

GUTTAFLOW BIOSEAL VERSUS MONOCONE OBTURATION TECHNIQUE. A SCANNING ELECTRON MICROSCOPY STUDY.

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INTRODUCTION

The adaptation of root filling materials on the root canal wall has been studied for many years.

To date, the warm vertical compaction technique has been the gold standard of thermoplasticised gutta-percha technique because of the ability to seal root canal three-dimensionally.

However, the presence of a newer obturation system (GuttaFlow Bioseal) which is flowable and does not require heat source has drawn the attention of researchers whether or not it can provide similar results as of the thermoplasticised gutta-percha.

The effectiveness of this method is still unknown due to lack of evidence although being highlighted by the manufacturer that it expands slightly during setting, the procedure is less time consuming, does not require additional sealer and able to provide good adaptation to the root canal wall. In addition, it has bioactive glass, therefore, can have biocompatible property.

GuttaFlow Bioseal was analysed for the cytotoxicity potential (Collado-González et. al., 2017, Saygili et. al., 2017) and chemical stability (Gandolfi et. al., 2017, Filho et. al., 2017) but limited for the sealing ability.

AIMS AND OBJECTIVES

- To compare the sealing ability between GuttaFlow Bioseal and monocone obturation techniques using Scanning Electron Microscope.
- To identify aspects related to obturation:
 - i. Extrusion of obturation materials beyond apical foramen.
 - ii. Duration of time required for obturation.

METHODS AND MATERIALS

PART 1: SAMPLE SELECTION

- 20 single-rooted mandibular premolars.

PART 2: ACCESS CAVITY

- Access cavity was prepared according to the standard procedure.

PART 3: ROOT CANAL PREPARATION

- Hyflex CM rotary files at 500rpm and 2.6Ncm.

PART 4: OBTURATION

- All prepared samples were divided into two groups; GuttaFlow Bioseal and monocone.
- The materials were delivered into the root canal using special tip and the master gutta-percha was then fitted in.
- Access cavity was restored with composite resin and all samples were stored in 100% humidity for 7 days.

PART 5: PREPARATION FOR SCANNING ELECTRON MICROSCOPY (SEM)

- Root sectioning (Apical 1/3, Middle 1/3, Coronal 1/3).
- Dehydration with ethanol.

PART 6: OBSERVATION UNDER SEM

- Resected root samples were observed at 20x magnification.

PART 7: SketchAndCalc AREA CALCULATOR SOFTWARE

- Evaluation of root canals sealed with root filling materials.

PART 8: DATA ANALYSIS

- The data was analyzed using SPSS version 23.0.

