Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies ***NLM ID:*** *101716117*

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Indian Citation Index (ICI) Index Copernicus value = 100

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Comparison of apical sealing ability between Guttaflow and AH flow. A prospective study

[1]Henston DSouza, [2]Madhura Pawar

[1]Specialist Endodontist, PHCC, Doha, Qatar;
[2]Department of Pedodontics and Preventive Dentistry, Dr DY Patil Dental College and Hospital, Dr DY Patil Vidyapeeth, Pimpri, Pune, Maharashtra, India

ABSTRACT:
Background: The adaptability of a root canal sealer with dentin walls is a desirable property for achieving complete disinfected status. **Aim**: The aim of present study was to compare apical sealing ability of Gutta flow and AH flow. **Materials and methods**: This prospective, cross-sectional study was performed using 100 single rooted anterior teeth which were equally distributed in two broad groups: a) Group A: In this group teeth were root canal treated using GuttaFlow whereas b) Group B: In this group, teeth were obturated using AH Flow. Bacterial infiltration was performed under laminar flow where 50 µL Enterococcus faecalis with concentration of 1.5 x 10^9 UFC/milliliters was done. Viability of bacteria was maintained during experiment by continuous replenishment using 200µL selective media at 37°C. During the period of experiment, bacteria entered root canals by leakage as seen as cloudy appearance of media. Cervical openings of these teeth were sealed by epoxy resin after which they were immersed in 1% solution of Methylene blue for 24 hours. These teeth were washed for 24 hours followed by removal of coated resin layer. All teeth was longitudinally sectioned by low speed water cooled circular saw at rate of 350 r.p.m. Degree of dye microleakage was done by measuring linear infiltration of 1 % methylene blue from apical to maximal depth of penetration in coronal direction for apical seal leak test. After measurement of penetration of this dye, greatest distance of linear directional leakage was considered as final reading. For eliminating operator based bias, both apical and coronal sealant leakages were measured by two independent evaluators by stereomicroscope (Olympus, Japan) at 20 X magnification fitted with a calibrated scale in eye-piece. Finally obtained scores were calculated in form of arithmetic average of measurements recorded by two operators. Statistical analysis was done by Fisher's exact test and P value<0.05 was considered as statistically significant. **Results and observations**: Following statistical analysis, no statistically significant differences between both the sealers was found sing dye penetration and bacterial infiltration techniques. **Conclusion**: In present study, Guttaflow and AH Flow exhibited identical leakage sealing properties. However, since these findings are contradictory to many studies, it can be suggested that a large sample size must be studied for more conclusive evidence.
Keywords: Guttaflow, AH flow, sealer, root canals, methylene blue, E. Faecalis

Received: 15 July, 2023 Accepted: 17 August, 2023

Corresponding author: Madhura Pawar, Department of Pedodontics and Preventive Dentistry, Dr DY Patil Dental College and Hospital, Dr DY Patil Vidyapeeth, Pimpri, Pune, Maharashtra, India

This article may be cited as: DSouza H, Pawar M. Comparison of apical sealing ability between Guttaflow and AH flow. A prospective study. J Adv Med Dent Scie Res 2023;11(9):63-67.

INTRODUCTION

Microleakage can be defined as "Oral fluid as well as bacterial flow within the microscopic space existing between any prepared dentinal root surface and any restorative dental material". [1] On using obturating materials, some amount of microscopic gap might always be existing that can lead to development of micro-leakage. Re-infection following endodontic treatment is primarily the result of improperly performed obturation that allows micro-leakage of bacterial toxins either through coronal or apical route. Hence, a fluid-tight apical seal has an important role in prevention of re-infection. The quality of apical root seal with obturation of root canal can be assessed using different methods such as penetration of dye or radio-isotope, study of bacterial micro-leakage, by electro-chemical techniques and infiltration of fluids.[2] Various short-comings associated with these methods are no reproducibility along with semi-quantitative data obtained.[3,4] These methods lack

