

ORIGINAL RESEARCH

Three-dimensional Obturation “Thrill to fill”

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ABSTRACT

To compare and evaluate the volume inadequacy of two different obturation techniques using cone beam computed tomography (CBCT) in an *in vitro* study.

Aim: The aim of this study was to evaluate the adequacy of two obturation techniques, namely, Calamus and Thermafil, via volume rendering method utilizing a three-dimensional (3D) cone beam computed tomography.

Materials and methods: Sixty freshly extracted single rooted teeth (maxillary first premolar) were collected and randomly allocated to two groups. Biomechanical preparation was done in all the teeth using rotary instruments. The teeth were placed in a CBCT scanner and imaged before obturation. The teeth were then obturated through following methods: group 1 – Calamus and group 2 – Thermafil. Evaluation of the volume of pulp chamber and gutta-percha after obturation was done via volume rendering technique, which reflects the adequacy of obturating system.

Results: There is a statistical difference between the Thermafil and Calamus with regard to the adequacy of obturation. The 3D obturating material Calamus has less volume inadequacy as compared to Thermafil.

Conclusion: The adequacy of obturation was better with Calamus than with Thermafil. But the research with regard to Calamus and Thermafil still continues in endodontics as a 3D obturating material.

Keywords: Calamus, Cone beam computed tomography, Thermafil, Three-dimensional obturation, Warm vertical compaction.

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INTRODUCTION

Stephen Cohen stated that the complete obturation of root canal system to the cement–dental junction is

an important goal in endodontic treatment. To achieve this goal, the root canal filling must seal the pulp space both apically and laterally to prevent further apical irritation from incomplete elimination of bacterial products.¹

In the past, the adequacy of root canal filling procedure was primarily based on its vertical appearance on the dental radiograph and whether the material had reached the radiographic apex or not. But now what is required is a deeper appreciation of the importance of filling canals laterally as well as vertically.¹

Herbert Schilder describes the final objective of endodontic procedure as being the “total obturation of root canal space” or filling the radicular space three-dimensionally. Rich Mounce in 2004 defined three-dimensional (3D) obturation as placing a homogeneous and dense filling material, from the canal orifice to the minor constriction of the apical foramina, as well as into all anatomical ramifications. Clifford Ruddle described that 3D obturation is done in a space that differs from root to root and teeth to teeth, thus it becomes a challenge to cleaning and shaping.²

Shaping of the canal always facilitates the 3D obturation by allowing prefit pluggers to work deep and move the thermosoftened gutta-percha into all aspects of the root canal. Gutta-percha is the most important root canal filling material accepted in dentistry today because it is least irritating and least toxic. A variety of thermoplasticized gutta-percha techniques are available for the 3D obturation.³

Since not much research is available on the volume adequacy and 3D obturation of the material; thus, the aim of our study was to evaluate the volume adequacy of 3D obturating techniques, namely, Thermafil and Calamus utilizing cone beam computed tomography (CBCT).

MATERIALS AND METHODS

Sixty freshly extracted single-rooted teeth (maxillary first premolar) were selected for this study (Fig. 1), and were stored in normal saline. Access cavity was prepared in all teeth using no. 4 round bur, followed by coronal enlargement using Gates Glidden drills.

Glide path was created using path files (Fig. 2). Working length was determined and canal preparation was done in all teeth using rotary protaper up to F2 (Fig. 3). Any calcific obstruction, if present was negotiated with ethylene

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Fig. 1: Specimens used in this study

