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The effect of a new endodontic irrigant solution on push out shear bond strength of a Root Canal Filling System

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ABSTRACT

Aims: The aim of this study was to evaluate the effect of a new endodontic irrigant solution (mixture of coconut and bromelain) on a push out shear bond strength of the root canal filling system.

Materials and Methods: Forty roots were randomly divided into two groups (n = 20) according to the irrigant used. Group I (NaOcl &EDTA) andGroup II (mixture of coconut & bromelain).All roots were prepared with protaper Ni Ti rotary instrument to seize F3. After completion of root canal preparation for both groups, the root canals were obturated using F3 gutta percha and resin sealer. Two-millimeter thick horizontalsections of the coronal third of each rootwere sliced by using a microtome for the push-out bond strength measurement.

Results: Statistical analysis revealed that there was no significant difference in push out bond strength between group I and group II.

Conclusion: The push-out shear bond strength of root canal irrigated with the new irrigant solution(mixture of coconut and bromelain) was comparable to that for root canal irrigated with NaOCl and EDTA.

INTRODUCTION

The Successful endodontic therapy depends on thorough chemomechanical preparation of the root canal system as well as three-dimensional obturation that providescomplete sealing of the spaces previously occupied by the canal contents (1). Mechanical instrumentation usually results in an amorphous irregular smear layer covering thecanal dentinal surfaces and plugging the dentinal tubules.The alternating use ofEDTA and sodium hypochlorite (NaOCl) has long been proved efficient in removing endodontic smear layer (2).

Sodium hypochlorite has been widely accepted as the endodontic irrigant of choice because of its antimicrobial and tissue dissolving properties. However it has unpleasant taste and if applied improperly, may cause edema, ecchymosis, tissue necrosis and parasthesia. Toxicity and potential caustic effect are its other pitfalls (3,4). Also, NaOCl solutions exert no effects on inorganic components of smear layer. (5)
Ethylene diamine tetraacetic acid (EDTA) is also commonly used as an irrigant because of its ability to form complexes with calcium ions and remove the smear layer. (6,7)

Coconut oil is antiviral, antifungal and antibacterial. Coconut oil is a powerful inhibitor of a large variety of pathogenic organisms,largely due to its naturally high lauric acid content. Coconut oil, a natural antibiotic destroys the bacteria that cause tooth decay and it improves calcium and magnesium absorption in the body, which in turn is greatly beneficial to dental and bone health(8). Researchers found that incorporating enzyme-modified coconut oil into dental hygiene products would be an attractive alternative to chemical additives. (9)

Bromelain is a crude extract from the pineapple that contains, among other components, various closely related proteinases. It is a proteolytic enzyme, demonstrating, in vitro and in vivo, antiedematous, antiinflammatory, antithrombotic and fibrinolytic activities. Due to its efficacy after oral administration, its safety and lack of undesired

side effects, bromelain has earned growing acceptance and compliance among patients. Biochemical experiments indicate that these pharmacological properties depend on the proteolytic activity of bromelain (10).
For a successful treatment, a strong bond between obturating material and dentin is needed.Traditionally gutta-percha in combination with resin sealers is used (11). Poor bonding at these interfaces will lead to debonding, microleakage, and eventual failure. (12)

Adhesion of sealers to dentin is a required property for root canal sealers.Differences in the adhesive properties of sealers to dentin may be expected for several reasons, including differences of root dentin between specimens, or even in different sites of the same root(13,14). The presence or absence of smear layer after root preparation has also been related as an important factor to be evaluated.(13)

It was considered the hypotheses that bond strength of all sealers is higher in the absence of smear layer.
Therefore, the aim of this studywas to evaluate the effect of a new endodontic irrigant solution(MCB) (mixture of 20% coconut and 4% bromelain) on a push out shear bond strength of the root canal obturating system (gutta-percha / resin sealer).

MATERIALS AND METHODS

Preparation of the new irrigant solution:

Ten grams of sodium hydroxide were dissolved in 25 ml of de ionized water then added to 55 gm of coconut oil on warming bath(40C) with continuous mixing by glass rod until hardening .The final product was left to dry on filter paper and then crushed manually to powder. Twenty grams of coconut powder were added to 100ml of deionized water with continuous mixing until it dissolve completely, then 4gm of bromelain powder were added to the mixture to obtain the final solution which consist of 20% coconut and 4% bromelain (MCB).

Preparation of the samples:

Forty freshly extracted sound human, single rooted teeth were collected and used in this study. The soft tissue remnants and calculus on external root surfaces were removed mechanically by scaler, then stored in distilled water until needed. Each tooth was decoronated at the level of CEJ using a low speed water-cooled diamond sectioning disc. Root canal patency and working length of each root canal were confirmed and determined by No.10 k-type file, which inserted inside the root canal under stereomicroscope (Motic-Italy) at(x 20 magnification) until the tip of the file was just being visible at the apical foramen and then subtracting 1mm from the measured length of the file. All roots were prepared with protaper NiTi rotary system (Endo-Mate DT,NSK,NAKANISHI,INC,JAPAN) to size F3(rotational speed of 300 rpm and torque 3 N cm).