RESULTS

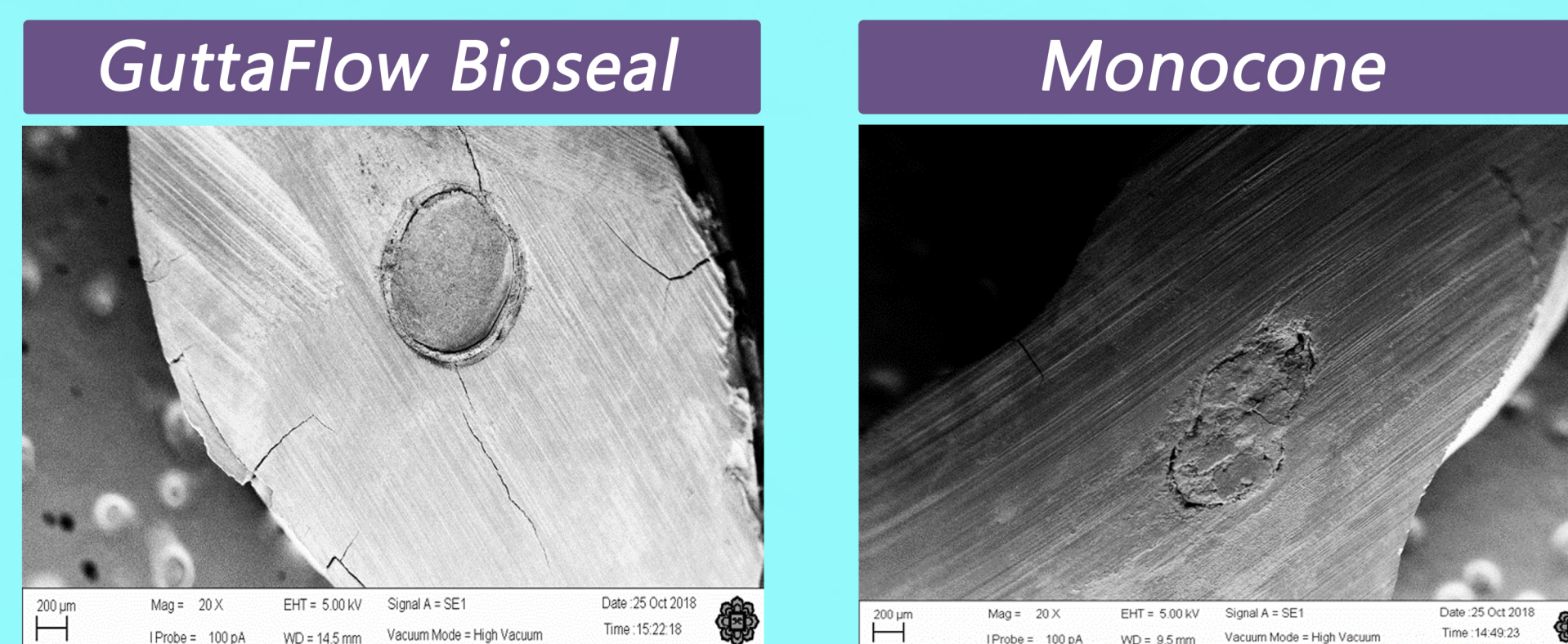


Figure 1: Apical 1/3 of the root.

