

ORIGINAL RESEARCH

COMPARATIVE EVALUATION OF SEALING ABILITY OF ROOT CANAL SEALERS WITH ANTIBIOTICS

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ABSTRACT

INTRODUCTION: This study compared the sealing ability of root canal sealers with and without the addition of antibiotics. **MATERIALS AND METHOD:** Sixty extracted permanent mandibular premolar single rooted teeth were selected and decoronated at 14 mm from the apex. After cleaning and shaping, the teeth were divided into three experimental ($n = 20$ each) and two sub groups ($n = 10$ each): *Group 1*, cold lateral condensation using Gutta-percha/and GuttaFlow; *Group 2*- Gutta-percha/AH Plus; *Group 3* Gutta- percha/ and sealapex. The groups were subdivided into two subgroups: Subgroup A: with double antibiotic paste; Subgroup B: without double antibiotic paste. Glucose leakage model was used to evaluate of sealing ability of root canal fillings at various time intervals using. A spectrophotometer was used to measure glucose leakage values. The values obtained were statistically analysed.

RESULT: At 7 days, significant difference was observed between Gutta Flow vs AH Plus and Gutta Flow vs Sealapex in both groups, i.e with and without DAP. At 10 days, significant

difference was observed between Gutta Flow, AH Plus and Sealapex in both groups, i.e with and without DAP. **CONCLUSION:** Gutta flow showed better sealing ability than AH plus and sealapex and addition of antibiotics improved the sealing ability.

Key words: Root canal sealers, double antibiotic powder, sealing ability

INTRODUCTION

Primary objective of endodontic therapy is to fill the cleaned and shaped root canal system [1]. Instrumentation, irrigation and intra-canal medicaments are useful in decreasing the microorganisms in the infected root canal [2]. Even with the best technique used, some micro irregularities are left in areas of the root canal system, thus some pulp tissue and inorganic debris remain in these areas. This result in growth and spread of microorganisms [3]. Utilizing obturating materials having anti-microbial activity is favorable in decreasing the number of remaining microorganisms and to put an end to infection. Systemic antibiotics are useful adjunct in treatment of certain endodontic cases but they pose risk of adverse effects which include toxicity and allergic reactions and also microbes become resistant to these antibiotics [4]. Moreover delivery of active drug to the infected site is dependent on the blood circulation. So localized application of antibiotics is more functional and powerful mode of delivering antibiotics [5].

Double antibiotic paste (DAP), containing metronidazole and ciprofloxacin may be effective in eradicating root canal bacteria. Incorporation of antibiotics may change the physical properties and sealing capacity of the root canal sealer [6]. To accomplish successful root canal treatment good sealing ability of root canal sealer is required, thus effect of this addition to sealers on sealing ability needs to be evaluated. Therefore the aim of present study is to compare sealing ability of root canal sealers with antibiotics

MATERIAL AND METHOD

Sixty extracted human mandibular first premolars were selected (based on a previous pilot study using Gpower software) and stored in saline solution during all stages of study. Radiograph was taken to affirm the existence of single canal. All the teeth included in study were free from any caries, open apices, cracks, curved canals and resorptive defect. Proper cleaning of teeth was done. The teeth were decoronated at the cemento-enamel junction by diamond disk.

Standardized access cavity preparation was done using round bur and Endo-Z bur. The canal length was determined by using a size 10 K-type file and the working length was established by reducing 1mm from obtained length.

Biomechanical preparation of canals was performed using ProTaper Universal files (Denstply, Germany) till F2 to get desired apical preparation of #25. During the biomechanical preparation the canal was opened using size 10 k file and irrigation with 5.25% sodium hypochlorite solution was done. After using the last files, the roots were irrigated with saline solution and parched with paper point (Denstply, Germany). The canals were irrigated in between instrumentation with 17 % EDTA and 5.25% sodium hypochlorite.

Preparation of double antibiotic powder:

The enteric coatings of antibiotic tablets (Ciprofloxacin, Metronidazole) were removed then grounded in a mortar and pestle until fine particles were formed [7]. Then, the powdered antibiotic and sealers were weighed separately in a digital weighing machine to make 1:10 proportion of antibiotic with sealer. Sealer was mixed as per manufacturer's instructions for obturation along with double antibiotic powder.

The teeth were obturated using three different root canal sealers i.e.; Guttaflow, Sealapex, AH Plus respectively. The three groups were further divided on the basis of Double Antibiotic Paste (DAP) used.

GROUP 1- Obturation using Gutta Flow

Subgroup 1A- With double antibiotic paste

Subgroup 1B- Without double antibiotic paste

GROUP 2- Obturation using AH Plus

Subgroup 2A- With double antibiotic paste

Subgroup 2B- Without double antibiotic paste

GROUP 3- Obturation using Sealapex

Subgroup 3A- With double antibiotic paste

Subgroup 3B- Without double antibiotic paste

The samples were placed in incubator at 37°C after obturation.

