

ORIGINAL RESEARCH

Assessment of sealing ability of two different single-cone obturation systems during root canal therapy: A comparative study

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ABSTRACT:

Background: The success of a root canal therapy strongly depends on creating a fluid-tight apical and coronal seal. The sealing ability is a basic feature that needs to be tested for every root canal filling material or technique. Hence; the present study was undertaken for assessing the sealing ability of two different single-cone obturation systems during root canal therapy. **Materials & methods:** A total of 40 freshly extracted mandibular first premolars were included in the present study. Cutting of all the specimens was done below the level of cement-enamel junction. Afterwards, all the specimens were broadly divided into two study groups with 20 specimens in each group as follows: Group 1: Single cone-technique with Gutta Percha (0.06 taper) + AH Plus sealer; and Group 2: Single cone-technique with Gutta Percha (0.06 taper) + Guttaflow2. Application of the prepared sealers was done into root canals using lentulo spiral instrument. After coating with a sealer, master gutta-percha cone was placed into the root canal at the full working length. Excess Gutta-percha was cut at the orifice level with a flame-heated hand plugger and vertically compacted. Microleakage along the root canal was evaluated using the glucose leakage model. **Results:** Mean glucose leakage concentration among the specimens of group 1 at day 1, 1 week and 1 month time interval was found to be 0.61 mg/dl, 5.96 mg/dl and 14.11 mg/dl respectively. Significant results were obtained while comparing the mean glucose concentrations within group 1 at different time intervals. In the present study, mean glucose leakage concentration among the specimens of group 2 at day 1, 1 week and 1 month time interval was found to be 1.58 mg/dl, 4.12 mg/dl and 8.36 mg/dl respectively. Significant results were obtained while comparing the mean glucose concentrations within group 2 at different time intervals. Also while comparing between the two study groups, it was found that mean microleakage was significantly higher among specimens of group 1 at 1 week and 1 month time interval.

Conclusion: Both the techniques showed some quantity of microleakage with microleakage being significantly higher in case of AH Plus sealer group.

Key words: Obturation, Single cone, Root canal therapy

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INTRODUCTION

materials and methods have been introduced for obturating an instrumented root canal. Endodontic sealers play a critical role in providing an impervious seal. They fill the irregularities and minor discrepancies between the root canal walls and core filling material. However, inappropriate sealer coating may result in voids and permit bacterial microleakage which can potentially lead to treatment failure. A variety of sealers have been used for this purpose including zinc oxide-eugenol (ZOE)-based cements, glass ionomer cements, polymer-based sealers, calcium hydroxide-based sealers and silicon-based sealers.¹⁻³

GuttaFlow2 (Coltene/Whaledent, Altstätten, Switzerland) is a cold flowable; self-curing material and composed of Gutta-percha powder, polydimethylsiloxane and nano silver particles. It has a better seal and good adaptability because of its high flowability and setting expansion. The sealing ability is a basic feature that needs to be tested for every root canal filling material or technique. A variety of laboratory-based experimental methods are used to detect and measure leakage along root fillings. These methods include dye penetration, spectrometry of radioisotopes, fluorometric and electrometric methods, bacterial penetration and fluid transport model.^{4, 5} Hence; the present study was undertaken for assessing the sealing ability of two different single-cone obturation systems during root canal therapy.

MATERIALS & METHODS

The present study was conducted with the aim of assessing the sealing ability of two different single-cone obturation systems during root canal therapy. A total of 40 freshly extracted mandibular first premolars were included in the present study. Cutting of all the specimens was done below the level of cement-enamel junction. Standardization of root length was done. Estimation of working length was done followed by instrumentation by NiTi rotary instruments. Regular irrigation of the canals was done using 3% sodium hypochlorite (NaOCl) solution. Afterwards, all the specimens were broadly divided into two study groups with 20 specimens in each group as follows:

Group 1: Single cone-technique with Gutta Percha (0.06 taper) + AH Plus sealer; and

Group 2: Single cone-technique with Gutta Percha (0.06 taper) + Guttaflow2

Application of the prepared sealers was done into root canals using lentulo spiral instrument. After coating with a sealer, master gutta-percha cone was placed into the root canal at the full working length. Excess Gutta-percha was cut at the orifice level with a flame-heated hand plugger and vertically compacted. Microleakage along the root canal was evaluated using the glucose leakage model as described by Xu et al.⁵ The concentrations of leaked glucose (mg/dl) were measured subsequently in a spectrophotometer. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Chi- square test and student t test were used for assessment of level of significance.

RESULTS

In the present study, a total of 40 specimens were analysed and were broadly divided into two study groups with 20 specimens in each group. Group 1 included specimens in which Single cone-technique with Gutta Percha (0.06 taper) + AH Plus sealer was used while group 2 included specimens in which Single cone-technique with Gutta Percha (0.06 taper) + Guttaflow2 was used. Mean glucose leakage concentration among the specimens of group 1 at day 1, 1 week and 1 month time interval was found to be 0.61 mg/dl, 5.96 mg/dl and 14.11 mg/dl respectively. Significant results were obtained while comparing the mean glucose concentrations within group 1 at different time intervals. In the present study, mean glucose leakage concentration among the specimens of group 2 at day 1, 1 week and 1 month time interval was found to be 1.58 mg/dl, 4.12 mg/dl and 8.36 mg/dl respectively. Significant results were obtained while comparing the mean glucose concentrations within group 2 at different time intervals. Also while comparing between the two study groups, it was found that mean microleakage was significantly higher among specimens of group 1 at 1 week and 1 month time interval.

