canal filling.[9]

The aim of the study is to evaluate the adhesion of AH-PLUS sealer to root dentin when the teeth are subjected to different irrigating solutions using ultrasonic irrigation by push out bond strength.

Materials and method

40 extracted mandibular first premolar teeth were included in the study. The teeth were thouroghly cleaned for the removal of hard deposits using curettes and stored in 5.25% of NaOCl solution for 30 minutes .then they were rinsed with normal saline. The teeth were decoronated using a diamond disc and water spray to obtain standardized 14mm long root segment. Canal patency and working length were determined by inserting K file #15 upto root apex and then subtracting 1 mm from this measurement. The root canals were then instrumented using 0.06 tapered Ni-Ti protaper files upto F_2 size with intermittent irrigation with 3% sodium hypochlorite using ultrasonic irrigation device. The root canal was rinsed with normal saline. The specimens were randomly assigned to 4 groups of 10 teeth each and root canal dentin was submitted to the following treatments:

Group I : Saline & 3% NaOCl
Group II : Freshly prepared 17% EDTA
Group III : RC-HELP
Group IV: Freshly prepared 10 % citric acid

The specimens received a final flush with 20 mL distilled water and were dried with corresponding sterile absorbent protaper paper

points. AH plus sealer was mixed on a sterile paper pad and coated along the walls of the root canal using finger spreaders. Gutta percha protaper master cone was then lightly coated with the sealer and placed into the canal upto the working length. The roots were placed in 100% humidity for 48 hours ensuring complete setting of the sealer. Horizontal sections of 3 mm were made from apical third of each root canal using a diamond disc and each section was marked with an indelible marker on its apical surface. Exact thickness of 3 mm was ensured using a digital caliper.

Fig 1.Materials used for the study

Push out test-

Each 3 mm section tooth was subjected to a compressive load via universal testing machine wherein the apical surface faced the jig and jig contacting only the filling.0.3 mm cylindrical plunger was used to dislodge the filling by producing compressive forces in apico-coronal direction. These forces were applied until the gutta percha was dislodged.

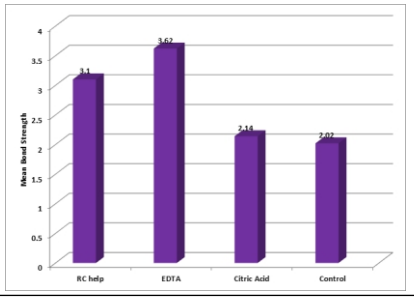
$$\text{Push out bond strength} = \frac{\text{Maximum load (N)}}{\text{Adhesion area of root canal filling (mm}^2\text{)}} \text{ (Mpa)}$$

Fig 2.universal testing machine

RESULTS-

When the push out bond strength of 10 teeth in each group were analyzed, their mean value were statistically significant in relation to the control group ($p<0.05$). Results showed that the control (Group1) presented a lower push–out bond strength value (2.02±0.61MPa) than the experimental groups ($P < 0.05$). 17% EDTA (Group II) as the final irrigant provided the highest mean bond strength values of (3.62±0.72MPa) , followed by RC-HELP (Group III) with values of (3.10±0.85MPa) and 10%CITRIC ACID(Group IV) with a value of (2.14±0.48MPa).

STATISTICAL ANALYSIS-



DISCUSSION-

Adhesion is defined as a process in which two surfaces of different molecular compositions are bonded by chemical, physical or mechanical attraction forces. Adhesion of an endodontic sealer is defined as its capacity to adhere to the root canal walls and promote the union of gutta-percha cones to each other and to the dentin.[4]

One of the desirable properties for an ideal irrigant include the ability to dissolve pulp tissue and inactivate endotoxins.Therefore, sodium hypochlorite is recommended as the main irrigant. [10] But NaOCl has been shown to damage the organic components of dentin – mainly through collagen dissolution – and can hinder the formation of consistent hybrid layer. Furthermore, NaOCl breaks down into sodium chloride and oxygen, which can interfere with resin sealer polymerization, leading to strong inhibition at the resin/dentin interface and decreasing bond strength.[11,12]

During root canal preparation, a smear layer is formed on the walls of the canal which consists of dentin debris, including pulp remnants, bacteria and endotoxins. The smear layer prevents the penetration of the sealer into dentin tubule which increases the potential for microleakage. Hence, it has to be removed. [13]

According to Hülsmann, Heckendorff and Lennon, EDTA has calcium ion chelating capacity.[14] It is able to act on tooth mineral matrix, promoting the removal of smear layer formed during biomechanical preparation, and allows a better penetration of the sealer into the dentinal tubules. Regarding the treatment of dentin surface, in the present study, the use of a chelating agent (EDTA) for treatment of the root canal walls resulted in higher adhesion values of the sealers to dentin.

