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Effect of Intracanal Medicament on Bond Strength of Three type Root Canal Sealers

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Bond strength
Calcium hydroxide
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Resin-based sealer
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ABSTRACT

Objectives: This study was designed to evaluate the adhesion of different root canal sealers (TotalFill BC, AH Plus and MTA Fillapex) to human root dentin treated with different types of intracanal medicaments (CHX gel & Ca(OH)2 paste), using the push-out test. Materials and methods: One hundred and thirty five extracted single-rooted human teeth were prepared using protaper rotary files instruments up to size #F4. The specimens were divided into three groups according to the medication used (CHX gel, Ca(OH)2 and control). Each group was subdivided into three subgroups according to the sealer used for obturation (TotalFill BC, AH Plus, and MTA Fillapex). The obturated roots were cut perpendicular to the long axis to create 2-mm thickness of slices, from the apical, middle and coronal thirds then subjected to push-out test at a crosshead- speed of 0.5mm/min to record the maximum failure load.. Results: Regardless of the type of intracanal medication used TotalFill BC sealer & MTA Fillapex sealer showed the highest and lowest bond strength respectively. The use or absence of medication did not statically affect dislodgment resistance of root canal filling. Conclusion: Prior application of CHX gel or Ca(OH)2 paste did not significantly affect the adhesion of Total Fill BC, AH Plus and MTA Fillapex Sealers

تأثير الدواء داخل القناة على قوة الترابط لثلاثة أنواع من مانعات تسرب قناة الجذر

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المخلص

الهدف من هذه الدراسة هو تقييم نسبة التصاق معاجين حشو مختلفة لقناة الجذر (TotalFill BC, AH plus, MTA Fillapex) لعاج جذر الاسنان المعالج بانواع مختلفة من الادوية (Ca(OH) paste, CHX gel) وذلك باستخدام اختبار الضغط التدريجي. جمعت لهذه الدراسة مائة وخمسة وتلاتون سنا أدمى بقناة واحدة. تم قطع تيجان الاسنان المحددة للحصول على الجذور بعد ذلك تم تحضير الجذور باستخدام مبارد بروتيبر النيكل تيتانيوم وتوسيعه لحجم نهائى 06/40. للطول المطلوب. تم تقسيم العينات الى ثلاث مجموعات متساوية في كل مجموعة خمسة وأربعين سنا تبعا لنظام الادوية المستخدم: **المجموعة الأولى**: تمثل الأسنان المستخدم فيها دواء (Ca(OH) paste). **المجموعة الثانية**: تمثل الأسنان المستخدم فيها دواء (CHX gel). **المجموعة الثالثة**: تمثل الأسنان بدون استخدام دواء (Control). ثم قسمت المجموعات الاصلية الى تلات مجموعات فرعية في كل مجموعة خمسة عشر سن: **المجموعة الفرعية الأولى**: تمثل الأسنان التى تم حشوها باستخدام معجون الحشو(TotalFill BC) **المجموعة الفرعية الثانية**: تمثل الأسنان التى تم حشوها باستخدام معجون الحشو (AH plus) **المجموعة الفرعية الثالثة**: تمثل الأسنان التى تم حشوها باستخدام معجون الحشو (MTA Fillapex). جميع الأسنان تم حشوها باستخدام تقنية المخروط الواحد. تم وضع الأسنان في قوالب من مادة الأكريل الشفاف بعد ذلك ثم تقطيع كل سن الى ثلالث شرائح بسمك 2 مم من الجزء التاجى والأوسط والمنطقة القمية من السن وتم استخدام هذه الشرائح. لاختبار قوة رابط حشوات الجذور، تم تعريض كل عينة الى تحميل الضغط عن طريق جهاز الاختبار الخاص بحساب قوة رابطة الحشو. **بناء على النتائج التي تم الحصول عليها من هذه الدراسة فانها قد لخصت كما يلى:**

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1. استخدام الادويه المعالجه للجذور (Ca(OH) & CHX gel) لا يؤترعلى قوة الربط بين مواد الحشو (TotalFill BC, AH plus & MTA Fillapex) والعاج.
2. وجد ان أعلى قوة ربط بالعاج مع معجون حشو (TotalFill BC) مقارنة بباقي انواع معجون الحشو واقل قوة ربط وجدت مع (MTA Fillapex).
3. دواء (CHX gel) يحسن نسبيا قوة الربط بين العاج و دواء .(TotalFill BC & AH plus)

1. Introduction

The endodontic treatment based on distinguish and remove the causative factors that lead to apical periodontitis to get good healing (1). The bacteria and their byproducts have major role in the pathogenesis of apical periodontitis (2). Bacteria or their products are major etiological factors for pulpal necrosis and periapical lesions, where elimination of bacteria is most important steps in endodontic therapy. Furthermore, microorganisms are very frequently contribute in failures of treatment (3).