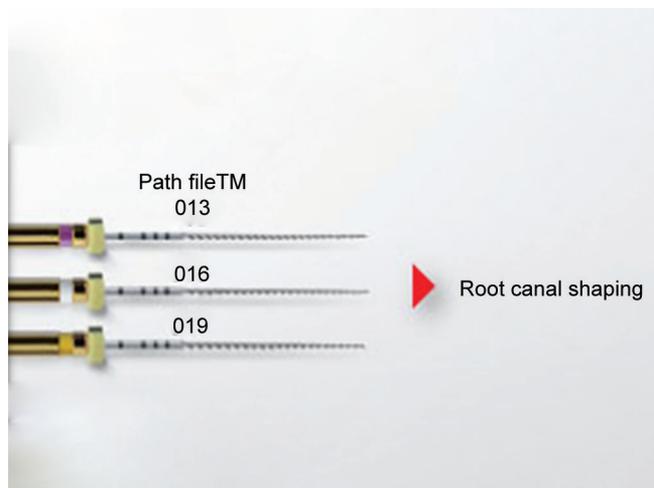


Fig. 2: Path files for creating a glide path



Fig. 3: Rotary protapers used for the biomechanical preparation

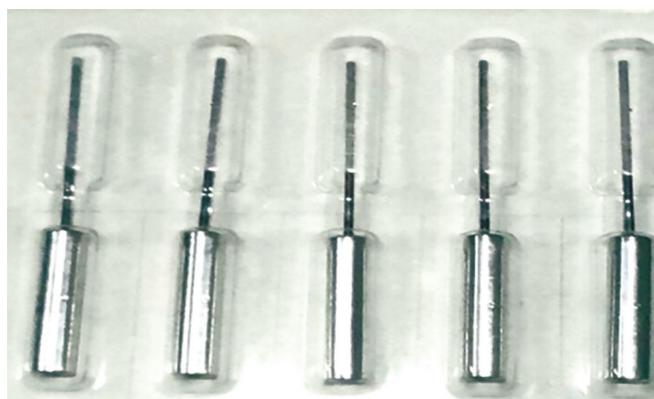


Fig. 4: Calamus for 3D obturation

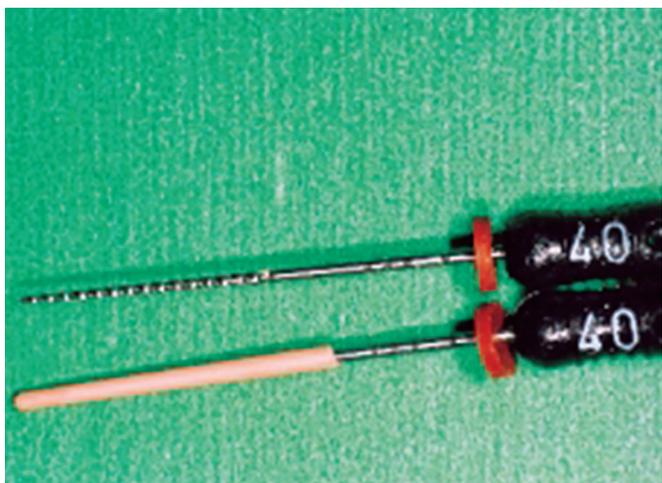


Fig. 5: Thermafil for 3D obturation

diamine tetra acetic acid (EDTA). Copious irrigation was done with 5% sodium hypochlorite and normal saline. The canals were dried with sterile paper points.

Cone beam computed tomography scanner was used for the details of the canals after cleaning and shaping and before obturation. The teeth were divided into two

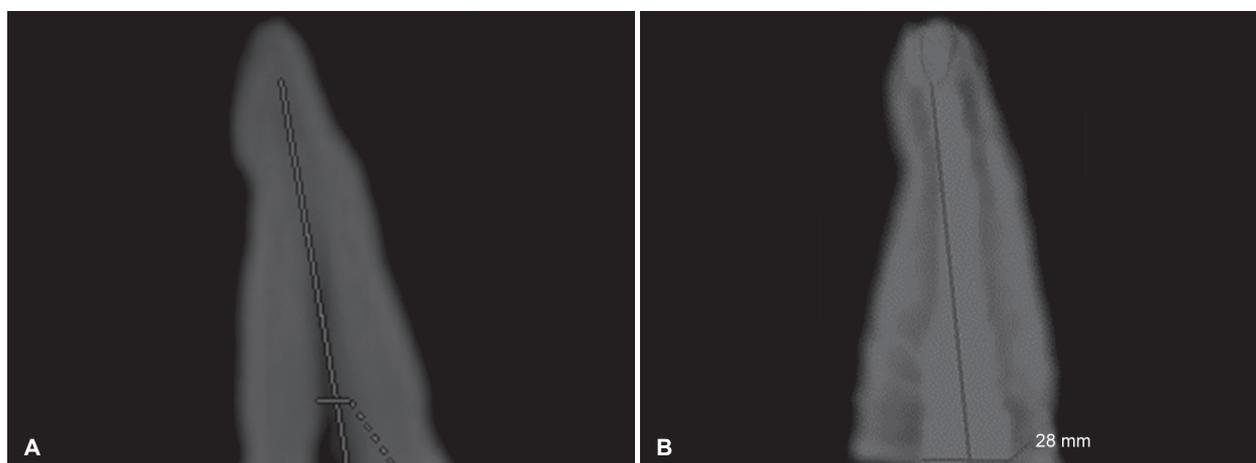
groups, namely, group 1 – Calamus (that is based on the warm vertical compaction) and group 2 – Thermafil (involves the core carrier technique) (Figs 4 and 5). AH Plus was used as a sealer in both the groups. After obturation, volumetric analysis of the obturated space was done using the DICOM software utilized in the CBCT scanner.⁴

