

Original Research

Assessment of quality of fill of lateral condensation and thermoplasticized gutta percha obturation techniques: A stereomicroscopic in vitro study

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ABSTRACT:

Background: The present study was conducted for comparatively evaluating the quality of filling of two root canal obturation techniques. **Materials & methods:** 40 single rooted extracted permanent maxillary central incisors with single straight canals were used for this study. The pulp chambers of all the teeth were opened and number 10 K-file was introduced in the access cavity to establish the patency of the canal. Biomechanical preparation was carried out using crown down technique using Protaper Universal Files up to master apical file of F5. The teeth were randomly divided into two groups accordingly to the filling technique used (n = 20): Thermoplasticized gutta percha obturation technique and Cold Lateral Condensation technique. Obturation was performed by specific techniques without using sealers. Assessment of quality of obturation was done by calculating the filling area and voids in each tooth sections at 2-3 mm from apex. All the results were recorded and analysed. **Results:** Mean percentage of gutta-percha filled material among specimens of Thermoplasticized injectable gutta percha group and CLC group was 98.45 and 96.12 respectively. Non-significant results were obtained while comparing the mean percentage of gutta percha filled material. **Conclusion:** No technique could completely fill in root canal.

Key words: Obturation, Root canal treatment, Thermoplasticized Technique

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INTRODUCTION

A three dimensional seal of the root canal system is achieved by proper root canal obturation to prevent the recurrence of bacterial infection. The microleakage between the root canal and the periapical tissues is hindered leading to death of any surviving microorganisms. This prevents the entry of nutrients and toxic bacterial products into the periapical tissues.¹⁻³

Various techniques have been developed to achieve the proper obturation of root canal system including the Thermoplasticized gutta-percha obturation, cold lateral compaction and carrier based obturation. Over the years, pitfalls with one technique have often led to the development of newer methods of obturation. Thermoplasticized gutta percha provides a relatively void free obturation along with minimal sealer thickness and a higher degree of homogeneity. The

ability to provide fluid tight apical seal determines the efficacy of a particular obturation technique. Although the sealing properties of different obturation systems have been investigated, the effect of overall sealing performance with Fast Fill obturation system in various levels of root canal is still unknown.⁴⁻⁶ Hence, the present study was conducted for comparatively evaluating the efficacy of two root canal obturation techniques.

MATERIALS & METHODS

Forty single rooted extracted permanent maxillary central incisors with single straight canals were used for this study. Teeth were collected and cleaned with ultrasonic scaler. The pulp chambers of all the teeth were opened with small round bur and number 10 K-file was introduced in the access cavity to establish the patency of the canal. The working length of each

tooth was measured. Biomechanical preparation was carried out by crown down technique using Protaper Universal Files (Dentsply Maillefer) upto master apical file of F5. The teeth were randomly divided into two groups according to the filling technique used (n = 20), Thermoplasticized injectable gutta-percha technique and Cold Lateral Condensation (CLC) technique. Obturation was performed by specific techniques without using sealers.

GROUP I: THERMOPLASTICIZED OBTURATION TECHNIQUE

For this technique Fast Pack and Fast Fill devices (Eighteeth Medical) were used. Tip of Fast Pack heat source (Down Pack device) whose diameter was just slightly less than that of canal preparation at 3-5 mm from apex was used after master cone insertion to plunge 3- 5 mm into the apical most extent of gutta-percha heated to 200°C to cut the gutta percha and removed. Largest prefitted plugger was used to vertically pack gutta percha mass apically. The created space in coronal and middle third of the canal was back filled by heat softened gutta percha with cordless Fast Fill obturation device in increments of 2 to 3mm and the obturation material was packed at the orifice with a plugger.

