

Evaluation of Apical Microleakage of Endodontically Treated Teeth Sealed With Three Different Root Canal Sealers

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الخلاصة

الاهداف: تقييم انواع عدة من موادالتثبيت للاسنان المالجة لليبيا باستخدام المبرد الالكتروني لتنظيف القنوات لغاية من الدراسة لمعرفة اي من المثبتات هو الافضل والاقل تسريب خارج الذروة. **المواد وطرائق العمل:** استخدمت الدراسة 50 سن صحيح خالي من التشوهات الخلقية بعد قطع التاج باستخدام القاطع الكهربائي بعد المعاينة النظرية وايضا باستخدام اشعة اكس جميع الاسنان قسمت الى 3 مجاميع عشوائية المجموعة الاولى الاقنية ملئت باستخدام الاندوفيل سيلرالمجموعة الثانية استخدمت تيجي سيلرالمجموعة الثالثة استخدمت اياج سيلركل الاقنية اغلقت بالشكل المخروطي الاحادي بعدها كل الجذورتم طلاؤها باستخدام صبغ الاظافرماعدا نهاية الذروة بعدهاغمرنا كل النماذج بسائل المثلين الازرق لمدة اسبوع كامل بعدها نبدأ بازالة صبغ الاظافرونبدأ بقص الجذورطوليا ونبدأ عملية الفحص تحت الميكروسكوب باستخدام الكاميرة الرقمية ومن ثم تحليل النتائج باستخدام محلل النتائج: **النتائج:** اظهرت النتائج AH هو المثبت الاقل تسريب من الانواع الاخرى

ABSTRACT

Aims: Different materials are used during endodontically treating of teeth as root canal sealers. Thus, this study was done to evaluate the sealing ability of three different types of root canal sealers on the apical part of the tooth. **Materials and Methods:** 50 sound human teeth were instrumented by using a rotary ProTaper nickel-titanium files under crown down technique. The samples were divided randomly into 3 groups (n=10), additionally two groups were used as +ve controls, first group used Endofill sealer (PD product dentaires SA, Switzerland), and group two used Tagadseal sealer (technical general United kingdom), and the third group used AH plus sealer (Dentsply, Switzerland). All teeth were obturated using the single cone technique with the sealers, then the whole root surface was coated with two layers of aspecial type of nail varnish, except the apical 1 mm, then all teeth were placed into 2 % methylene blue dye liquid for one week at 37° C. After that they were removed from the dye, the nail varnish was removed. The positive controls (n=10) were left unfilled and coated as described earlier. Then the tooth was splited longitudinally and each half examined under a stereomicroscope with magnification: 10 X. A computer software was used taken by a digital camera. Analyzing of data was done by One-Way Anova and Duncan's Test analysis among the means of microleakage of the three types of sealers. All tests were computed at 5% significance level. **Results:** showed statistically significant difference among groups. Group 3 (AH plus) showed abtter seal among (Tg and Endofill) groups while Tg and Endofill showed no significant difference between both. **Conclusions:** Under the conditions of this study, the AH plus sealer provided a better sealing ability than Endofill and Tagadseal sealers, but long term in vivo study is important to prove it.

Key words Apical sealing, root canal sealer, AH plus sealer.

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INTRODUCTION

The main objective of endodontic treatment is to obtain the full elimination of microorganisms from the canal of the root and to obtain an apical, lateral, and coronal seal to prevent colonization by the microorganisms. Failure to seal the apical part of the root has accounted for as many as 60% of endodontic treatment failures⁽¹⁾⁽²⁾.

Sealing of the root canal space is an important point for the success or failure of endodontic therapy, as it is related to the result of root canal treatment. It is an important point in enhancing periapical healing and preventing disease progression. Obturating materials as gutta-percha has been considered the main standard for endodontic treatment as it has the least toxic and tissue irritating endodontic material available. However, gutta-percha cannot provide a lateral seal in the wall and for this reason a sealing agent is required.⁽³⁾ A sealer for endodontic teeth requires a permanent seal of the obturating material because it adheres the gutta-percha to the canal walls of the roots and fills all the irregularities and holes between gutta-percha cones and between the space of the root canal and fillings⁽⁴⁾.

The physical characteristics that are needed to be obtained from endodontic sealer are capability to seal with the root canal space and gutta-percha with the body fluids and its stability after setting. For those reasons, more than one sealer will be developed to obtain the

requirements of perfect sealing⁽¹⁾. Various studies have been done on the sealing capability of many sealers and many levels of residual moisture in the root canal space have been shown to change the sealing characteristics of conventional and resin based sealers⁽⁵⁾. Therefore, this study was aimed to compare the apical leakage of three commonly used root canal sealer cements.

MATERIALS AND METHODS

This study included 50 extracted mono-rooted teeth with mono-canal teeth. This feature included mono canal with the curvature in the apical ≤ 20 degree (Schneider method), apical constriction \leq K-file #20, complete and clean apex (under microscopic), and root canal opened. Exclusion features were: root surface carious, closed canals and internal/external root resorption (clinically and x-ray radiographs). Samples were washed and purified with a tooth micro brush under steamy water and kept in normal saline then a crown of the teeth were cut at the CEJ with a diamond bur disks under a water coolant to facilitate canal instrumentation.