RESULTS

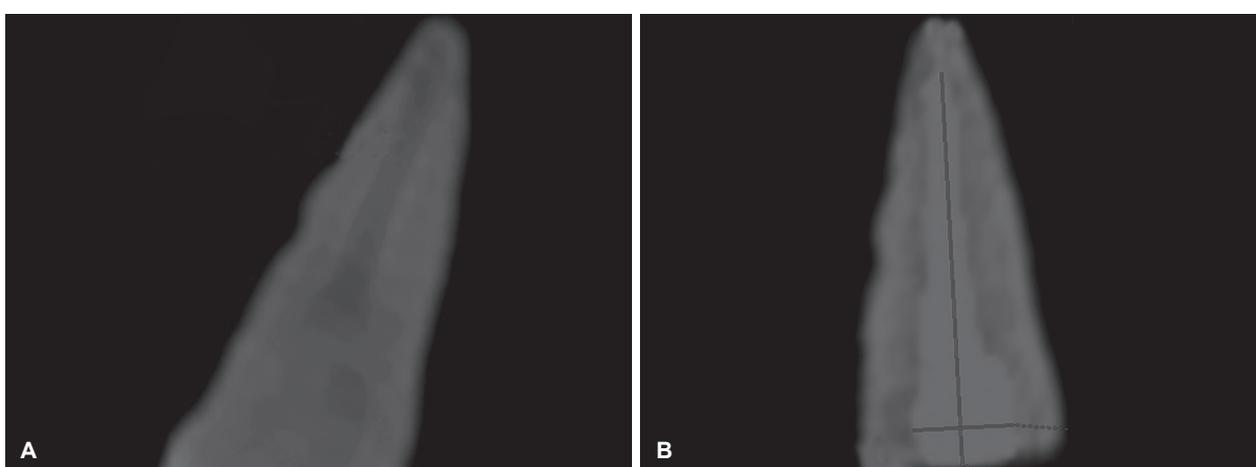
The mean and the standard deviation (Figs 6 and 7) of the two obturating material were calculated before and after obturation and their volume inadequacy was determined (Table 1). The volume inadequacy in group 1 (Calamus) was 2.33, but in group 2 (Thermafil) it was 7.13 (volumes were measured in cubic mm).

Wilcoxon signed rank test was used to evaluate the p value. The p value was found to be 0.005, which states that the difference between the volume inadequacy between the two group was significant.

The test of significance is shown using the p value in Table 2.



Figs 6A and B: Group 1 (A) Before obturation, and (B) after obturation



Figs 7A and B: Group 2 (A) Before obturation, and (B) after obturation

Table 1: Mean and SD were calculated before and after obturation, and their volume inadequacy was determined

	<i>Before obturation</i>	<i>After obturation</i>	<i>Volume inadequacy</i>
Group 1	20.702 SD= 4.417	113.917 SD=2.220	93.215 (2.334)
Group 2	28.806 SD=1.311	167.2 SD=6.67	138.314 (7.138)

Table 2: Test of significance

<i>Groups</i>	<i>p-value</i>	<i>Test of significance</i>
Gr 1 vs Gr 2	0.005	Significance

DISCUSSION

Gutta-percha is by far the most universally used solid core root canal filling material used in root canal treatment. It exists in two phases, alpha and beta phase. When heated, it exists in alpha phase, which is tacky, sticky, and non-compatible. But when cooled down to the beta phase shrinkage occurs, and the degree of shrinkage is always greater than the degree of expansion.⁵

The purpose of obturating the prepared root canal space is to eliminate all avenues of leakage from the oral cavity or the periradicular tissue into the root canal system and to seal within the system any irritants that cannot be fully removed during canal cleaning and shaping procedures.