accurateness in measuring leakage and the long time required for obtaining data. The use of penetration of a dye is the most popular method of choice that has been frequently used for measurement of apical micro-leakage as it easy to perform.[1] Commonly used dyes include India ink, methylene blue, basic fuschin and silver nitrate with developer. Of these, India ink is the most useful dye used for measuring micro-leakage in endodontics. Gutta Flow is an improved formulation of original material known as "Roekoseal". It contains a combination of sealer with extremely fine powdered gutta percha that has flowable properties at room temperature. This sealer can expands upto 0.2% after setting. When this expansile property of this sealer is combined along with close adaptability of gutta percha cones against a prepared root canal wall, better flow as well as adaptability against dentin tubular walls can be obtained. [3] Gutta Flow bio-seal (Colt `ene/Whaledent, Altst¨atten, Switzerland) is a silicone-based, cold filling type of root canal sealer which contains Gutta percha powder as well as bio-active glass. It has been claimed that combination of gutta percha with bio-active glass results in formation of hydroxy-apatite crystals. [5,6] AH Flow (Dentsply Maillefer, Switzerland) is an epoxy resin based root canal sealer which can be used along with gutta percha. This sealer consists of paste systems that are supplied in form of 2 tubes in double barrel syringe. AH Flow primarily consists of silicone based oils. Thickness of sealer film is approximately 25 millimeters, that is lesser than 50 mm as per ISO standards. [7] The studies that have evaluated the root canal sealing ability have demonstrated contradiction in study findings when comparisons have been made among various endodontic cement sealers. Hence, by considering the availability of different root canal sealing materials, the aim of present study was to compare the apical sealing ability between Guttaflow and AH flow.

MATERIALS AND METHODS

STUDY DESIGN

This was a prospective cross-sectional two-arm study conducted by a single investigator after obtaining consent from Institutional Ethical Committee.

STUDY SAMPLE

Total number of samples studied was 100 and the sample was then randomly categorized in two groups a) Group A: This group comprised of 50 samples endodontically treated using GuttaFlow while b) Group B: This group comprised of 50 samples endodontically treated using AH Flow.

Inclusion criteria: a) Teeth which were extracted due to pulpal involvement b) Single rooted anterior teeth c) Extracted teeth which were not allowed to dry and immediately stored in 10% formalin. Exclusion criteria: a) Grossly decayed teeth b) Multi-rooted teeth and c) Dried or desiccated teeth.

METHODS

Working length was ascertained by subtraction of 1mm length from total root canal length determined radiographically. Selected teeth were instrumented using manually technique by K files numbered15 and 20 (Dentsply Ind. Com. Ltda., Petrópolis- RJ, Brazil). This was then followed up by rotary instruments by use of K3VTVT filing sequence (Sybron Endo Corp.,Orange, CA, USA).Root canal irrigant used was 5 ml of 1% solution of sodium hypochlorite in between filing sequence followed by irrigation using 10 ml 15 % citric acid solution (Laboratório F&A Ltd, São Paulo, SP, Brazil) for removal of smear layer. Final irrigation using 10 ml 1 % sodium hypochlorite solution for removal of de-mineralizing solution. After cleaning & shaping, the instrumented root canals were dried-up using absorbent paper points (Dentsply Ind. Com. Ltd). As an external layer of coating, a finger spreader (SybronEndo Corp.) was kept inside each apical foramina. Teeth were then externally coated using fast polymerizing epoxy resin- Araldite (Henkel Ltd, Brazil). The teeth were equally randomized and obturated using sealers: Groups studied were a) Group I: This group used Gutta Flow endodontic sealer by using the lateral condensation technique and b) Group II: This group comprised of ' AH Flow' endodontic sealer using lateral condensation protocol. The obturated teeth were then fixed using poly-propylene Eppendorf test tubes with cut ends. Interface between tooth and test tube was then sealed using epoxy resin with fast polymerization. All prepared tooth models were then sterilized under Gamma irradiation (Cobalt 60) at 25 Kilo Grey radiation. Bacteriological infiltration was done in laminar flow wherein 50 µL of Enterococcus faecalis at 1.5 x 10**9** UFC/mL concentration was done in 250 µL of EVA culture media. Bacterial viability was maintained during 60 days of experiment by continuously replenishing with 200µL of selective media solution in an incubator maintained at 37°C.During experimental period, bacterial cells entered the root canals by means of leakage as evident by cloudy appearance of the media demonstrating percolation. After 60 days of experiment, all tooth specimens were then removed from Eppendorf tubes. Cervical accesses of all teeth were then sealed using epoxy resin following which they were immersed in 1% solution of Methylene blue dye (Laboratório F&A Ltd) for duration of 24 hours. Following this, teeth samples were then washed for a period of 24 hours, coated resinous layer was then removed and each tooth was sectioned in longitudinal direction through center of root canal by means of a low-speed water cooling circular saw Labcut (Extec Corp., Enfield, CT, US) at a speed of 350 r.p.m. Analysis of 1% methylene blue dye's linear leakage was conducted by projecting image of sectioned tooth by Nikon Optical Comparator Profile Projector (Nikon Instruments Inc., NY, USA) for the purpose of linear infiltration distance (millimeters).