Then, when cutting the crown the canal were opened and full length of the canals was obtained by inserting #15 K-file inside the canal until it was seen at the end of the foramen, and then subtracting 1 mm from the length⁽⁶⁾.

The root canals were prepared using a rotary ProTaper nickel-titanium files with

crown-down method at 250 rpm starting with Sx to S2 and F1 to F3 used the entire working length. Then canals were irrigated with 10 mL of a prepared solution of 5.25% sodium hypochlorite between each file. After instrumentation completion, a wash with 10 mL of 17% EDTA for one minute was used to clean the smear layer, then washing by 5.25% NaOCl then by distilled water. The canals were then dried by using sterile paper points.

After that samples were divided into 3 experimental groups (n=10), Additionally two groups were used for positive and negative controls. The endodontic sealers were prepared according to instructions of the manufactures.. Three sealers were used in this study , the first group used Endofill as a root canal sealer with dexamethasone (PD product dentairesSA, Switzerland), and group two used Tagadseal resin based root canal sealer (technical general United kingdom), and the third group used AH plus root canal sealer (Dentsply, Switzerland). All teeth were obturated using the single cone technique, with the using F3 protaper gutta-percha dipped in the three sealers, excess gutta-percha was cleaned and condensed with a plugger 1 mm under the canal opening. The root canal opening was sealed with composite resin for better seal coronaly, then the whole root surface coated with twice , a special nail varnish away 1 mm from the apex, the all teeth were then placed into 2 % methylene blue dye

liquid for seven days at 37° C. The samples were removed from dye solution, then teeth washed with running water and dried. The varnish was removed with a scalpel.

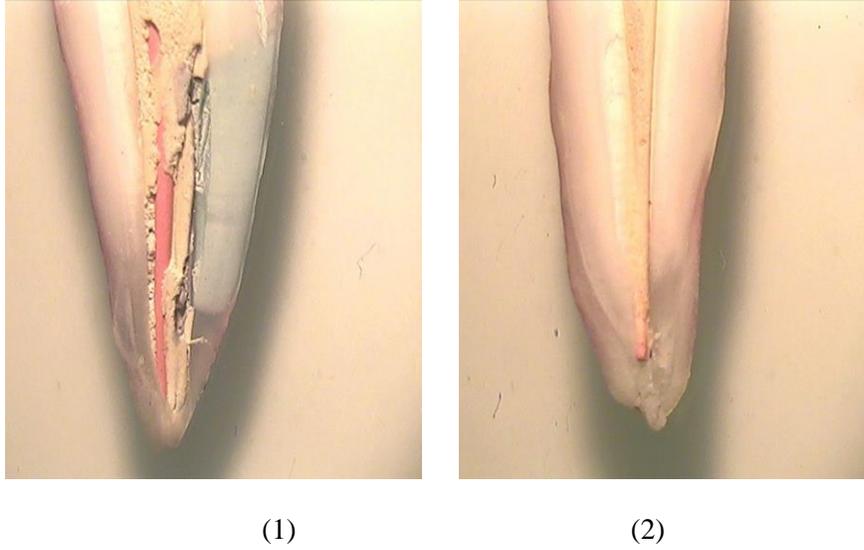
Positive and negative controls:

The positive controls (n=10) were left unfilled and coated as described earlier. The negative controls (n=10) were filled and totally coated, including the apical foramina.

The Canals obturated with gutta-percha (without sealer) and un layered with varnish are used as positive controls (n _ 10); the same roots are then entirely layered with special nail varnish for negative controls (n _ 10).

Measurement of micro-leakage:

The roots of teeth were grooved longitudinally on each sides, using a diamond disc and handpiece (NSK, Japan) under cooling with distilled water. After positioning the location for splinting buccally lingually Divided along longitudinal axis near to the center of the canal and then teeth were split, and then each half examined with a stereomicroscope. To measure dye entrance, a stereomicroscope with magnification: 10 X was used. The degree of leakage was measured from the end of the root to the highest amount of dye entrance in micrometers using computer software on the image captured by a digital camera as seen in Figures (1,2) ⁽⁷⁾.



Figures (1,2): Pictures of teeth after splitting by digital camera of stereomicroscope.

RESULTS

The results of our study showed group 3 (AH Plus) to have the lowest mean value of

dye penetration, whereas the highest mean value of dye penetration appeared in group 1 (Endofill). As in Figures (3,4,5).

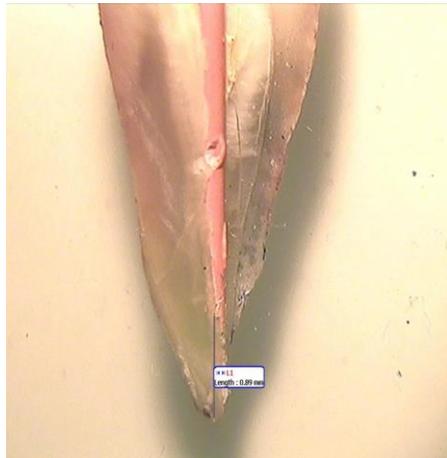


Figure (3): show degree of leakage of dye with AH plus sealer.