The irrigation is applied to flush out loose debris, lubrication of the dentinal walls, dissolve organic substance in the root canal, and have antimicrobial effect. Cleaning and disinfecting procedures basically dependent on the mechanical and chemical effects of the irrigant solutions. Mechanical effects generated by the flow and backflow of irrigant solution inside root canal space. The microorganisms inside the root canal is reduced primerly by the mechanical effects of irrigation more than the type of irrigant .Where some studies discovered that chemical compounds that have antibacterial effects that give superior effectiveness in bacterial reduction when compared with normal saline (4).

Different type of medicaments are used as intracanal dressings and they divided according to chemical composition to: the phenolic compounds, iodine-potassium iodide, calcium hydroxide, antibiotics, and diverse combinations.

More than 80 years, the calcium hydroxide Ca (OH)2 have important role in dentistry that has been used as a pulp-capping agent. The high pH (approximately 12.5–12.8) of calcium hydroxide inhibit dissolution of mineralized tissues and sport formation of hard tissue. When calcium hydroxide contacts with water release calcium ions throughout ionic dissociation. The calcium ion level is responsible for mineralized tissue formation (5).

Chlorhexidine (CHX) was other type from intra canal medication that developed in the late 1940. However, they have little anti-viral efficacy, and discovered later as antibacterial agents. Chlorhexidine is a powerful base that is stable in the form of salts. The main salts were chlorhexidine acetate and hydrochloride , that is poorly soluble in water. For thus, they have been replaced with chlorhexidinedi gluconate(6).

Recently the use of CHX as an intracanal medicament has been offered in the form of 2% gel that is bactericidal and effect against both gram positive and gram negative bacteria, and particularly effective against facultative an aerobes as E faecalis, strictanaerobes and yeasts and fungi as Candida albicans(7).

The aim of endodontic obturation of root canal is to obtain a 3D seal of the root canal. And not good enough of filling material through obturation will ends up in return and re-growth of organisms within the root canal which the periapical tissue was irritates & the root canal treatment not success(8). Different types of root canal sealers Zinc oxide, calcium hydroxide, glass ionomer, epoxy resin,silicone andmethacrylate considered as different types of endodontic sealers(9).

The important property of filling materials from strength endodontic sealers to dentin is a because it minimizes the danger of filling detachment of dentin during restorative procedures, ensuring that sealing is maintained. Other tests were reported for bond strength assessment. Micro tensile, Shear strength, and even pull-out or push-out tests have described as an effect for direct comparison of the results. Push-out test permit an accurate standardize of the samples(10, 11).

2. Material and Methods

Materials:

Intracanal medicaments:

1) Calcium hydroxide paste. 2) Chlorhexidine gel.

Root canal sealers:

1) AH plus sealer. 2) MTA Fillapex sealer. 3) Totalfill BC sealer

Methods:

1- Teeth selection and preparation:

One hundred and thirty-five single-rooted human teeth with a single straight root canal and completely formed apices taken for orthodontic reason that collected to this study. Teeth with the following criteria will be excluded: multiple canals, previous root canal treatment, root caries, cracks, root canal calcification and resorption. The teeth were thoroughly cleaned and stored in 0.9% saline solution. Before canal instrumentation, the teeth were sectioned to the level of the cemento-enamel junction by employ a diamond disc by a low-speed hand piece. The root lengths is about 14-16mm.

2- Root canals instrumentation:

Canal patency and working length were established for all the canals by placement size 15 K-file inside the canal till seen the apical foramen and then take out 1 mm from this measurement and recorded as the working length. All the canals were prepared by using the ProTaper rotary system up to size F4 (size 40, .06) as the master apical file. After instrumentation apical patency was checked using size 15 k-file. Irrigation all root canals through instrumentation by 5 ml of 2.5% NaOCI sol between each file change by a 27-gauge monoject endodontic needle.

3- Classification of the samples:

The one hundred and thirty-five specimens that were divided into three groups (n = 45) according to the applied intracanal medicament: Group I: Calcium hydroxide paste. Group II:Chlorhexidine gel. Group III: No intracanal medicament (control group).