MEASUREMENT OF DYE PENETRATION

The prepared teeth were immersed in 2 % methylene blue solution and were stored at temperature of 37°C for up to 72 hours following which these specimens were rinsed under running tap water. The nail varnish was removed using a scalpel. These teeth were sectioned in a longitudinal bucco-lingual direction using a hard tissue microtome into 2 equal halves. The degree of micro-leakage was assessed by measurement of extent of linear penetration of methylene blue from its apical end to maximal penetration coronally for testing of apical seal leakage. For measurement purpose, measurement points were set at two points, coronal most for testing of apical seal leakage and most apical point for testing of coronal leakage. After splitting tooth roots, penetration of dye was then measured as dye on root canal obturating material or over walls of root canal and on walls of root canals after removal of obturating material using an explorer used for endodontic purposes. After measuring penetration of dye, greatest point of linear leakage of dye was considered final. For elimination of operator bias, apical as well as coronal leakages were independently measured by two evaluators by using a stereomicroscope (Olympus, Japan) at 20 X magnification eye-piece which was fitted with calibrated scale in ocular eye-piece. Final scores were calculated as arithmetic average of measurements derived by two independent operators. Statistical analysis was performed using Fisher's exact test. P value at less than 0.05 was considered as with statistical significance.

RESULTS AND OBSERVATIONS

On analyzing bacterial leakage, it was seen that 74.1% and 69.7% teeth with Guttaflow and AH Flow sealers had bacterial leakage. (Table 1) On the other hand, dye penetration showed mean ± S.D. values in Groups A and B as 3.143 ± 0.12 and 4.192 ± 1.23, respectively (table 2 and graph 1). Following statistical analysis, no statistically significant differences were observed between bacterial infiltration and dye penetration.

Table 1: Table showing bacterial infiltration in each of the experimental group for each of the tested sealer

Group studied	Bacteriological leakage (%)	P value
Group A (Guttaflow)	74.1 %	0.07
Group B (AH Flow)	69.7 %	

Table 2: Table showing linear infiltration of methylene blue dye in both the experimental study groups

Group studied	Dye infiltration (in mm)	P value
Group A (Guttaflow)	3.143 ± 0.12	0.06
Group B (AH Flow)	4.192 ± 1.23	

Graph 1: Graph demonstrating mean value of methylene blue penetration

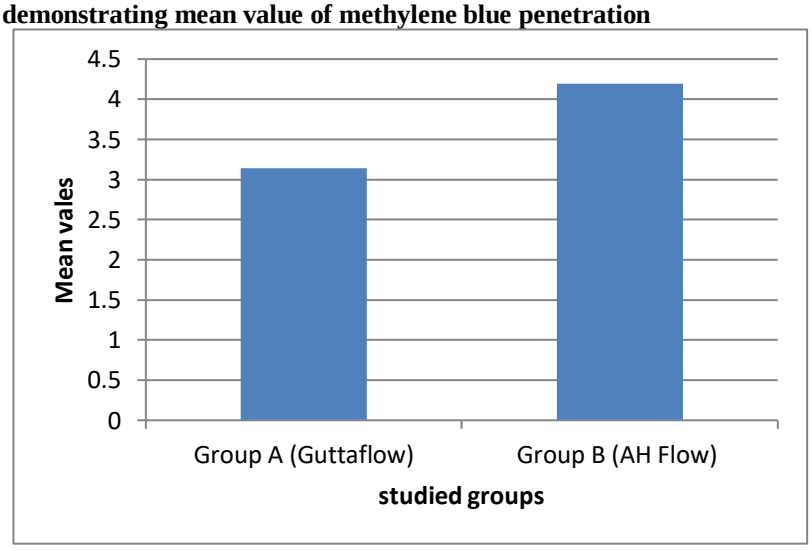

Table 3: Table illustrating composition of Guttaflow and AH Flow

Sealer	Composition
AH Flow (Dentsply/Maillefer, Germany)	**Paste 'A'** a) Di-glycidil-bisphenol-A-ether. b) Calcium. c) Tungsten. d) Zirconium oxide.