GROUP I: COLD LATERAL CONDENSATION OBTURATION TECHNIQUE

A standardized 50 number gutta-percha master cone was fitted in the root canal at the working length and checked for tug-back criteria. Cold lateral condensation was done using standardized finger spreaders. The finger spreader was inserted between

Table 1: Mean percentage of gutta-percha filled material

Group	Mean	SD	p- value
Thermoplastic technique	98.45	0.28	0.185
CLC technique	96.12	0.32	

DISCUSSION

The removal of the pulpal tissue and necrotic materials, the disinfection procedure, the biomechanical preparation, and the complete filling of the canal are important for the success of endodontic treatment. The root canal morphology is also critical for endodontic success. The success of endodontic treatment depends on adequate mechanical debridement of root canal and quality obturation with biocompatible material.⁷

Several root canal filling techniques are used during endodontic treatment, with lateral condensation as the most commonly used technique. Although it is easy to control the working length during condensation, it cannot fill irregularities in root canal as good as thermoplastic filling technique. However, warm techniques also have some disadvantages. The gutta-percha expands when heated and during cooling it contracts. Therefore, it may result in voids inside the root canal filling.⁸⁻⁹

the master cone and the canal wall to within 1 mm of the working length. Cold lateral condensation was performed using accessory gutta-percha points until the canals were completely filled. The filling was judged to be completed when size-15 finger spreader could not penetrate beyond the coronal third of the canal. Excess gutta-percha was removed with the hot instrument (Fast Pack) at the orifice and vertically condensed lightly.

SECTIONING AND IMAGE ANALYSIS

After obturation, the teeth were cross-sectioned horizontally at 2 to 3 mm from apex with the help of double-sided diamond disk. Colour studies of sections were taken using a Stereomicroscope at magnification of 50x. The slides were scanned as tagged image file format (TIFF) images. Using Image J software the area of canals and the gutta-percha was recorded and the percentage of gutta percha filled area (PGFA) was calculated. The measurements were repeated randomly in at least two sections per group to assure reproducibility of measurements.

Statistical analysis was performed using SPSS software version 20. Students’ t-test was performed to determine significance. P value of <0.005 was considered significant.

RESULTS

Mean percentage of gutta-percha filled material among specimens of thermoplastic group and CLC group was 98.45 and 96.12 respectively. Non-significant results were obtained while comparing the mean percentage of gutta percha filled material.

In the present study no sealer was used although generally recommended during conventional root canal filling procedure. Peters (1986) and Georgopoulou et al (1995) stated that sealer shrinks upon setting while others are susceptible to dissolution in contact with tissue fluids leading to increase in leakage along the root filling over time.^{10,11} If sealers had been used there would have been variations regarding the width of root canal, the depth of the heat application and also the size of the sealer filled canal area. Although including sealer may facilitate gutta-percha movement, the reasons to leave sealers out were more important.

In the present study maxillary anterior teeth were used in attempt to avoid the presence of isthmus or flattening area, commonly found in molars and mandibular incisors. The prepared teeth were randomly divided and obturated in following two groups (n = 20 per group) namely Thermoplasticized technique (group I) and CLC technique (group II). Cold lateral condensation technique is a common method for obturation technique serves as the standard against which new techniques are compared.^{12,13} In the present study obvious voids and spreader tracts were apparent in the cross-sections in CLC group ,though the density of gutta-percha was found to be

relatively good. In group II (Thermoplasticized technique) percentage of gutta percha filled area (PGFA) was greater than that of CLC. Group II utilized some form of heat to plasticize the gutta-percha. It can be concluded that after thermoplastic obturation the quality of the adaptation of gutta-percha to the wall of the apical root canal varies and the sufficient amount of gutta-percha present in the apical canal and sufficient heating are essential in achieving a good adaptation in canals of widely varying diameter.

The thermoplastic gutta-percha techniques are simpler than the lateral condensation technique which means the operator is less subjected to fatigue, but such consideration must be subordinate to the primary goal of achieving the best prognosis for the patients.^{14,15}

After obturation, each sample was sectioned horizontally at 2 to 3 mm from the apical foramen using low-speed saw with a diamond disk and continuous water irrigation in order to prevent overheating. The specimens were polished before they were examined under stereomicroscope. This study was designed to quantify the gutta-percha component on percentage basis in order to provide a measure of quality. As observed in the present study, the mean PGFA was found to be maximum in group I (Thermoplastic obturation technique) followed by group II (CLC technique).

CONCLUSION

On the basis of the results and statistical analysis, it can be concluded that:

1. Cold lateral obturation technique resulted in definite voids and gaps between the gutta-percha and canal interface at apical third of root canals.
2. Warm vertical condensation techniques produce a homogenous mass of gutta-percha with reduced voids and increased adaptation as compared to cold lateral obturation technique.
3. None of the tested obturation techniques provided a gap-free or void-free root canal filling after obturation

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