GuttaFlow Bioseal versus monocone obturation technique. A scanning electron microscopy study.

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INTRODUCTION

The understanding on how well GuttaFlow Bioseal (GFB) adapts to the root canal space is unclear and the evidence on its effectiveness is limited.

GFB is a newer obturation system, containing bioactive materials to promote hard tissue formation.

It is flowable, does not require heat source and expands slightly during setting, making it more effective at sealing the root canal system.

GFB has been evaluated for the material adaptation to the root canal wall [1, 2], cytotoxicity analysis [3, 4, 5] and physicochemical properties [6, 7] but when it comes to evaluating multiple aspects related to the obturation, the scientific evidence is not present at all.

OBJECTIVES

To compare the:

i. obturated surface area,
ii. extrusion of root filling material beyond the apical foramen,
iii. duration of obturation procedure between GFB and monocone.

METHODOLOGY

Part 1: Selection of samples

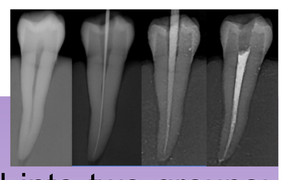
20 single-rooted mandibular premolars.

Part 2: Access cavity

Access cavity was prepared according to the standard procedure.

Part 3: Preparation of root canal

Hyflex CM rotary files (Coltène/Whaledent) at 500 rpm and 2.6 Ncm.



Part 4: Obturation procedure

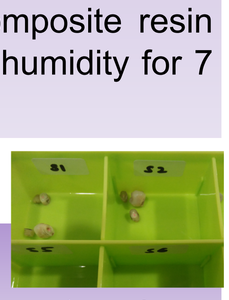
All prepared samples were divided into two groups; GFB and monocone.

The root filling material was delivered into the root canal using a special tip and the gutta-percha cone was then fitted into the root canal.

The duration of obturation was recorded with a digital timer.

The obturation radiograph was taken to assess the extrusion of root filling material.

Access cavities was restored with composite resin and all samples were stored in 100% humidity for 7 days.



Part 5: Tooth sectioning

Horizontal root section to obtained 3 root regions; apical 1/3, middle 1/3, coronal 1/3.

Part 6: Observation under scanning electron microscope

20x magnification.

Part 7: SketchAndCalc Area Calculator software

All images were transferred to the software for the evaluation of obturated surface area.

Part 8: Data analysis

SPSS version 25.0.