	e) Aerosol. f) Iron. g) Oxides **Paste 'B'** a) Amina 1-adamantane. b) N, N-di-benzyl-5-oxanonandiamine-1, 9. c) TCD di-amine. d) Calcium-tungsten oxide e) Zirconium oxide. f) Silicone oxide
Guttaflow (Coltene, Germany)	a) Poly-dimethyl siloxane b) Silica c) Paraffin oil. d) Platinum (catalyst) e) Zirconium dioxide f) Nano-silver. g) Gutta percha powder

DISCUSSION

The effectiveness of an endodontic sealer is an important aspect for prevention of microbial leakage as well as re-infection of root canals. It is impossible to prove any direct inter-relationship between extent of bacterial infiltration and outcome of endodontic therapy although use of biomarkers like bacteria along with their metabolic end products might help in evaluating marginal area infiltration**.** [8,9[This particular method is coherent and reproducible under *in vitro* conditions**.** [10] Hermetic sealing is one of the main factors that have been associated with a successful endodontic treatment. Ingle et al in 2008 has concluded that 58 % failures in endodontic treatment were the result of obturation related inaccuracies. There are fewer studies that have evaluated sealing ability of endodontic sealers by utilizing bacteria as a marker of sealing leakage. Hence, in this study two endodontic sealers were tested using these methods.[12] In present study, no statistically significant difference was observed between Guttaflow and AH Flow using dye penetration and microbial assessment techniques. However, in contrasting findings, Rana et al (2023) in their study fond that GuttaFlow2 in combination with Gutta percha obturation had excellent sealant properties. [13]

Also, Lee et al (2020) observed that Guttaflow demonstrated better sealing ability when compared to AH Flow.[14] In another contrasting findings, De-Deus et al (2007) in their assessment of Gutta Flow sealer demonstrated less leakage using AH Flow than with Guttaflow. [15] In accordance with our study, Elias et al (2010) in their study findings demonstrated identical leakage sealing abilities between AH Flow and Guttaflow sealers. [15] In similar manner, Brackett et al (2006) demonstrated that Guttaflow sealer along with AH Flow sealer demonstrate identical sealing using bacterial as well as dye penetration methods. [16] Epoxy resin based endodontic sealers demonstrate good adhesion with radicular dentin when compared with other sealers. Epoxy resinous sealers interact with exposed amino acids with tubular collagen forming covalent bonding between resin and tubular collagen with opening of epoxide rings. [17] However, GuttaFlow can demonstrate good adaptability with root canal dentinal walls as a result of its slight expansile properties with setting. [18] Savariz et al (2010) in their observations noted that Guttaflow had better adaptability with root dentin walls when compared with AH Flow using single gutta percha cone with lateral condensation technique. [17] One of the main reasons behind any good endodontic treatment is complete sealing from both apical as well as coronal pathways for preventing leakage as well as maintenance of disinfected root canal achieved by means of chemical as well as mechanical canal preparation by preventing re-infection as well as bacterial substrate percolation that allows integrity of periodontium and its subsequent healing. [18,19,20] In present study, two different types of endodontic sealers namely, Guttaflow and AH Flow were analyzed for their leakage sealing ability. It was observed that on analyzing microbial leakage and dye penetration both of these endodontic sealers demonstrated identical leakage sealing properties.

CONCLUSION

Obtaining a perfect apical and coronal seal following obturation is important for a successful endodontic treatment. Varieties of techniques as well as sealant materials have been studied in the past for achieving good leakage properties. In contrast to several published studies in literature in present study, no significant difference in leakage sealing properties were observed between Guttaflow and AH Flow. However, the limitation of present study might be the small sample studied in each of the groups.