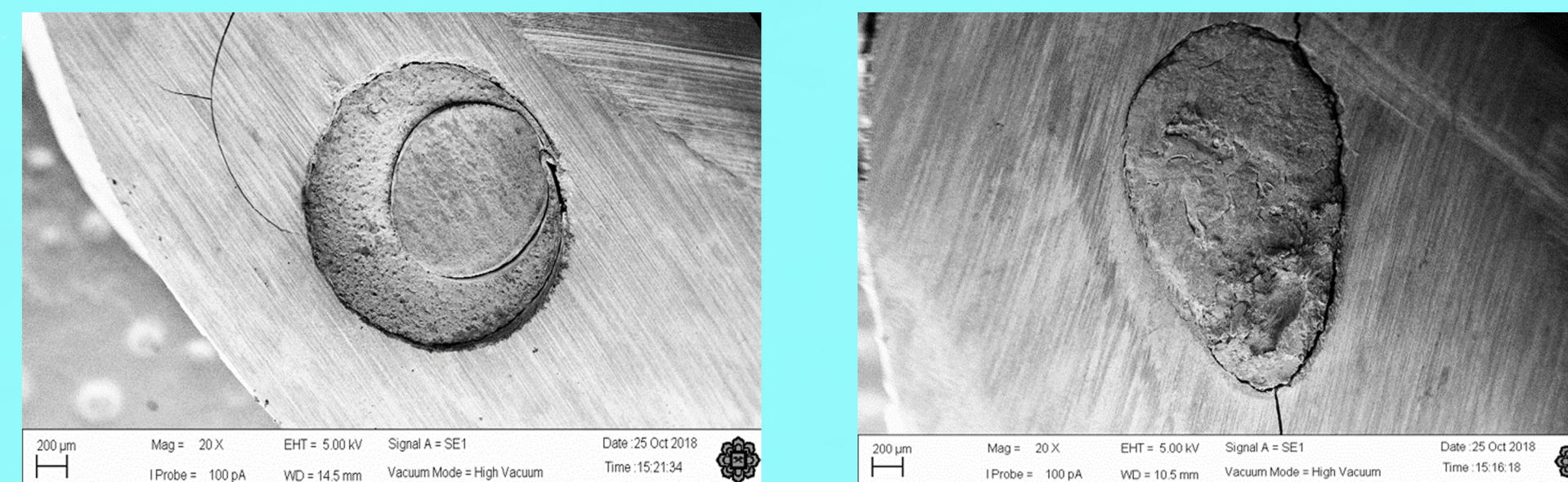


Figure 2: Middle 1/3 of the root

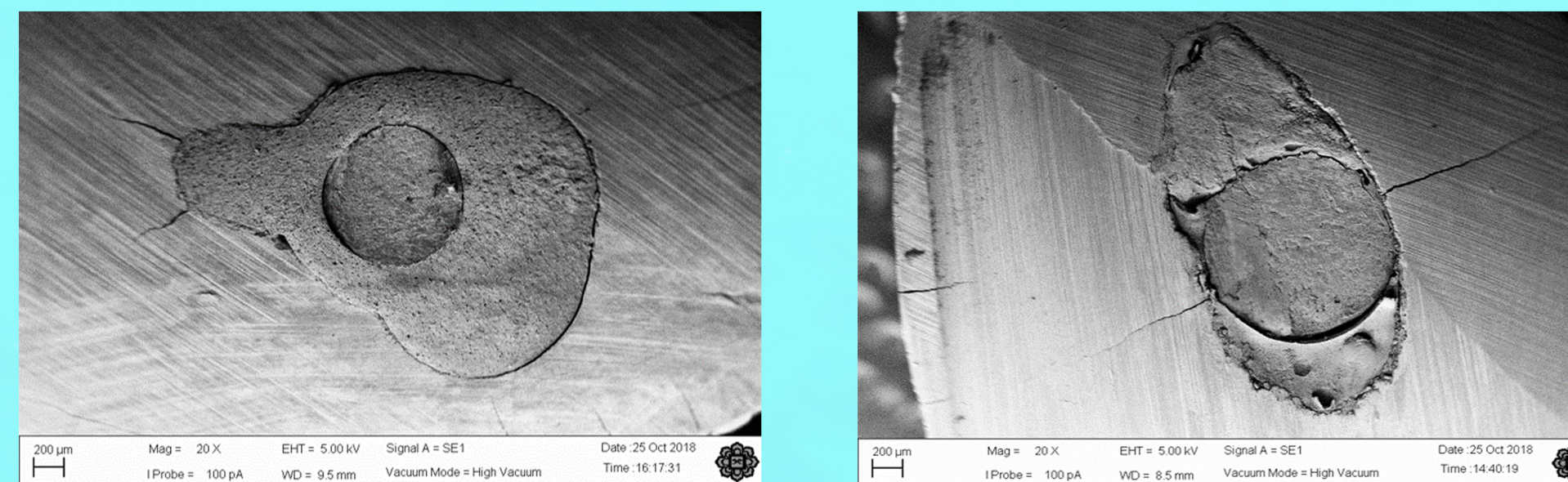


Figure 3: Coronal 1/3 of the root

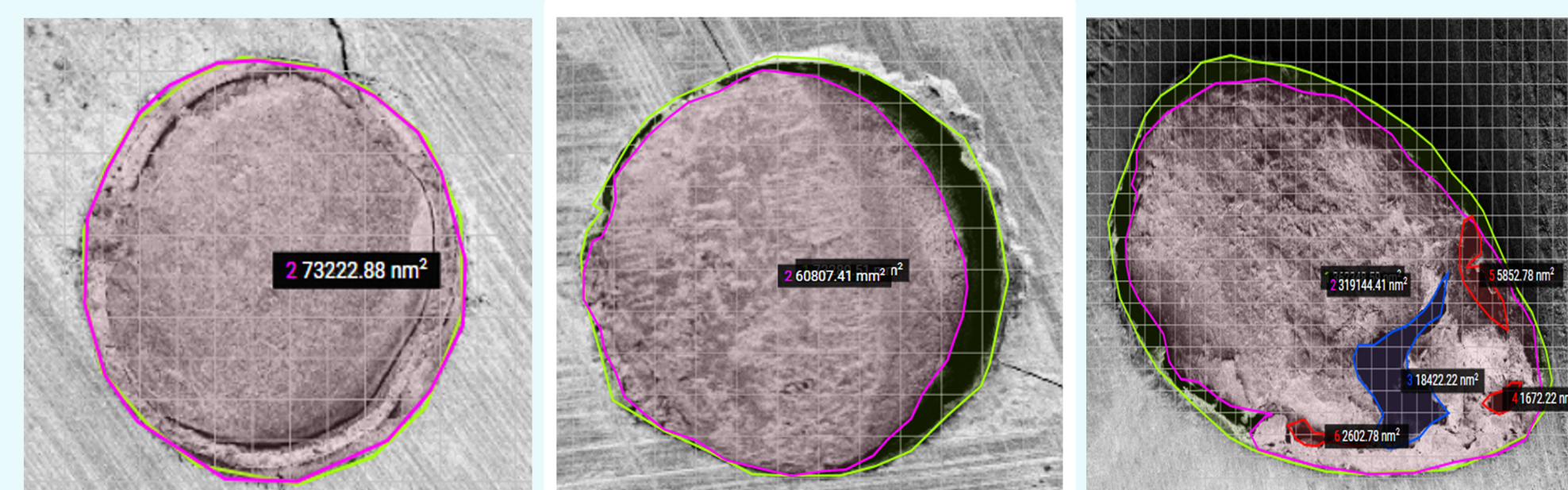


Figure 4a: Effective seal depicted by the overlapping of two different colored lines