The roots were divided randomly into two groups (n=20).

Group I: 3 ml of 2.5% NaOCl solution was used for irrigation at the beginning of instrumentation and between each file size, then final irrigation with 5ml of the solution. Then the root canals were further irrigated with 17% EDTA solution which left in the canal for 5 minutes.

Group II: 3ml of the new solution(MCB) was used for irrigation at the beginning of instrumentation and between each file size, then final irrigation with 5ml of the solution.

After completion of root canal preparation & irrigation procedure, all roots in both groups were irrigated with 10 ml distilled water to remove any remnants of the irrigating solution, then the root canals were dried by F3 absorbent paper points.

After completion of root canal preparation for both groups, the root canals were obturated using F3 gutta percha and AH plus root canal sealer (Dentsply, Detrey, GmbH, Germany).

The roots were coded and placed in 100% humidity and incubated at 37C for 3 days to ensure the complete setting of the sealer. Each root was then embedded in acrylic resin in a plastic tube. After setting of the acrylic resin, a horizontal sections of 2-mm thickness (Fig.1) were cut from the coronal third of each root by using a microtome(Struers – Denmark). The section was coded and measured for the apical and coronal diameters of the obturated area using a stereomicroscope.The root section was then subjected to a compressive load via a universal testing machine(SANS-Shenzhen -China)at a crosshead speed of 1 mm/min using a 0.8-mm diameter stainless steel cylindrical plunger.The plunger tip was positioned so that it only contacted the filling material (Fig.2).The push-out force was applied in an apico-coronal direction until bond failure occurred, which was manifested by extrusion of the obturation material (Fig.3) and a sudden drop along the load deflection.

The maximum failure load was recorded in newtons and was used to calculate the push-out bond strength in megapascals(MPa)according to the following formula (15):

Push-out bond strength (MPa)=**Maximum load (N)**
Adhesion area of root canal filling (mm²)

The adhesion (bonding) surface area of each section was calculatedas:**(pr1 + pr2)** X **L.L** was calculated as $\sqrt{(\mathbf{r1 - r2})^2 + \mathbf{h}^2}$, where **p** isthe constant 3.14, **r1** is the smaller radius, **r2** is the larger, and **h** is thethickness of the section in mm.

The data were statistically analyzed using the student T-test.

RESULTS

The mean values of push-out bond strengths recorded forgroups I and II are presented in table I.Group I (NaOcl &EDTA) yielded a mean push-out bond strength of 5.549 MPa.
Group II (MCB) yielded a mean push-out bond strength of 5.512 MPa.
Statistical analysis revealed that there was no significant difference in push out bond strength between group I and group II.(Table I)
Figure(4) showed the push out the shear bond strength curve for one of the tested samples.

DISCUSSION

A Dentin surface treatment with different irrigation regimens maycause alteration in the chemical and structural composition ofhuman dentin, thereby changing its permeability and solubility characteristics(16)and hence affecting the adhesion of obturating materials to dentin surfaces (17). Optimum adhesion requires intimate contactbetween the adhesive material and the substrate to facilitate the molecularattraction and allow either chemical adhesion or penetrationfor micromechanical surface interlocking. (18)

In the present study, When 17% EDTA was used as a final irrigant (group I), the recordedpush-out bond strength values agree with thosereported by Sly et al (19). Final irrigation with EDTA resulted in high bond strength value,this could be attributed to the alteration of the dentin surface energy as a result of the pretreatment with EDTA.
Attal et al (20)reported that EDTA significantly decreased the wetting ability of a dentinal wall (ie, decreasedsurface energy). Therefore, a suitable dentin substrate could beprovided for the adhesion of materials with hydrophobic nature as the resinous AH plus. Furthermore, the effective removal of the smearlayer by EDTA allowed for the extension of the resin into the opendentinal tubules, creating efficient microretention. (14)

Statistical analysis revealed that there was no significant difference in push out bond strength between group I and group II(Table I).This resultindicates that the MCBirrigant solution(group II) produced a push out bond strength comparable to that for group I. This result could be attributed to the ability of this solution toremovethe smear layerand this allows the extension of the resin into the opendentinal tubules, creating efficient microretention.This result agree with that reported byDayem R.N. and Tameesh M.A. (21) who found thatthe application of bromelain enzyme on conditioned dentin significantly decreases the values of the global leakage score and gives the lowest values of global leakage scores. This is due to the ability of the bromelain enzyme to remove the collagen network from acid etched dentin efficiently and this will lead to increase the diffusion potential of the monomer to the dentin and minimizing the nanoleakage.