When the two-dimensional (2D) radiographic appearance of root canals is unacceptable and leakage is high, then the importance of 3D obturation comes to play. The 3D obturation leaves no space for the lateral canals to hide.⁶

In our study, Thermafil and Calamus were used as obturating materials and the volume inadequacy was compared. This was done to ensure which material has the maximum voids after obturation and better ability to seal the canal, both being 3D obturating materials.

Vannier et al demonstrated the feasibility of CBCT for quantitative study of oral hard tissues in the presence of metal restorations. Blake Nielson R et al evaluated the value of microcomputed tomography in morphological relationships in endodontic research and concluded

that CBCT is an important diagnostic tool used for various dental hard and soft tissues. Kleoniki Ly Roundi et al studied the application of both digital 3D image processing and virtual reality techniques in endodontics, and he concluded that the CBCT is an important tool for depicting the 3D volume of the obturated canals.

Thus, the volume-rendering technique used with the help of CBCT is the most accurate mode of depiction of 3D volume of the obturated canals. It allows the clinician to visualize the filling from all angles unlike radiographs, which give 2d reproductions. The voids at various axial levels can be calculated.²

Results of our study indicated that Thermafil showed more deviation from root canal volume as compared to Calamus. Three-dimensional obturation was better with calamus than with thermafill. This can be explained by the fact that calamus first creates an apical plug, then a back fill obturation is done, thus it provides a better 3D obturation, while Thermafil flows through all of the canals, so it may also flow through the apex.⁷

The backfill obturation technique is very sensitive. Proper condensation of the gutta-percha should be done in order to avoid voids during obturation.

A study by Willhelm Pertot mentioned some other disadvantages with Thermafil like the carrier present may get stripped of from the gutta-percha in curved canals and inefficiency in obturating elliptical canals. He also reported that there may be pain upon insertion of the obturator and occlusion of the openings of other canals in multirouted teeth upon elimination of the carrier and excess of gutta-percha.²

Ken Serota stated the disadvantage of Thermafil obturation in an endodontic retreatment case. In this case report, in the apical area, it was difficult to remove the plastic carrier from the mesiobuccal canal 2. Thus, incomplete preparation of mesiobuccal canal 2 leads to failure of root canal therapy.⁶

CONCLUSION

There is a statistical difference between the Thermafil and Calamus with regard to the adequacy of obturation. Within the limitation of this study, Thermafil showed more volume inadequacy than Calamus as there was more deviation from the root canal volume.

REFERENCES

1. Stephen C, Burns R. Pathways of pulp. 6th ed. USA: Mosby Publications; 2000. p. 225.
2. Chokkalingam M, Ramaprabha, Kandaswamy D. Three-dimensional helical computed tomographic evaluation of three obturation techniques: in vitro study. J Conserv Dent 2011 Jul-Sep;14(3):273-276.
3. Gutmann JL, Kuttler S, Stephen P. Root canal obturation, an update. p. 1-9. Available from: www.ineedce.com.
4. Ruddle CJ. Filling root canal systems: the Calamus 3-D obturation technique. Dent Today 2010 Apr;29(4):76, 78-81.
5. Maalouf S, Attieh-Abikanaan, Ounsi HF. Thermafil: a conventional technique in endodontics. Dental News, 1996;3(3):27-31.
6. Serota K. Clinical endodontics. Endodontic-retreatment-of-failing-thermafill-obturation. p. 1-5. Available from: blogohj.oralhealthjournal.com.
7. Schilder H. Failing root canals in three dimensions. JOE 2006 Apr;32(4):281-290.