DISCUSSION

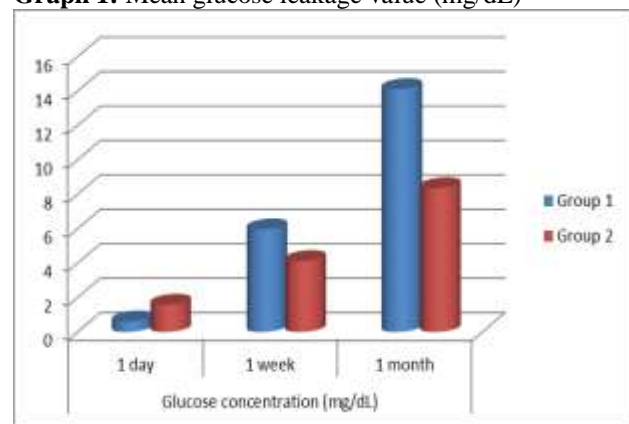
Obturation of the cleaned and shaped root canal system is a critical step in root canal therapy to inhibit the penetration of bacteria and their by-products into the

cleaned and disinfected root canal system, as well as preventing the recolonization of bacteria remaining after root canal therapy. Providing a filling in the root canal capable of sealing the coronal, apical, and lateral openings is one of the main treatment objectives. Sealing the root canal system relies on the adequate adaptation of a filling material to obliterate the canal space and its intricacies: fins, deltas, isthmuses and lateral canals. Obturation of the root canal system hermetically, both apically and coronally, prevents leakage and contamination of the root canal space.⁵⁻⁷

Table 1: Comparison of glucose leakage value (mg/dL)

Group	Glucose concentration (mg/dL)			p- value
	1 day	1 week	1 month	
Group 1	0.61	5.96	14.11	0.002 (Significant)
Group 2	1.58	4.12	8.36	0.007 (Significant)
p- value	0.023 (Significant)	0.046 (Significant)	0.00 (Significant)	-

Graph 1: Mean glucose leakage value (mg/dL)



The sealing ability is a basic feature that needs to be tested for every root canal filling material or technique. Various test methods have been described to evaluate the quality of the seal by such methods as dye penetration, radioactive isotopes test, bacteria or bacterial metabolites leakage test, electrochemical technique, and fluid filtration.^{8,9} Hence; the present study was undertaken for assessing the sealing ability of two different single-cone obturation systems during root canal therapy.

In the present study, a total of 40 specimens were analysed and were broadly divided into two study groups with 20 specimens in each group. Group 1 included specimens in which Single cone-technique with Gutta Percha (0.06 taper) + AH Plus sealer was used while group 2 included specimens in which Single cone-technique with Gutta Percha (0.06 taper) + Guttaflow2 was used. Mean glucose leakage concentration among the specimens of group 1 at day 1, 1 week and 1 month time interval was found to be 0.61 mg/dl, 5.96 mg/dl and 14.11 mg/dl respectively. Significant results were obtained

while comparing the mean glucose concentrations within group 1 at different time intervals. El Sayed MA et al compares the coronal-apical sealing ability of three single-cone obturation systems using a glucose leakage model. A total of 90 extracted maxillary single rooted teeth were selected and their crowns were cut. The root canal of each sample was instrumented using a rotary crown down technique and then divided into four experimental (n = 20 each) and two control groups (n = 5 each). Samples in the experimental groups were filled as follows: Group 1, cold lateral condensation using Gutta-percha/AH Plus; Group 2, single-cone Gutta-percha and AH Plus; Group 3, single-cone Gutta-percha and GuttaFlow2; Group 4, single-cone Resilon/RealSeal SE after 7 days, the sealing ability of root canal fillings was tested at different time intervals using glucose leakage model. The four experimental groups presented significantly different glucose leakage values at all test periods ($P < 0.05$). At the end of the observation period, the cumulative glucose leakage values of Groups 3 and 4 were significantly lower than those of Groups 1 and 2 ($P < 0.05$). Gutta-percha/GuttaFlow2 or Resilon/RealSeal SE combinations provided the superior sealing ability over the lateral condensation technique.⁹

In the present study, mean glucose leakage concentration among the specimens of group 2 at day 1, 1 week and 1 month time interval was found to be 1.58 mg/dl, 4.12 mg/dl and 8.36 mg/dl respectively. Significant results were obtained while comparing the mean glucose concentrations within group 2 at different time intervals. Also while comparing between the two study groups, it was found that mean microleakage was significantly higher among specimens of group 1 at 1 week and 1 month time interval. Samiei M et al evaluated the sealing ability of single-cone obturation technique with mineral trioxide aggregate and calcium-enriched mixture based on bacterial leakage approach. Sixty-four single-canal teeth were prepared and randomly divided into 5 groups, consisting of three experimental groups (n = 16) and two control groups (n = 8). In group 1, root canal obturation was performed using gutta-percha with 0.02 taper and AH26 sealer by lateral compaction technique. In groups 2 and 3, single Protaper gutta-percha cone was used for obturation with MTA and CEM cement, respectively. A bacterial leakage apparatus was utilized for leakage assessment for 60 days. The mean bacterial leakage intervals in groups 1, 2 and 3 were 33.68 ± 9.39 , 40.68 ± 11.03 and 39.56 ± 9.03 days, respectively. One-way

ANOVA indicated no significant differences in bacterial leakage between the three experimental groups ($P = 0.109$). Single-cone obturation with well-fitted gutta-percha and MTA and CEM cement is an appropriate alternative for traditional lateral compaction technique.¹⁰

CONCLUSION

From the above results, the authors concluded that both the techniques showed some quantity of microleakage with microleakage being significantly higher in case of AH Plus sealer group. However; further studies are recommended.

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