Topic 1. Drug discovery and Pharmaceutical Science

GuttaFlow Bioseal as Monocone Obturation Technique in Curved Root Canals. A Scanning Electron Microscopy Study.

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ABSTRACT

Background. The obturation quality of GuttaFlow Bioseal (GFB) in curved root canals is not clearly investigated. **Objectives.** This study evaluated the volumetric percentage of obturated root canals (VPORC), extrusion of root filling material beyond the apical foramen (ERFM) and duration of obturation procedure (DOP) in curved root canals. **Methods.** Access cavity was prepared on twenty mandibular first molars. The degree of root canal curvature in mesiobuccal and mesiolingual root were determined according to Schneider's method. Samples were prepared using HyFlex CM rotary files and divided into two groups (n=10); Group 1 [gutta-percha (GP) cone and GFB] and Group 2 [GP cone and RoekoSeal Automix]. DOP was recorded and obturation radiograph was taken. Mesial roots were sectioned horizontally to obtain the apical, middle and coronal regions and observed under scanning electron microscope (SEM) at 70x magnification. SEM images were transferred to SketchAndCalc Area Calculator software. **Results.** VPORC and ERFM in both groups showed no statistically significant difference irrespective of root canal curvature. DOP in severe canal curvature between Group 1 and Group 2 revealed statistically significant difference. **Conclusion.** VPORC and ERFM were not affected by the status of root canal curvature. DOP with GFB in severe canal curvature was slightly longer.

BACKGROUND

The obturation with GuttaFlow Bioseal is not clearly investigated due to the newer generation of root filling material.

GFB has been evaluated for the sealing ability [1, 2,3], cytotoxicity [4, 5, 6], physicochemical properties [2,7, 8], osteogenic activity [9], retreatability [10] and fracture strength of root canal treated teeth [11], but scientific evidence related to other aspects in obturation procedure is not present.

OBJECTIVES

To evaluate the

i. volumetric percentage of the obturated root canals at the apical, middle and coronal root regions,
ii. extrusion of root filling materials beyond the apical foramen,
iii. duration of obturation procedure on mandibular first molars with curved root canals.

METHODOLOGY

PART 1: Samples selection

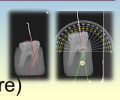
20 mandibular first molars

PART 2: Access cavity

Standard preparation

PART 3: Determination of root canal curvature

According to Schneider's method.



10° to 20° (moderate root canal curvature)
>20° (severe root canal curvature)

PART 4: Root canal preparation

HyFlex CM rotary files at 500 rpm and 2.5 Ncm

PART 5: Obturation and restoration

Group 1 – GP cone and GuttaFlow Bioseal

Group 2 – GP cone and RoekoSeal Automix root canal sealer

The obturation procedure was timed

Obturation radiograph was taken

Restoration with composite resin

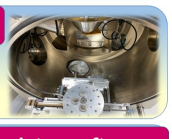
PART 6: Preparation for observation under SEM

Vertical sectioning - to divide mesial and distal roots

Horizontal sectioning of mesial root - to obtain the apical, middle and coronal root regions

PART 7: Observation under SEM

70x magnification



PART 8: SketchAndCalc Area Calculator software

Evaluation of the obturated root canals

PART 9: Data analysis

SPSS version 25.0

RESULTS

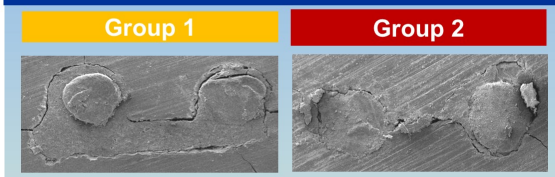


Figure 1: Apical root region

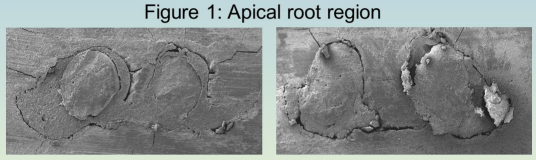


Figure 2: Middle root region

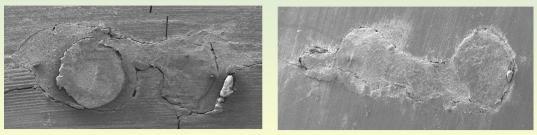


Figure 3: Coronal root region

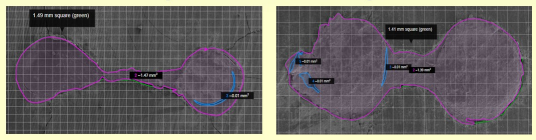


Figure 4: Evaluation of the obturated root canals

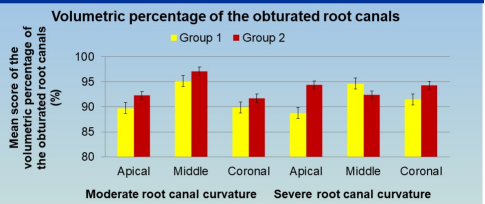


Figure 5: Volumetric percentage of the obturated root canals

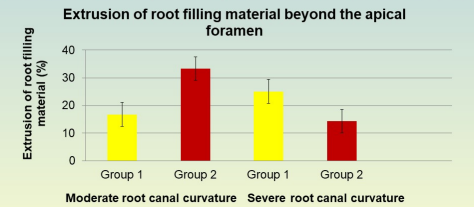


Figure 6: Extrusion of root filling material beyond the apical foramen

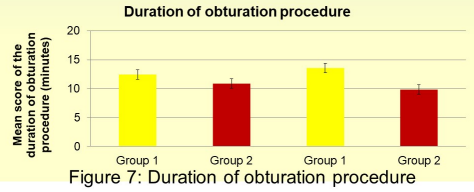


Figure 7: Duration of obturation procedure

DISCUSSION

The present study is the first research evaluating other aspects in obturation using GFB on curved mandibular molars.