CONCLUSION

Within the limitations of this study, it could be concluded that;

1)The push-out shear bond strength of root canal irrigated with the new irrigant solution (MCB) (mixture of 20% coconut and 4% bromelain) was comparable to that for root canal irrigated with 2.5% NaOcl and 17% EDTA.

2)Root canal irrigation with single irrigant (MCB) was easier than the use of twoseparated irrigants especially when a comparable results were obtained.

REFERENCES

[1]. Shipper G, Ørstavik D, Teixeria FB, et al. An evaluation of microbial leakage in rootsfilled with a thermoplastic synthetic polymer-based root canal filling material (Resilon). J Endod 2004;30:342–7.
[2]. Hu¨ lsmann 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.

[3]. M. S. Clegg, F. J. Vertucci, C. Walker, M. Belanger, and L. R. Britto, "The effect of exposure to irrigant solutions on apical dentin biofilms in vitro," Journal of Endodontics,2006, vol. 32, no.5, pp. 434–437.
[4]. Moghadas L, Shahmoradi M, Narimani T. Antimicrobial activity of a new nanobased endodontic irrigation solution: In vitro study. Dent Hypotheses, 2012;3:142-6
[5]. M. Torabinejad, A. A. Khademi, J. Babagoli et al., "A new solution for the removal of the smear layer," Journal ofEndodontics,2003, vol. 29, no. 3, pp. 170–175.
[6]. De-Deus G, Soares J, Leal F, luna AS, Fidel S, Fidel RA. Similar glucose leakage pattern on smear-covered, EDTA-treated and BioPure MTAD-treated dentin. J Endod. 2008;34:459–62.
[7]. Hulsmann 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.
[8]. Gopala Krishna A.G., Gaurav Raj, Ajit Singh Bhatnagar, Prasanth Kumar P.K. and Preeti Chandrashekar, "Coconut Oil: Chemistry, Production and Its Applications -A Review,"Indian Coconut Journal,July 2010, pp.15-27.
[9]. W. Bamabé, T. de Mendonça Neto, F. C. Pimenta, L. F. Pegoraro, J. M. Scolaro, "Efficacy of sodium hypochlorite and coconut soap used as disinfecting agents in the reduction of denture stomatitis, *Streptococcus mutans* and *Candida albicans*" Journal of Oral Rehabilitation,May 2004; **31: Issue 5,** pp. 453–459.
[10]. H. R. Maurer, "Bromelain: biochemistry, pharmacology and medical use" CMLS, Cell. Mol. Life Sci.,2001, 58, pp.1234-1245.
[11]. Collins J, Walker MP, Kulild J, Lee C. A comparison of three gutta-percha obturation techniques to replicate canal irregularities. J Endod. 2006;32:762–5.
[12]. Wu MK, De Gee AJ, Wesselink PR, Moorer WR. Fluid transport and bacterial penetration along root canal fillings. Int Endod J. 1994;26:203–8.
[13]. Eldeniz AU, Erdemir A, Belli S. Shear bond strength of three resin based sealers to dentin with and without the smear layer. J Endod. 2005;31:293-6.
[14]. Tagger M, Tagger E, Tjan AH, Bakland LK. Measurement of adhesion of endodontic sealers to dentin. J Endod. 2002;28:351-4.
[15]. Nagas E, Cehreli ZC, Durmaz V, et al. Regional push-out bond strength and coronalmicroleakage of Resilon after different light-curing methods. J Endod 2007;33:1464–8.
[16]. Van Meerbeek B, Lambrecht P, Inokoshi S, et al. Factors affecting adhesion tomineralized tissues. Oper Dent 1992;5:111–24.
[17]. Dogan H, Oalt S. Effects of chelating agents and sodium hypochlorite on mineralcontent of root dentin. J Endod 2001;27:578–80.
[18]. Erickson RL. Surface interactions of dentin adhesive materials. Oper Dent 1992;5:81–94.
[19]. Sly MM, Moore KB, Platt JA, et al. Push-out bond of a new endodontic obturationsystem (Resilon/Epiphany). J Endod 2007;33:160–2.
[20]. Attal JP, Asmussen E, Degrange M. Effects of surface treatment on the free surfaceenergy of dentin. Dent Mater 1994;10:259–64.
[21]. Dayem R.N. ,Tameesh M.A. A New Concept in Hybridization, Bromelain Enzyme for Deproteinizing Dentin before Application of Adhesive System. Smile Dental Journal 2013;8: 18-23.