Figure 4b: Gaps between walls and root filling material depicted by the empty space between two lines

Figure 4c: Combination of gaps and voids within material, distinguished by the multiple lines

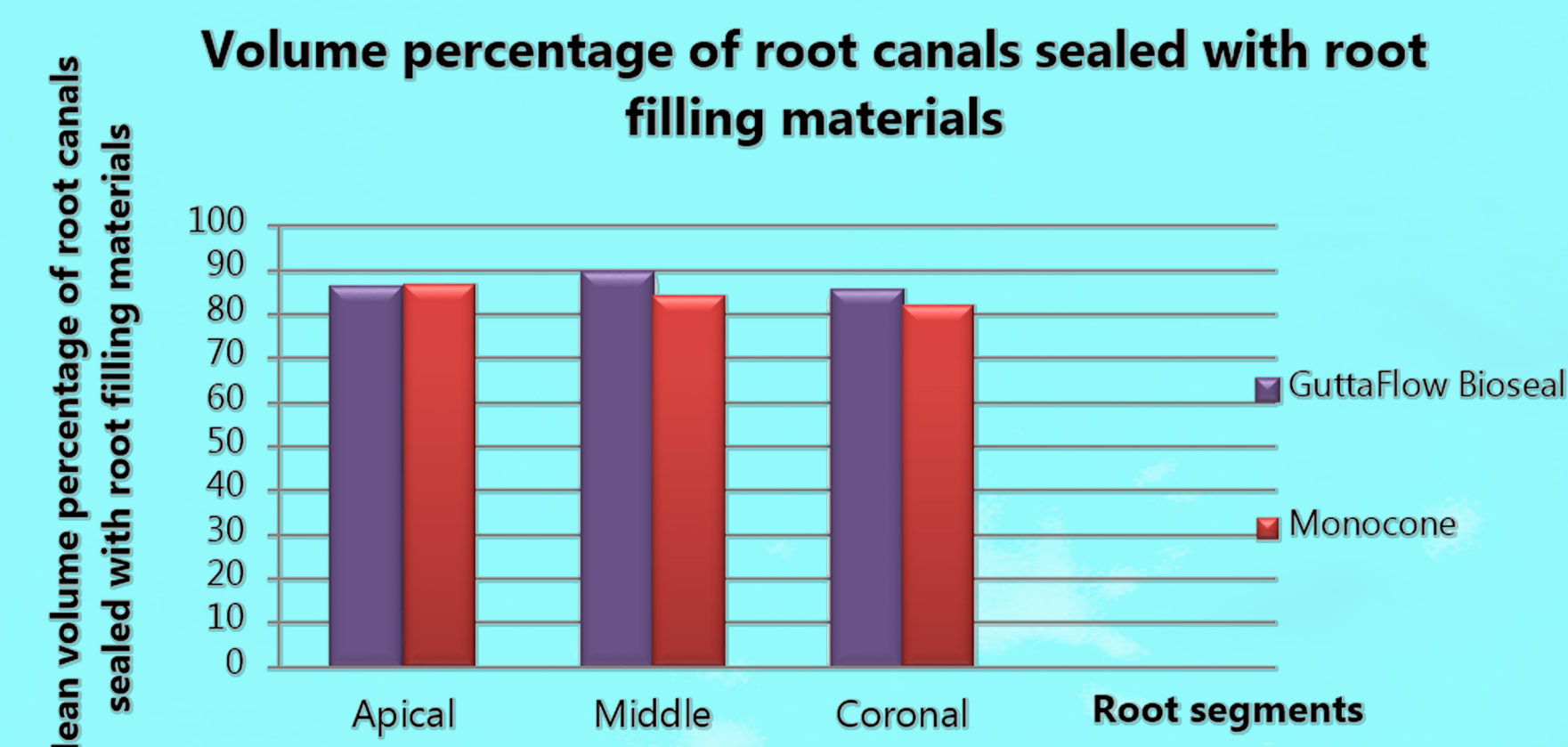


Figure 5: Mean volume percentage of root canals sealed with root filling materials at three different levels.