Obturated root canals in moderate and severe root canal curvatures between GFB and silicone-based root filling material were equivalent at any level of evaluation.

The extrusion of root filling material beyond the apical foramen in moderate and severe root canal curvatures between GFB and silicone-based root filling material were comparable.

These findings could be attributed to the similar obturation technique and material viscosity but the later was not possible to confirm because of beyond the scope of the present study. Perhaps, future research can be done to validate these findings.

Duration of obturation procedure using GFB in severe root canal curvature was slightly longer than the obturation procedure using silicone-based root filling material. This might not be associated with the status of root canal curvature directly, but rather the amount of GP mass from the combination of GP cone and GFB.

CONCLUSIONS

Within the limitation of the present study, the conclusions were:

i. The volumetric percentage at the apical, middle and coronal root regions, as well as the extrusion of root filling material beyond the apical foramen between GFB and silicone-based root filling material were comparable irrespective of the status of root canal curvature.

ii. The duration of obturation procedure using GFB in severe root canal curvature was 27.5% longer than the obturation using silicone-based root filling material.

Neither root filling material was able to seal the curved root canal of mandibular molars completely. The root filling materials in the present study can be opted depending on the clinical cases, material availability and clinician preference. It is hoped that research in this field will point towards improving the limitations in various obturation techniques for future clinical practice.

REFERENCES

1. Akcay M, Arslan H, Durmus N, Mese M, Capar ID. Dentinal Tubule Penetration of AH Plus, iRoot SP, MTA fillapex, and GuttaFlow Bioseal Root Canal Sealers after Different Final Irrigation Procedures: A Confocal Microscopic Study. Lasers Surg Med. 2016; 48(1): 70–76.
2. Gandolfi MG, Shabankare AK, Zamparini F, Prati C. Properties of a Novel Polydimethylsiloxane Endodontic Sealer. Giornale Italiano di Endodonzia. 2017; 31(1):35-43.
3. Gok T, Capar, ID, Akcay I, Keles A. Evaluation of Different Techniques for Filling Simulated C-shaped Canals of 3-dimensional Printed Resin Teeth. J Endod. 2017; 43(9), 1559–1564.
4. Collado-González M, Tomás-Catalá CJ, Oñate-Sánchez RE, Moraleda JM, Rodríguez-Lozano FJ. Cytotoxicity of GuttaFlow Bioseal, GuttaFlow2, MTA Fillapex, and AH Plus on Human Periodontal Ligament Stem Cells. J Endod. 2017; 43 (5): 816 – 822.
5. Saygili G, Saygili S, Tuglu I, Davut Capar I. In Vitro Cytotoxicity of GuttaFlow Bioseal, GuttaFlow 2, AH-Plus and MTA Fillapex. Iran Endod J. 2017 Summer;12(3):354-359.
6. Rodríguez-Lozano FJ, Collado-González M, Tomás-Catalá CJ, García-Bernal D, López S, Oñate-Sánchez RE, et al. Guttaflow Bioseal Promotes Spontaneous Differentiation Of Human Periodontal Ligament Stem Cells Into Cementoblast-Like Cells. Dent Mater. 2019; 35(1): 114-124.
7. Camargo RVd, Silva-Sousa YTC, Rosa RPd, Mazzi-Chaves JF, Lopes FC, Steier L, et al. Evaluation of the Physicochemical Properties of Silicone- and Epoxy Resin-Based Root Canal Sealers. Braz. Oral Res. 2017; 31:e72.
8. Tanomaru-Filho M, Torres FFE, Chávez-Andrade GM, de Almeida M, Navarro LG, Steier L, et al. Physicochemical Properties and Volumetric Change of Silicone/Bioactive Glass and Calcium Silicate-based Endodontic Sealers. J Endod. 2017 ;43(12):2097-2101.
9. Hoikkala NJ, Wang X, Hupa L, Smätt JH, Peltonen J, Vallittu PK. Dissolution and Mineralization Characterization of Bioactive Glass Ceramic Containing Endodontic Sealer Guttaflow Bioseal. Dent Mater J. 2018; 37(6): 988-994.
10. Pedullà E, Abiad RS, Conte G, Khan K, Lazaridis K, Rapisarda E, et al. Retreatability of two hydraulic calcium silicate-based root canal sealers using rotary instrumentation with supplementary irrigant agitation protocols: a laboratory-based micro-computed tomographic analysis. Int Endod J. 2019; 52(9): 1377-1387.
11. Omran AN, Alhashimi RA. The Effect of AH Plus and GuttaFlow Bioseal Sealers on the Fracture Resistance of Endodontically Treated Roots Instrumented with Reciprocal Rotary Systems. International Journal of Medical Research & Health Sciences. 2019; 8(2): 102-108.