Every group was further parted to others three subgroups A, B and C (n = 15) according to the type of root canal sealer used for obturation, for all groups' single cone obturation technique was used: Subgroup A: AH plus sealer. Subgroup B: MTA Fillapex sealer. Subgroup C: Totalfill BC sealer.

4- Obturation of the root canals:

All samples dried by using paper points then classified to subgroups (A, B and C) as previously mentioned. The used sealers were prepared according to manufacturing instructions and applied inside the canals by lentulo spiral. A gutta-percha cones size F4 were coated by sealer and inserted inside the full working length of the canals. The excess gutta-percha at the canal orifices was removed with hot instrument. A slight amount of vertical condensation was applied using hand plugger and any excess sealers were removed with cotton pellet. After the completion of obturation of all roots the specimens were radiographed to ensure a good quality of obturation. All obturated specimens were stored at 37ºC in 100% humidity for one week to ensure a complete setting of the sealers.

5- Bond strength evaluation using Push-out test:

Each root was firmed in acrylic resin inside the plastic syringe (length 16 mm, diameter 10 mm) which was used as a mold for acrylic resin. After setting of acrylic resin, three division in horizontal plans (coronal, middle, apical) of 2mm thickness were cut using water cooled precision saw mounting diamond disk 0.6 mm thickness at speed 2500 rpm and feeding rate 10 mm/min under water cooling. The thickness of the slices was confirmed using a digital caliper. A space of 2 mm was left between each slice and the other.

Loading applied by a flat tip plunger of 1mm diameter for the coronal third slices, 0.7mm diameter for the middle third slices and 0.5 mm for the apical third slices. The most failure load was listed in newtons (N) and was applied to calculate the push-out bond strength in megapascals (MPa).

3. Statistical analysis:

1 - F-test (ANOVA)

Quantitative variables that compare between more than two studied groups, Post Hoc test (LSD) for pairwise comparisons.

2– Two-way ANOVA test

Quantitative variables that test effect of two independent variables on specific outcome.

3. Results

Comparison between intracanal medications and different types of root canal sealers without thirds using One Way ANOVA test:

The only statically significant difference of maximum load was found in Total fill BC sealer between Ca (OH) and CHX groups with high mean in CHX groups than Ca (OH) (2.47 versus 1.79, respectively). Other sealer materials showed non statically significant difference groups.

Table (1): Dislodgement resistance values (MPa, mean ± standard deviation) of root canal sealers without thirds using One Way ANOVA test.

Sealer material	Intracanal medication groups			Test of significance
	Ca(OH) group Mean ± SD	CHX group Mean ± SD	Control group Mean ± SD	
AH plus	1.45±1.2	1.94±1.2	1.93±1.5	F=2.05 P=0.13
Total fill BC	1.79±0.8^{A}	2.47±1.3^{A}	2.18±1.5	F=3.2 P=0.04*
MTA fillapex	0.75±1.2	0.62±0.56	1.15±1.4	F=2.7 P=0.07

Similar letters within same row denote significant difference within groups by Post Hoc Tukey. F:One Way ANOVA test. P: probability. ** high statistically significant if P<0.01.

4. Discussion

The success of endodontic treatment depended mainly on cleaning and shaping followed by complete obturation with an impervious, biocompatible and dimensionally stable material.(12)

Gutta-percha has served as a benchmark for evaluating newer materials when used with different sealers. A wide variation of sealers are used with gutta percha. The Sealers can be collected depend on their prime constituents or structure like, calcium hydroxide, zinc oxide eugenol, resin and glass ionomer sealer. Adhesion is very important feature for root canal sealers. the best root canals filling materials must adhere to the dentin of root canal and resist dislocating force. To achieve this, the sealer must bond as much as possible with the dentin of root canal.(13)

Intracanal medication acts as a mechanical barrier via decreasing marginal infiltration, neutralizing tissue debris, providing dryness of the canal and reducing inflammation of periapical tissue and pulp remains.(14) The intracanal medicaments can be influence the bond of the root filling both negatively as well as positively.(15, 16)

This study was aimed to evaluate the effect of Chlorhexidine gel on the bond strength of a TotalFill BC, MTA Fillapex, and AH Plus sealers compared to calcium hydroxide which was selected as the benckmark for comparison being used successfully for decades for root canal disinfection.