REFERENCES

1. Gulabivala K, Holt R, Long B. An in vitro comparison of thermoplasticised gutta-percha obturation techniques with cold lateral condensation. Endod Dent Traumatol.1998;14(6):262-9.

2. Ingle JI, Bakland LK, Baumgartner JC. Ingle's Endodontics 6th Edition Pmph USA 2007.
3. M.-K. Wu and P. R. Wesselink, “Endodontic leakage studies reconsidered. Part I. Methodology, application and relevance,” Intern Endodc J1993; 26(1): 37–43,.
4. W. G. van der Borden, M.-K. Wu, and P. R. Wesselink, “Percentages of gutta-percha-filled canal area observed after increased apical enlargement,” J Endod 2010; 36(1):139–42.
5. Monticelli F, Sword J, Martin RL, Schuster GS, Weller RN, Ferrari M, Pashley DH, Tay FR Sealing properties of two contemporary single-cone obturation systems. Int Endod J 2007;40(5):374-85.
6. Coltene, GuttaFlow2 bioseal, .
7. Tyagi S, Mishra P, Tyagi P. Evolution of root canal sealers: An insight story. Eur J Gen Dent 2013;2:199-218.
8. Sevimay S, Kalayci A. Evaluation of apical sealing ability and adaptation to dentine of two resin-based sealers. J Oral Rehabil 2005;32(2):105-10.
9. Wu MK, Tigos E, Wesselink PR. An 18-month longitudinal study of a new silicon-based sealer, RAS Roeko Seal: A leakage study in vitro. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2002;94(4):499-502.
10. Bouillaguet S, Shaw L, Barthelemy J, Krejci I, Wataha JC. Long-term sealing ability of pulp canal sealer, AH-Plus, GuttaFlow and Epiphany. Int Endod J 2008;41(3):219-26.
11. Benenati, F.W. Obturation of the radicular space. Ingle’s Endod. 2008; 6:1053–1087.
12. Lee SH, Oh S, Al-Ghamdl AS, Mandorah AO, Kum KY, Chang SW. Sealing ability of AH Plus and GuttaFlow Bioseal. Bioinorganic Chemistry and Applications 2020; 2020; https://doi.org/10.1155/2020/8892561.
13. Rana R, Kaur T, Aggarwal A, Bhardwaj S, Thakur D, Mehak. Comparison Of Apical Sealing Ability Of Gutta Flow 2 With Traditional Gutta Percha: An In-Vitro Study. Eu Chem Bul *2023;12(5: 5898-5903*
14. De-Deus G, Brandão MC, Fidel RAS, Fidel SR. Sealing ability of GuttaFlow in oval-shaped canals: an ex vivo study using a polymicrobial leakage model. International Endodontic J 2007;40(10):794–9.
15. Elias I, Guimaraes GO, Caldeira CL, Gavini G, Cai S, Akisue E. Apical sealing ability comparison between GuttaFlow and AH Plus: in vitro bacterial and dye leakage. J Health Sci Inst 2010;28(1):77-9.
16. Brackett MG, Martin RBS, Sword JBS, Oxford CBS, Rueggeberg FA, Tay FR, Pashley DH. Comparison of seal after obturation techniques using a polydimethylsiloxane-based root canal sealer. J Endod 2006;32(12):1188-90.
17. Savariz A, González-Rodríguez MP, Ferrer-Luque CM.Long-term sealing ability of GuttaFlow versus Ah Plus using different obturation techniques. Med Oral Patol Oral Cir Bucal. 2010 Nov 1;15 (6):e936-41.
18. Hammad M, Qualtrough A, Silikas N. Extended setting shrinkage behavior of endodontic sealers. J Endod. 2008;34:90-3.
19. Davalou S, Gutmann JL, Nunn MH. Assessment of apical and coronal root canal seals using contemporary endodontic obturation and restorative materials and techniques. Int Endod J 1999;32:388-96.
20. Sjögren U, Figdor D, Persson S, Sundqvist G. Sundqvist: Influence of infection at the time of root filling on the outcome of endodontic treatment of teeth with apical periodontitis. Int Endod J 1997;30:297–306.