The values of push out bond strength recorded in this study when EDTA is used as a final irrigant, are in conjunction with the previous study conducted by Hashem et al. In their study they concluded that ,final irrigation with EDTA resulted in higher bond strength values with AH plus sealer.[5 4] Natalia Sabadin et al concluded that the use of 17% EDTA should be indicated after root canal preparation with 2% chlorhexidine gel for smear layer removal, enhancing the AH Plus sealer penetration.[15]

The penetration of the sealer into the dentine tubules of the root canal changes according to the type of sealer, the irrigation systems and solutions. [16] AH plus sealer has greater adhesion to root dentin than Epiphany. This is likely due to the fact that, as an epoxy resin-based sealer, AH Plus has better flow properties because of its viscosity, its penetration into the microirregularities because of its creep capacity and long setting time, increases the mechanical interlocking between sealer and dentinal walls of the root canal. [17]

Accordingly, a comparative evaluation of the adhesion of Epiphany and AH Plus endodontic sealers to human root dentin treated with 1% NaOCl or 1% NaOCl + 17% EDTA using the push-out test have shown that AH Plus sealer presented greater adhesion to dentin than Epiphany, regardless of the treatment of the root canal walls. [18]

In case of hydrophobic sealers,such as AH-PLUS sealer, it is important to have a low wetting ability of the irrigant to promote penetration of the sealer into dentin. This can be justified with the study conducted by Attal et al and Dogen Buzoglut et al,who concluded in their study that the alteration of surface energy gave information on adhesion mechanisms involving hydrophilic and hydrophobic interactions.[19,20]

Use of an agent like EDTA in the present study, that decreases the surface energy could provide a suitable dentin substrate for the adhesion of materials with hydrophobic nature as the resinous AH plus.[7]

Conclusion-

Within the limitations of the study, it can be concluded that pretreatment of root dentin with different irrigating solutions affect

the adhesion of root canal sealer. Among the irrigants tested, EDTA provided highest bond strength to AH plus sealer, followed by RC-HELP and CITRIC ACID. Saline had lowest push-out bond strength values among all the group.

References-

1. Young Kyung Kim'critical review on methacrylate resin based root canal sealer'JOE — Volume -, Number -, - 2009
2. Dr. M Kala, Dr. Shaktidar PR, Dr. Allappanavarkeerti, Dr. Gupthanagendra Vr 'A Comparative Evaluation of Fracture Resistance of Endodontically Treated Teeth Obturated with AH Plus with GuttaPercha, Guttaflow with GuttaPercha and Resilon Epiphany- an Invitro Study'IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861. Volume 13, Issue 3 Ver. II. (Mar. 2014), PP 54-58
3. Tay FR, Pashley DH. Monoblocks in Root Canals: A Hypothetical or a Tangible Goal. Journal of Endodontics, 33(4), 2007, 391398.
4. Vinicius Humberto NUNES 'Adhesion of Epiphany and AH Plus Sealers to Human Root Dentin Treated with Different Solutions' Braz Dent J (2008) 19(1): 46-50
5. Ahmed Abdel Rehman Hashem 'the effect of different irrigating solutions on bond strength of two root canal filling system' JOE — Volume -, Number -, - 2009.
6. Cohen's Pathways of the Pulp. 10th ed. St.Louis: Mosby; 2012. p. 349-88
7. Shivanna V. The effect of different irrigating solutions on the push out bond strength of endodontic sealer to dentin and assessing the fracture modes: An In-vitro study. J Int Clin Dent Res Organ 2014;6:86-91.
8. Singh S. "Evaluation of the effect of EDTA, EDTAC, RC-Prep and BioPure MTAD on the microhardness of root canal dentineAn in vitro study"
9. Dalai DR, Bhaskar DJ, Agali CR, Singh N, Singh H. Modern Concepts of Ultrasonic Root Canal Irrigation. Int J Adv Health Sci 2014; 1(4):1-4.
10. Zehnder M. Root canal irrigants. J Endod 2006;32:389-98.
11. Morris MD, Lee KW, Agee KA, Bouillaguet S, Pashley DH. Effects of sodium hypochlorite and RC-prep on bond strengths of resin cement to endodontic surfaces. J Endod 2001;27:753-7.
12. Ari H, Yaşar E, Belli S. Effects of NaOCl on bond strengths of resin cements to root canal dentin. J Endod 2003;29:248-51
13. H.E. Kandil 'Effect of different irrigant solutions on microhardness and smear layer removal of root canal dentin'Tanta Dental Journal 11 (2014) 1-11.
14. Hülsmann M, Heckendorff M, Lennon A. Chelating agents in root canal treatment: Mode of action and indications for their use. Int Endod J 2003;36:810-30.
15. Natalia Sabadin 'Resin-based sealer penetration into dentinal tubules after the use of 2% chlorhexidine gel and 17% EDTA: in vitro study' Braz J Oral Sci. 13(4):308-313
16. Deivanayagam Kandaswamy, Nagendrababu Venkateshbabu, Ganesh Arathi, Riaz Roohi, Suresh Anand 'Effects of various final irrigants on the shear bond strength of resin-based sealer to dentin'Journal of Conservative Dentistry | Jan-Mar 2011 | Vol 14 | Issue 1
17. J. T. Marais 'Cleaning efficacy of a new root canal irrigation solution: a preliminary evaluation'International Endodontic Journal, 33, 320–325, 2000.
18. Patil AS, Dodwad KP, Patil AA. An in vitro comparison of bond strengths of Gutta-percha/AH Plus, Resilon/Epiphany self-etch and EndoREZ obturation system to intraradicular dentin using a push-out test design. J Conserv Dent 2013;16:238-42
19. Attal JP, Asmussen F, Degrange M. Effects of surface treatment on the free surface energy of dentin. Dent Mater 1994;10:259-64.
20. Dogan Buzoglu H, Calt S,Gumusderelioglu M. Evaluation of the free surface energy on the root canal dentin walls treated with chelating agents and NaOCl. Int Endod J 2007;40:18-24.