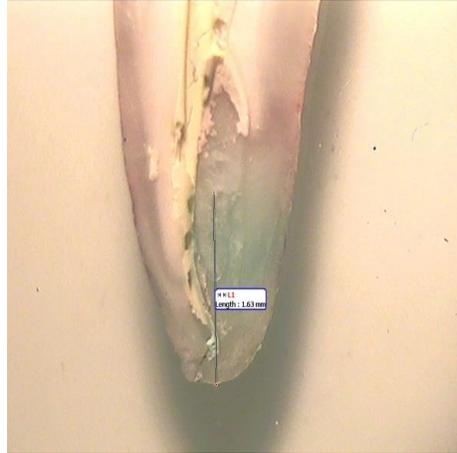


Figure (4): show degree of leakage of dye with Tagadseal sealer.



Figure (5): show degree of leakage of Endofill sealer.

Mean and standard deviation for the degree of dye penetration for the study groups were measured as shown in Table (1), dye leakage in groups appeared mostly at the junction of the endodontic sealer and root canal space in more of the samples.

Table (1): Descriptive analysis of the means of apical micro leakage of the three types of sealer

Type of Sealer	N	mean	SD
Gp(3) AS	10	0.20	0.40
Gp (2) TS	10	0.79	0.73
Gp (1) ES	10	1.22	0.30

AS (AH Plus Sealer), TS (Tagadseal Sealer), ES (Endofill sealer).

All data obtained evaluating analysis using parametric test One Way ANOVA and Duncan's multiple range analysis test (Table 2.3) respectively. One -Way Anova test show statistically significant difference among groups. Group 3 (AH plus) show less dye penetration among (Tg and Endofill) groups while Tg and Endofill show no significant difference between them as shown in Table (3).

Table (2): One-Way ANOVA analysis among the means of microleakage of the three types of sealers.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	5.245	2	2.622	10.013	.001 *
Within Groups	7.071	27	.262		
Total	12.315	29			

Df: degree of difference, F: F value at $P \leq 0.05$, Sig: significantly*: Significantly highly.

Table (3): Duncan multiple range analysis test

Groups (type of sealer)	N	Mean*± SD	Duncan's groups**
Gp (3) AS	10	0.20 ±0.40	A
Gp (2) TS	10	0.79 ± 0.73	B
Gp (1) ES	10	1.22 ±0.30	B

AS (AH Plus Sealer), TS (Tagadseal Sealer), ES (Endofill sealer) (*Mean in millimeter measurement **Different letter mean significant difference at $p \leq 0.05$)

DISCUSSION

An endodontic sealer is used to close the space between filling material and root canal making a mass that can obtain a full seal. The apex of the root considered the most complex part of the root, because it has a large variation of anatomy like as ramifications, small canal, or lateral canals that make it increase the susceptibility of microorganism to leak ⁽⁸⁾.

The goals of this study were evaluate the the apical adhering capability of Endofill sealer, Tagadseal resin sealer and AH plus sealer. Sealing capability of the canal space of the root was measured by showing the line of coloring dye penetration on apex of the root.

The sealing efficiency of the endodontic sealer is observed by the adhering between the sealer and dentinal wall, and also by the physical

characteristics of the endodontic sealer. Incomplete eradication of smear layer will affect the connection between dentin and sealer⁽⁹⁾.

The AH plus sealer showing best sealing ability. This was related to the characteristics of the AH plus sealer. The best characteristics of AH plus related to Endofill and Tagadseal sealers, and high bonding feature of the sealer that showed in a high seal to dentin explains the high bonding capability of the apical portion with that sealer. Whereas shrinkage after setting was shown with the other sealers, AH plus sealer was showing up to 1.0% expansion after settings suggesting more adaptation and least dye penetration at the space between tooth and filling. The AH plus sealer have low solubility can also enhance its sealing ability.

The results of this study agreed with those studies^{(10), (11), (12), (13), (14)}.

Endodontic treatment of the root canal space with filling-material that has biocompatibility and lesser amount of shrinkage is very important for a perfect endodontic treatment. After that a full bond of the root canal space is almost impossible with materials and methods using a combination of gutta-percha and endodontic sealer, the endodontic sealer have the ability of making adherence between the filling material and the dentinal wall, that preventing leakage⁽¹⁵⁾.

3D sealing of the root canal space (sealing from all side) was regarded the main goals of the root canal therapy and is important for avoiding re-infection of the tooth and for enhancing the health of the periradicular tissues, that obtained the successful of root canal therapy⁽¹⁶⁾.

More than one type of root canal sealers can be used to achieve this benefit and the evaluation of the apical bonding ability of the endodontic sealers is important. It should be observed that the sealing in the coronal part is of equal importance to the apical seal of the root canal for the success root canal treatment⁽¹⁷⁾.

CONCLUSIONS

Many techniques can be used to evaluate the sealing ability of root canal materials. The evaluation of the linear dye leakage is the best technique used to shown the leakage of root canal fillings after splitting the root⁽¹⁸⁾.

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