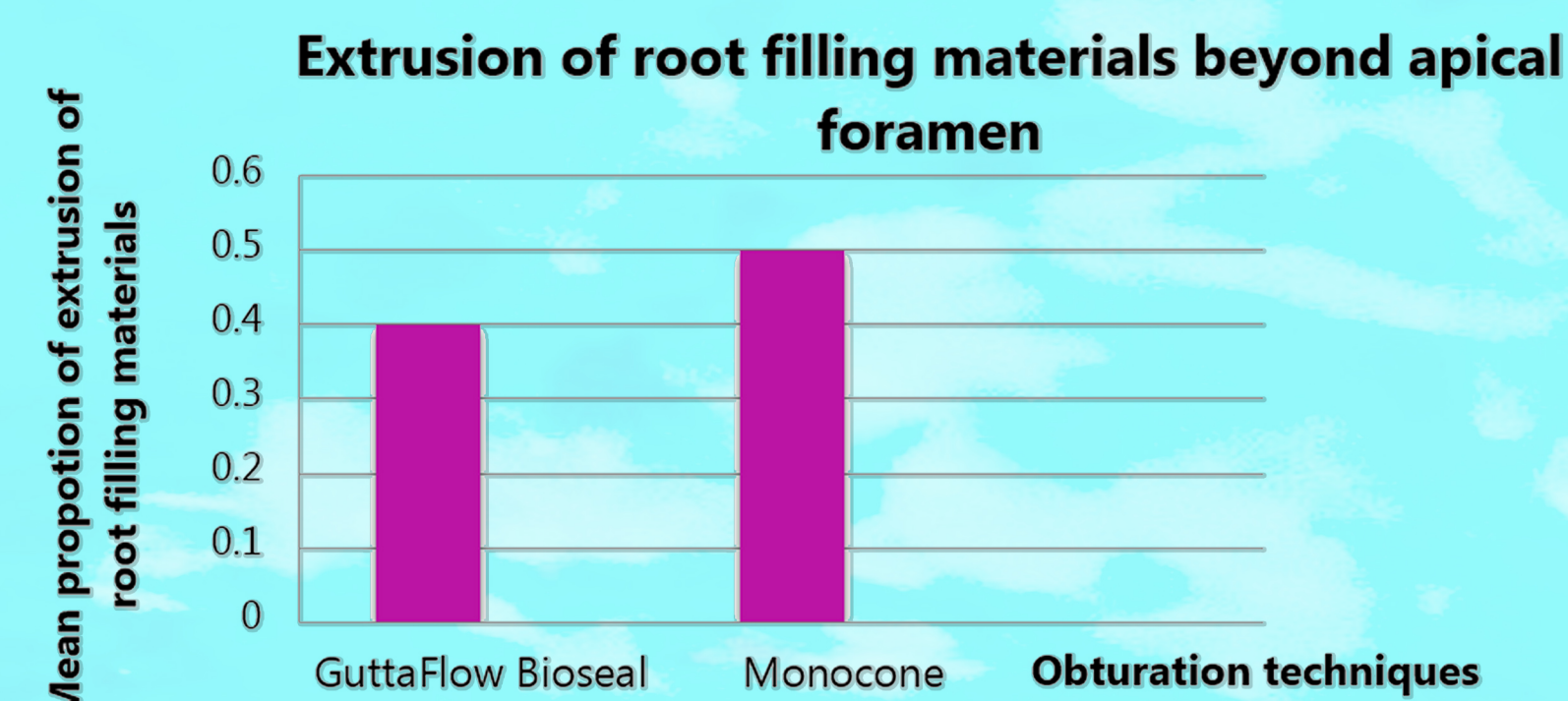


Figure 6: Mean proportion of extrusion of root filling materials beyond apical foramen