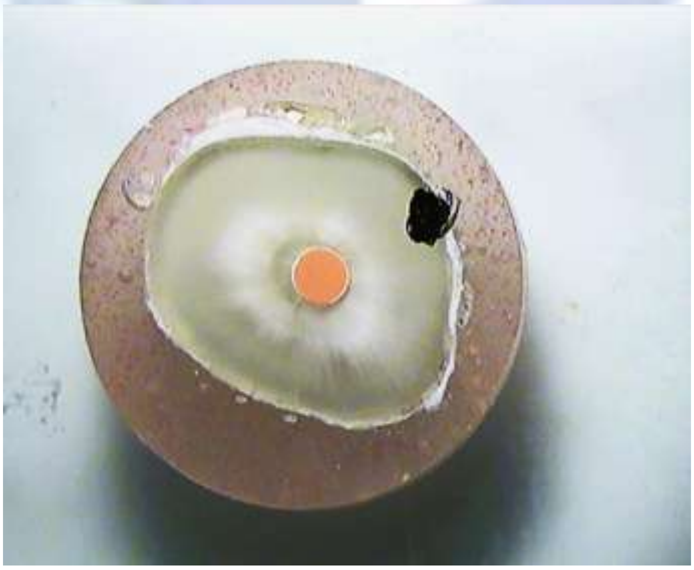

Figure 1: Horizontal section of 2 mm thickness cut from coronal third of root.

Figure 2: The 0.8-mm plunger only contacted the root canal filling material.

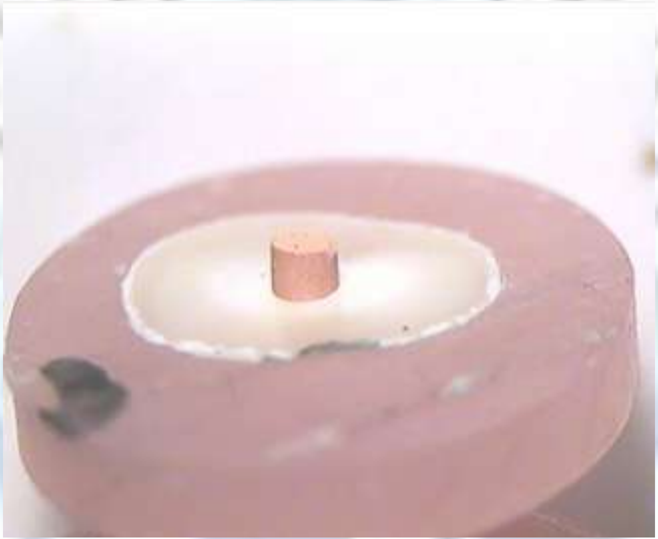

Figure 3: Extrusion of the root canal obturation material by the push-out force.

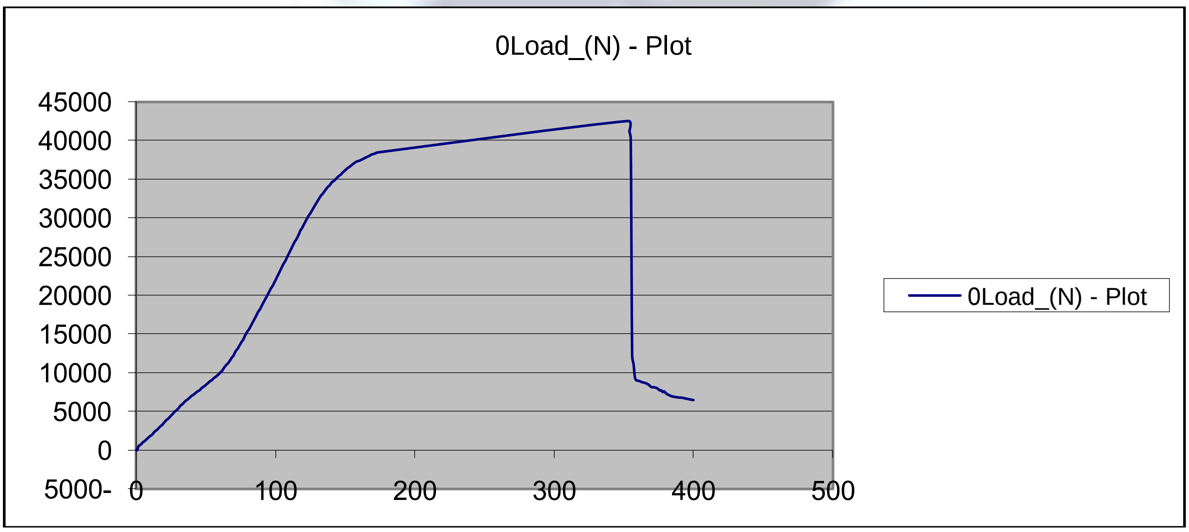

Figure 4: Push-out shear bond strength curve for one of the tested samples

Table1: Statistical analysis of push out bond strength between group I and group II

Group	N	Mean	SD	T-value	df	P-value
Experimental	20	5.512	0.034	-1.70	38	0.097
Control	20	5.549	0.091			