The Sealing Ability of Guttaflow2 Sealer in Comparison to AH Plus Sealer Using Dye Penetration Method

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Abstract: *The aim of this study was to evaluate the apical sealing ability of GuttaFlow2 obturation material using dye penetration method. Palatal roots of forty five extracted maxillary first molars were instrumented with ProTaper rotary files to size F4. The teeth were divided into three experimental groups according to type of sealer used, group1: root obturated with AH Plus sealer and single cone technique, group2: root obturated with GuttaFlow2 sealer and single cone technique, group3: root obturated with GuttaFlow2 sealer only.*

Results: *Data was subjected to statistical analysis. P-Value<0.05 was considered as significant. The results of this study showed that Gutta-Percha/AH Plus showed the lowest mean of leakage with no statistically significant difference with group2 and statistically difference between Gutta-Percha/AH Plus and group3.*

Conclusion: *The use of GuttaFlow2 with a single gutta-percha master cone creates an apical seal that is equivalent to that produced with gutta-percha/AH Plus sealer using single cone*

technique, GuttaFlow2 when used as only creates a poorer sealing than when used with single cone techniques.

Keywords: apical sealing, dye penetration, endodontic sealers,GuttaFlow2, single cone technique.

Introduction

The objective of root canal filling is to prevent the passage of microorganisms and their byproducts along the root canal [1]. Today's state of the art is the combination of a semi-solid material (e.g. gutta-percha) with a root canal sealer [1].

The latter has a significant impact on micro leakage of root canal fillings [2]. The group of silicone sealers exhibited promising results regarding micro leakage in different studies besides the well-established group of epoxy resins (e.g. AH Plus, DeTrey Dentsply, Konstanz, Germany) [3, 4, 5, 6, 7]. This may be due to their slight expansion upon Setting [8]. Silicone sealers remain relatively soft after Setting [9], which may cause difficulties when subsequently additional preparation, as for a root canal post, is necessary. This problem may be addressed using a silicone primer and/or special retentive gutta-percha points (Silicone Primer, Roeko Retention Points, both Coltène/Whaledent, Langenau, Germany).

Another way to handle this problem is the use of a silicone sealer with an optimized consistency due to variations in inorganic fillers: GuttaFlow2 (Coltène/Whaledent) [9]. To study the sealing property of new filling materials and techniques, several methods have been used: dye [10], fluid transport [11, 12]. The aim of this study is to test micro leakage of this newly developed silicone sealer GuttaFlow2 in comparison to the established AH Plus sealer material.

Materials and Methods

Forty five freshly extracted maxillary first molars teeth with straight palatal root were selected from different health centers for this study according to specific criteria. After extraction, all teeth were stored in 0.1% thymol solution at room temperature. The roots surfaces were verified with a magnifying eye lens (10X) and light cure device for any visible cracks or fractures. Using diamond disc mounted on straight hand-piece and under water coolant the palatal root of teeth was sectioned perpendicular to the long axis of the root at the furcation area to facilitate straight line access for canal instrumentation and filling procedure.

The length of the root was determined by digital caliper and marker to (10) mm from apex to cement-enamel junction. The exact location of the apical foramen and the patency of the canals were verified by insertion of a No.15 K-file into the canal and advancing until it is visualized at the apical foramen.

The canals were instrumented using rotary ProTaper instruments were used according to the manufacturer's instructions; the instrumentation was completed in crown down manner using gentle in and out motion. The canals were instrumented to MAF # F4/.06. During instrumentation procedures, 2 ml of 2% NaOCl solution was used before each file.

All specimens received a final flush of 2 ml of 17% EDTA for 3 min and 5 ml of saline solution. Then the root canals were dried with sterile paper points (Dentsply Maillefer).The prepared teeth were randomly divided into three groups of 15 teeth each. All teeth were obturated following manufacture's instruction using single cone technique.

Group (1): In this group, the AH Plus sealer (Dentsply, Germany) mixed according to the manufacture's instructions. The

tip of master cone #40/.06 was coated with the AH plus sealer and placed into canal to full working length.

Group (2): Canals were obturated with #40/.06 gutta-percha and GuttaFlow2 sealer (Coltene,Germany) according to the manufacturer's instructions. GuttaFlow®2 was spread on a mixing slab and inserted into the root canal with the master file #40; the gutta-percha cone was placed into the root canal. Then the master cone #40/.06 coated with sealer and inserted to the working length.

Group (3): GuttaFlow2 was injected into the root canal by placing the delivery tip within 3mm of the root apex. After filling the entire root canal with GuttaFlow2, a #15 file (Dentsply Maillefer, Ballaigues, Switzerland) was used to remove any air voids trapped in the root canal during the injection of GuttaFlow2.

For all groups excess gutta-percha was removed with hot plugger 1mm below the orifice. All obturated roots of all groups were wrapped in saline moistened gauze in closed plastic vial allowing the sealer to set for 1month at 37°C in an incubator [13], then the experimental root surfaces except the apical 2 mm were covered with one layer of nail varnish and two coats of sticky wax. The teeth were then immersed in India ink (Pelikan, Hannover,Germany) for 7 days[12].

After removal from the dye, the teeth were washed under running tap water and the sticky wax was scraped from the root surface with a lacron carver and washed again under running water [14]. Demineralization and clearing process was completed as described by Al-Hashimi [13]. The teeth were demineralized in 5 % nitric acid solution and dehydrated in99-100% ethyl alcohol for 3 days with daily change of alcohol.