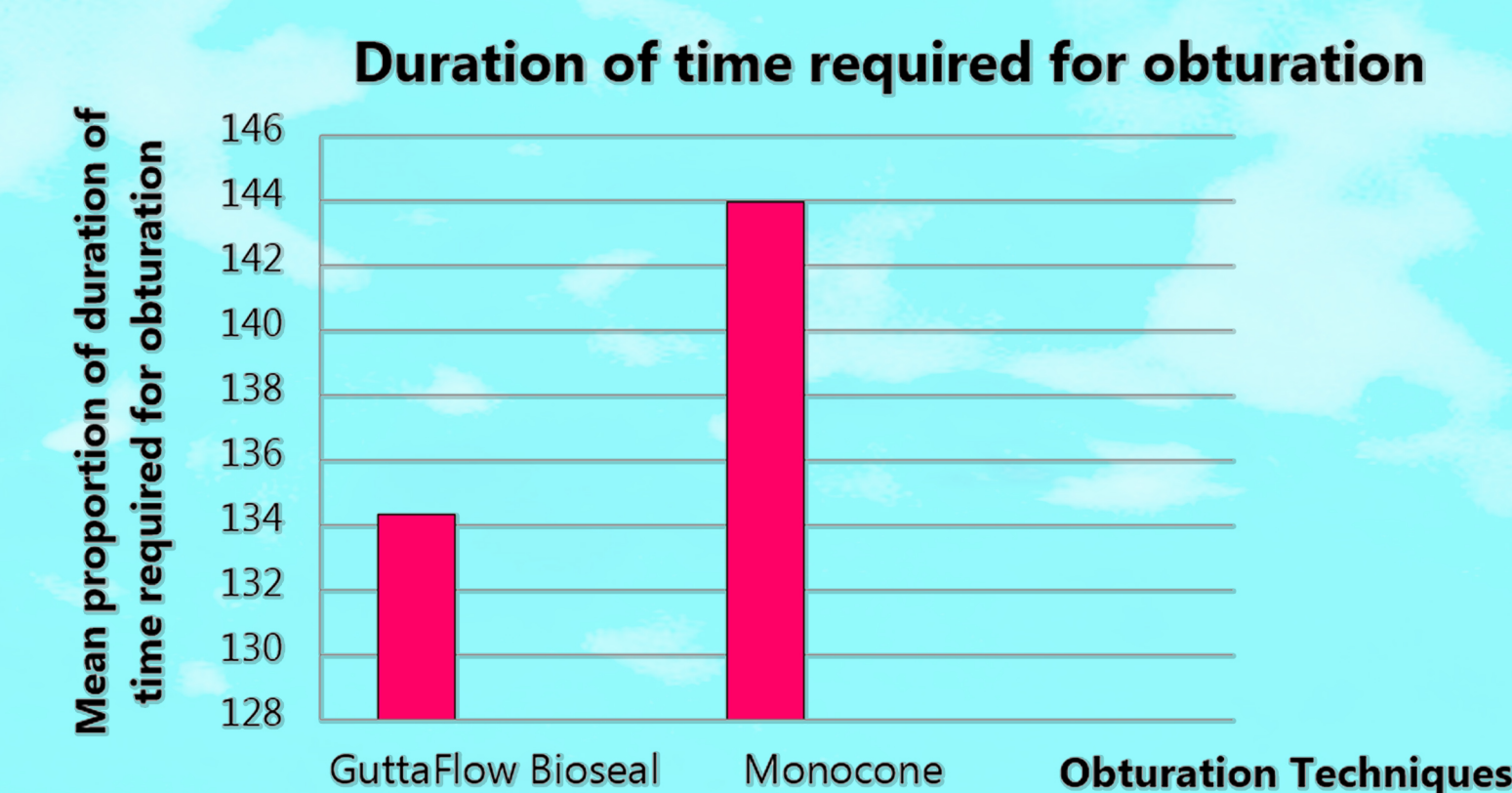


Figure 7: Mean duration of time required for obturation

DISCUSSIONS

The present study was the first research to evaluate sealing ability of GuttaFlow Bioseal on the root canal wall using human single-rooted mandibular premolars, therefore, a direct comparison of the results to the previous studies was not possible to be made.