Preparation of glucose penetration model for evaluation of sealing ability:

A glass pipette was taken. Sticky wax was used to secure pipette to root specimen. A ditch was prepared in screw cap of glass bottle by which glass pipette was connected. The

connections were placed in aseptic 10 ml glass bottle and cap was screwed and fastened with sticky wax. A static trench was drilled in screw cap with #10 diamond bur to ensure unbarred system at all times. 2 ml of 0.2% sodium azide mixture was added to glass bottle, such that apex of all samples were in constant contact with mixture. Tracer used was 1 mol/L glucose solution. 1ml of glucose solution was introduced into the pipette till top of solution was 14 cm higher than top of gutta percha in canal, and this will create hydrostatic pressure of 1.5 kPa or 15 cm H₂O. The concentration of glucose was then analyzed in a spectrophotometer at 283 nm wavelength. (λ_{max} of glucose).

RESULT:

At 7 days notable dissimilarity was noticed between Gutta Flow vs AH Plus and Gutta Flow vs Sealapex in both groups i.e. with and without DAP.

At 10 days notable dissimilarity was noticed between Gutta Flow, AH Plus and Sealapex in both groups i.e. with and without DAP.

Table 1: Mean Leakage at 7 days and 10 days

Sealers used	Leakage			
	7 Days		10 days	
	With DAP Mean±Standard deviation	Without DAP Mean±Standard deviation	With DAP Mean±Standard deviation	Without DAP Mean±Standard deviation
Gutta Flow	0.241±0.052 ^{ab}	0.394±0.082 ^{ab}	0.462±0.0791 ^c	0.648±0.100 ^c
AH Plus	0.380±0.079 ^a	0.602±0.087 ^a	0.555±0.0782 ^c	0.754±0.054 ^c
Sealapex	0.362±0.074 ^b	0.776±0.090 ^b	0.702±0.0559 ^c	0.976±0.085 ^c

Same superscript denotes significant difference across the columns at both 7 and 10 days.

(p value=0.001)

DISCUSSION

Microleakage existing between the filling of root canal and root canal walls affects the prognosis of root canal treatment. Hence complete filling of root canal with an inert obturating

material and formation of fluid tight apical seal is the primary objective of endodontic treatment [8].

Various materials are used for obturation with predominant use of gutta-percha cones. Sealer aids in filling up gaps and voids between the Gutta-percha and the root canal wall. If the adaptation of gutta percha to root canal wall is not proper leakage occurs. Biomechanical preparation and proper irrigation are not capable to provide sterile environment, so antimicrobial agents can be added in the sealer to increase the antibacterial property [9].

Triple antibiotic paste has been found to be efficient in reduction of the bacteria in biofilms on intraorally infected dentin compared to 2% chlorhexidine gel and calcium hydroxide. Thus, the combination of antibacterial drugs (metronidazole + ciprofloxacin + minocycline) can aid in sterilizing the carious lesion and necrotic pulp [10]. Minocycline results in pigmentation, hence was avoided in this study. Kangarlou A (2016) conducted a study to compare antibacterial power of AH Plus and AH26 sealers after mixing with amoxicillin and triple antibiotic paste and it was seen that there is significant improvement in antibacterial properties of AH Plus and AH26 sealers [11]. Various technologies have been used to determine the sealing ability which include polymicrobial leakage, linear dye leakage and electrochemical process [12]. Fluid filtration proposed by Derkson, et al is a recognized method for determining sealing ability [13]. In this method, sealing capacity of restorative materials is evaluated by determining the permeability of dentin which was modified by Wu and Wesselink (1993) for Endodontics [14]. The important leeway of this method is that it assists in conserving the samples after each assay which aid in its analysis at different time periods. Since it is sensitive and reproducible it has an advantage over other methods [12].

Various sealers used were Gutta flow, AH Plus and Sealapex. The results of the present study, showed that Gutta flow has better sealing ability than AH Plus and Sealapex. This could be attributed to the fact that Gutta Flow flows into the lateral canals and result in absolute filling of the space between the root canal wall and the master cone. Also, since heat is not used in positioning of the material, depreciation does not occur, and manufacturer reports an expansion of 0.2%. These findings are in agreement with some previous studies which also reported better sealing ability of Gutta Flow as compared to AH Plus [15],[16],[17].

AH Plus exhibited better sealing ability than Sealapex which might be because of penetration of AH plus into the micro-irregularities which improves the mechanical interlocking between sealer and root canal. Sealapex showed least sealing ability as it shows volumetric expansion during setting. This expansion might be due to calcium oxide which results in water sorption and may increase its solubility. Some authors have also shown greater leakage values for Sealapex [18],[19].

According to this study, better sealing ability was seen with DAP –Sealer combination. This might be because these antibiotics might have increased density of obturation when they are added in combination with sealer [20].

In the above study, only two antibiotics were used and also the sealer + antibiotic paste was kept for 10 days, so the further research studies can be carried out with other combination of drugs and with extended period of time.

CONCLUSION

Within the limitations of the current study, it can be concluded Gutta flow showed a better sealing ability than AH Plus and Sealapex. This study also illustrated that addition of antibiotics (metronidazole and ciprofloxacin) in sealers enhanced their sealing ability.

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