The clearing process was completed by immersing the teeth in methyl salicylate solution. The extent of dye penetration was measured by two observers using a Stereomicroscope (Kruss,

Germany) in millimeters. The measurements were made from the most apical extent of gutta-percha to the most coronal extent of dye penetration. The data were analyzed statistically using ANOVA and Least significant difference test (LSD) test [15].

Results

For the micro leakage parameter the results of this study showed that group 1 (AH Plus) have the lowest mean value of dye penetration (0.35mm) while the highest mean value of dye penetration showed by group 3 (GuttaFlow2 only) (0.53mm).

The rest value for the 2rd group (GuttaFlow2 with gutta-percha) was fluctuation between these values (0.39mm). Analysis of variance (ANOVA) test was performed and showed that there were very highly significant differences ($p \leq 0.000$), LSD test showed that there were very highly significant differences ($p \leq 0.001$), between group 1&3 and for 2&3 while there is no significant difference ($P \geq 0.05$) between 1&2.

Discussion

The sealing ability of a root canal filling material is an important factor in preventing leakage of microorganisms and reinfection of the root canal system [16]. Complete obturation of the root canal system with an impervious, biocompatible and dimensionally stable filling material is essential for successful root canal treatment. However, it has been reported that a complete seal of the root canal system is almost impossible with currently accepted materials and obturation techniques using a combination of gutta-percha and root canal sealer [17].

AH Plus sealer showed the lowest leakage value compared to other sealers , AH Plus is a root canal sealer based on epoxy resin derived from AH 26, several authors have shown that AH Plus is the material that has the best sealing capacity [17,18,19] , Other investigations have further shown high-quality properties with epoxy resin–based sealers, including very low shrinkage while setting, long term dimensional stability, flow, and long setting time, AH Plus sealer penetrates deeper into the surface microirregularities [19].

This agrees with the finding of Monticelli et al. 2007 [20] .Among the new techniques for preparation of the root canal, as well as new materials for root sealing, the single- cone method or the application of sealer as the only filling material are increasingly recommended procedures [21,22]. GuttaFlow has been studied in sole use to fill the root canal [23], or with just a single gutta-percha cone [24] as recommended by the manufacturer. In this study, none of the sealers or techniques applied proved capable of avoiding apical filtration in root canals filled.

GuttaFlow2 used as the only filling material resulted in more filtration apically, after 30days. These findings might be attributed to the greater amount of sealer used in this group. A high frequency of the voids at all measurement levels in the group3, although smaller in area, could increase the possibility of communication between these voids and the apical and coronal ends of the root canal filling [25]. GuttaFlow when used as only creates a poorer sealing than when used with single cone techniques and this finding agrees with Savariz et al., 2010 [26].

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Table (1): Descriptive statistics for all experimental groups, (microleakage).

Groups	N	Min	Max	Mean	Std. Deviation
Group1	15	.25	.50	.3587	.08484
Group2	15	.30	.53	.3993	.08013
Group3	15	.40	.75	.5300	.10987

Table (2) ANOVA test among groups

Source of variation	Sum of Squares	df	Mean Square	F	p.value	Sig.
Between Groups	.240	2	.120	14.037	.000	***
Within Groups	.360	42	.009			
Total	.600	44				

***** Very highly significant**

Table (3) LSD test between groups

Groups	P.value	Sig.
1&2	.236	N.S
1&3	.000	***
2&3	.000	***

***** Very highly significant; N.S Non-significant difference.**

الختم القمي لمادة اللاصق GuttaFlow2 بالمقارنه مع اللاصق AH Plus باستخدام طريقة التسرب الصبغي الدقيق

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المستخلص

ان الهدف من هذه الدراسة هولتقييم الختم القمي لسدادة القناة GuttaFlow2 باستخدام طريقة التسرب الصبغي الدقيق. تم اختيار خمسة وأربعين رحى اولى علوية وتم تحضيرها باستخدام ادوات تحضير دوارة نوع بروتيبر حجم F4. تم تقسيم الأسنان إلى ثلاث مجموعات تجريبية وفقا لنوع الماد اللاصقة، المجموعه الاولى: جذور محشاة بمادة AH Plus باستخدام طريقة تقنية المخروط الواحد، المجموعه الثانية: جذور محشاة بمادة GuttaFlow2 باستخدام طريقة تقنيةالمخروط الواحد، المجموعة الثالثة: جذور محشاة بمادة GuttaFlow2 سداده فقط.

النتائج: البيانات تعرضت للتحليل الإحصائي ، اذا كانت قيمه P <0.05 فيدل على وجود فرق معنوي. وأظهرت نتائج هذه الدراسة أن الكوتابيرشا /AH Plus أظهر أدنى مستوى تسرب ذروي مع عدم وجود فروق ذات دلالة إحصائية مع المجموعه الثانية مع وجود فرق معنوي بين الكوتابيرشا / AH Plus و المجموعة الثالثة.

الخلاصة: إن استخدام GuttaFlow2 مع كوتابيرشا مفردة ينتج عنه ختم قمي يعادل الختم القمي التي أنتجت مع الكوتابيرشا / AH Plus باستخدام تقنية المخروط الواحد، GuttaFlow2 عندما يستخدم لوحده ينتج عنه ختم قمي ضعيف مقارنة عند استخدامها مع تقنية المخروط الواحد.

الكلمات الرئيسية: الختم قمي، التسرب الصبغي، سداد القناة، GuttaFlow2، تقنية المخروط الواحد.