The results obtained from this study revealed that the TotalFill BC sealer had the highest push out bond strength value with statistically significant difference when compared to AH plus & MTA Fillapex sealers. This can be explained by the self-adhesive nature by the chemical bond at the sealer-dentin interface through the ability of the sealer to produce hydroxyapatite with dentin upon setting.(17)

In present study AH Plus sealer showed significantly higher bond strength than MTA fillapex sealers with significant difference.(18) And the lowest mean value was found with MTA Fillapex groups compared to AH plus and BC.(19)

5. Conclusion

1. Prior application of CHX gel or $Ca(OH)_2$ paste did not significantly affect the adhesion of Total Fill BC, AH Plus and MTA Fillapex Sealers.
2. Chlorohexidine gel relatively improve retention of TotalFill BC & AH plus sealers.

6. References

[1]- Law A, Messer H. An evidence-based analysis of the antibacterial effectiveness of intracanal medicaments. Journal of endodontics 2004;30:689-694.

[2]- Card SJ, Sigurdsson A, Ørstavik D, Trope M. The effectiveness of increased apical enlargement in reducing intracanal bacteria. Journal of Endodontics 2002;28:779-783.

[3]- Gomes B, Lilley J, Drucker D. Variations in the susceptibilities of components of the endodontic microflora to biomechanical procedures. International Endodontic Journal 1996;29:235-241.

[4]- Siqueira JF, Rôças IN, Favieri A, Lima KC. Chemomechanical reduction of the bacterial population in the root canal after instrumentation and irrigation with 1%, 2.5%, and 5.25% sodium hypochlorite. Journal of Endodontics 2000;26:331-334.

[5]- Misra P, Bains R, Loomba K, *et al.* Measurement of pH and calcium ions release from different calcium hydroxide pastes at different intervals of time: Atomic spectrophotometric analysis. Journal of Oral Biology and Craniofacial Research 2017;7:36-41.

[6]- Zehnder M. Root canal irrigants. Journal of endodontics 2006;32:389-398.

[7]- Gomes BP, Vianna ME, Zaia AA, Almeida JFA, Souza-Filho FJ, Ferraz CC. Chlorhexidine in endodontics. Brazilian dental journal 2013;24:89-102.

[8]- Ahuja L, Jasuja P, Verma KG, *et al.* A Comparative Evaluation of Sealing Ability of New MTA Based Sealers with Conventional Resin Based Sealer: An In-vitro Study. Journal of Clinical and Diagnostic Research: JCDR 2016;10:ZC76.

[9]- Ersahan S, Aydin C. Solubility and apical sealing characteristics of a new calcium silicate-based root canal sealer in comparison to calcium hydroxide-, methacrylate resin-and epoxy resin-based sealers. Acta Odontologica Scandinavica 2013;71:857-862.

[10]- Teixeira CS, Alfredo E, Thomé LHdC, Gariba-Silva R, Silva-Sousa YTC, Sousa-Neto MD. Adhesion of an endodontic sealer to dentin and gutta-percha: shear and push-out bond strength measurements and SEM analysis. Journal of Applied Oral Science 2009;17:129-135.

[11]- Reyhani MF, Ghasemi N, Rahimi S, *et al.* Push-out bond strength of Dorifill, Epiphany and MTA-Fillapex sealers to root canal dentin with and without smear layer. Iranian endodontic journal 2014;9:246-250.

[12]- Patel D, Sherriff M, Ford T, Watson T, Mannocci F. The penetration of RealSeal primer and Tubliseal into root canal dentinal tubules: a confocal microscopic study. International endodontic journal 2007;40:67-71.

[13]- Jainaen A, Palamara J, Messer H. Push-out bond strengths of the dentine–sealer interface with and without a main cone. International Endodontic Journal 2007;40:882-890.

[14]- Chong B, Ford TP. The role of intracanal medication in root canal treatment. International endodontic journal 1992;25:97-106.

[15]- Hegde V, Arora S. Effect of intracanal medicaments on push-out bond strength of Smart-Seal system. Journal of conservative dentistry: JCD 2015;18:414.

[16]- Akcay M, Arslan H, Topcuoglu HS, Tuncay O. Effect of calcium hydroxide and double and triple antibiotic pastes on the bond strength of epoxy resin–based sealer to root canal dentin. Journal of endodontics 2014;40:1663-1667.

[17]- Zhang W, Li Z, Peng B. Assessment of a new root canal sealer's apical sealing ability. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology 2009;107:e79-e82.

[18]- Lee K-W, Williams MC, Camps JJ, Pashley DH. Adhesion of endodontic sealers to dentin and gutta-percha. Journal of Endodontics 2002;28:684-688.

[19]- Madhuri GV, Varri S, Bolla N, Mandava P, Akkala LS, Shaik J. Comparison of bond strength of different endodontic sealers to root dentin: An in vitro push-out test. Journal of conservative dentistry: JCD 2016;19:461.