With regards to the presence of gaps and voids in the present study, it could be seen in almost all samples. This was in agreement with the previous studies (Nabavizadeh et al., 2013, Samadi et al., 2014, Gok et. al., 2017, Jain and Adhikari 2018, Adhikari and Jain 2018) where the gaps and voids were present in all samples.

The evaluation of sealing ability at three different levels of the root canal in the present study was supported by Guigand et al., 2005 and Akcay et al., 2016. This approach was chosen because the evaluation at each level provided more valuable information on the whole structure compared with a certain aspect in the root canal.

The use of 10 samples per group was also used in previous studies (Torabinejad et al., 1978, Nabavizadeh et al., 2013, Selem et al., 2014, Jain and Adhikari 2018, Adhikari and Jain 2018). The use of larger sample size provides more data to work with but would require larger financial and time commitments.

The present and previous studies differed in many aspects and this could be due to the research interests of the authors and the availability of different materials at the time of conducting research, each with its own limitations and the interpretation of the results should be carefully made.

CONCLUSIONS

Within the limitation of this study, the conclusion that could be made were:

- The sealing ability between GuttaFlow Bioseal and monocone obturation techniques was comparable at any level of evaluation.
- GuttaFlow Bioseal showed 25% less extrusion than the monocone obturation technique although this was not statistically significant difference.
- GuttaFlow Bioseal required 7.15% shorter duration of time for obturation than monocone obturation technique although this was not statistically significant difference.
- The sealing ability, the extrusion of root filling materials beyond apical foramen and the duration of obturation between GuttaFlow Bioseal and monocone obturation techniques were comparable.

REFERENCES

1. Gandolfi MG, Siboni F, Prati C.(2016). Properties of a novel polysiloxane-guttapercha calcium silicate-bioglass-containing root canal sealer. Dent Mater. 2016 May;32(5):e113-26
2. Torabinejad, Mahmoud et al.(1978). Scanning electron microscopic study of root canal obturation using thermoplasticized gutta-percha. J Endod , Volume 4, Issue 8 , 245 – 250.
3. Nabavizadeh MR., Moazami F., Sedigh Shamsi M., Emami Z. (2013). Comparison of the Percentage of Voids following Root Canal Obturation with Gutta Percha and AH26 Sealer Using Four Different Sealer Placement Techniques. Journal of Islamic Dental Association of IRAN (JIIDA) Fall 2013 ;25, (3).
4. Selem LC, Li GH, Niu LN, Bergeron BE, Bortoluzzi EA, Chen JH, Pashley DH, Tay FR (2014) Quality of obturation achieved by a non-gutta-percha-based root filling system in single-rooted canals. J Endod 40:2003–2008Jain, S., & Adhikari, H. D. (2018). Scanning electron microscopic evaluation of marginal adaptation of AH-plus, GuttaFlow, and RealSeal at apical one-third of root canals-Part I: Dentin-sealer interface. Journal of conservative dentistry: JCD, 21(1), 85-89
5. Adhikari, H. D., & Jain, S. (2018). Scanning electron microscopic evaluation of marginal adaptation of AH-Plus, GuttaFlow, and RealSeal at apical one-third of root canals - Part II: Core-sealer interface. Journal of conservative dentistry : JCD, 21(1), 90-94.
6. Samadi, F., Jaiswal, J., Saha, S., Garg, N., Chowdhary, S., Samadi, F., & Tripathi, V. P. (2014). A Comparative Evaluation of Efficacy of Different Obturation Techniques used in Root Canal Treatment of Anterior Teeth: An in vitro Study. International journal of clinical pediatric dentistry, 7(1), 1-5.Akcay, M., Arslan, H., Durmus, N., Mese, M. and Capar, I. D. (2016). 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., 48: 70-76. doi:10.1002/lsm.22446.
7. Al-Afifi NA, Abdullah M, Al-Amery SM, Abdulmunem M. (2016). Comparison between gutta-percha and resin-coated gutta-percha using different obturation techniques. Journal of Applied Biomaterials & Functional Materials. 2016, Vol. 14 Issue 3, pe307-e313. 7p.
8. Guigand M, Glez D, Sibayan E, Cathelineau G, Vulcain JM. Comparative study of two canal obturation techniques by image analysis and EDS microanalysis. Br Dent J. 2005;198:707–11.
9. 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;43:1559-64

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