RESULTS

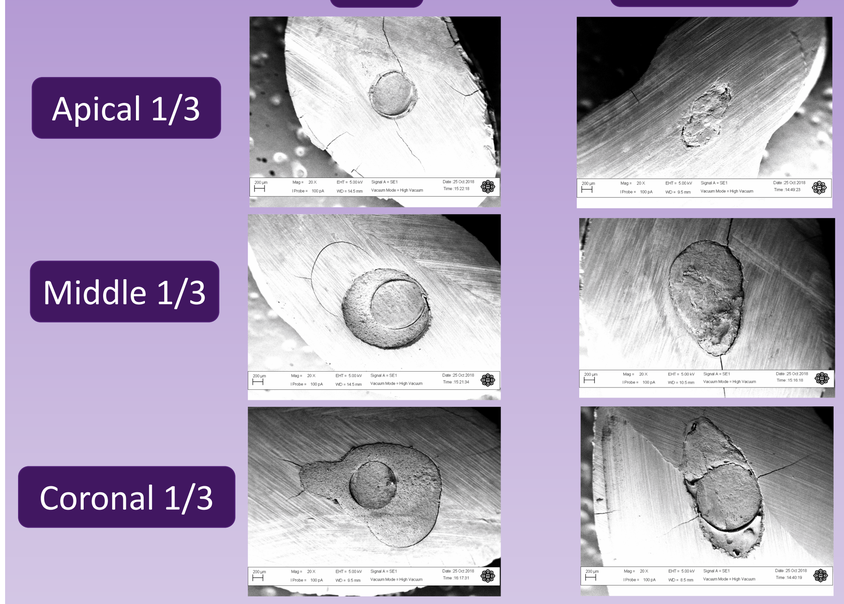


Figure 1: Observed SEM images of GFB and monocone

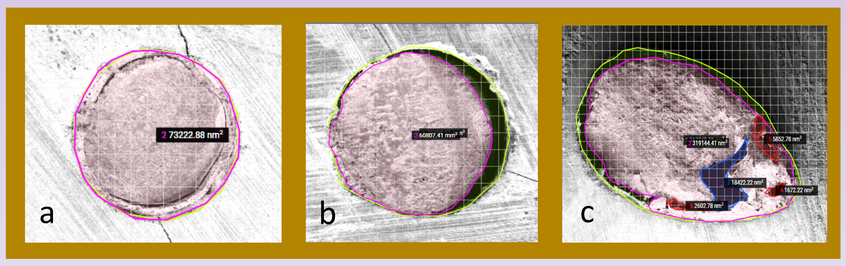


Figure 2: (a) Effective obturation, (b) marginal gaps, (c) combination of marginal gaps and voids within root filling material.

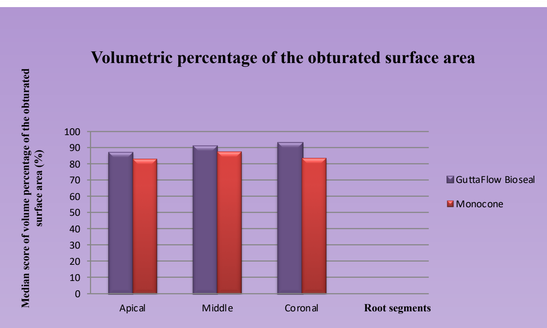


Figure 3: The obturated surface area.

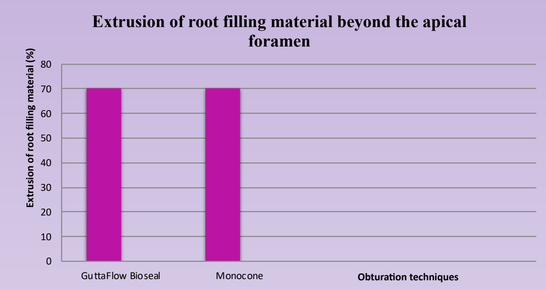


Figure 4: The extrusion of root filling material.

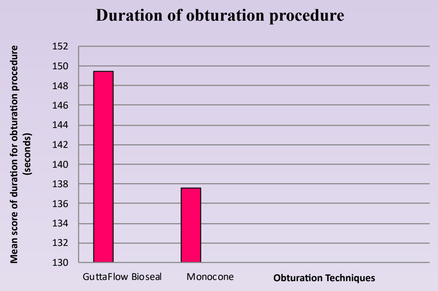


Figure 5: The duration of obturation procedure.

DISCUSSION

The present study was the first research evaluating multiple aspects related to the obturation using GFB in single-rooted mandibular premolars.

Three different levels (apical 1/3, middle 1/3, coronal 1/3) of the obturated surface area were observed under the SEM due to the root canal complexity and this approach was corroborated with the past studies [1, 8].

Similar obturated surface area was seen in both techniques at the apical 1/3 and middle 1/3 regions, but at the coronal 1/3 region the obturated surface area showed statistically significant difference. GFB was better than monocone could be due to two possible reasons;

1) adequate placement of GFB in the root canal.

2) root canal dimension.

The extrusion of root filling material beyond the apical foramen in both techniques was equivalent, could be attributed to the similar concepts of obturation technique and the material viscosity but the later was not possible to confirm because of beyond the scope of the present study. Perhaps, the material viscosity can be investigated for the future research works to validate this finding.

The duration of obturation procedure in both techniques showed statistically significant difference where the GFB required 8.6% longer than the monocone group. This could be due to the more amount of gutta-percha mass (combination of a gutta-percha cone and GFB) in which the removal of excess material took longer compared to the monocone group (combination of gutta-percha cone and root canal sealer).

CONCLUSIONS

Within the limitation of the present study, the conclusions that could be made were:

i. The obturated surface area at the apical 1/3 and middle 1/3 regions between GFB and monocone was comparable but at the coronal 1/3 the former showed 11.5% better.
ii. The extrusion of root filling material beyond the apical foramen between GFB and monocone was equivalent.
iii. The duration of obturation procedure with GFB was 8.6% longer than the monocone.

Both obturation techniques could be implemented depending on the individual cases. Further research on how to improve the limitations in both techniques could be done for future clinical practice.

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