



## Comparison of Efficacy of Different Obturation Techniques used in Root Canal Treatment

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### Abstract

**Aim:** Through microscopic examination of the cross-sections of root canals filled using the Thermafil technique, Warm Vertical Condensation technique (WVC), or Cold Lateral Condensation technique (CLC) without the use of sealers, the percentage of gutta-percha-filled area (PGFA) was assessed in this study. **Materials and methods:** 90 single-rooted permanent teeth that had been extracted were gathered. The teeth were cut out at the crowns and then randomly divided into three groups, each with 30 samples. Group A uses the Thermafil obturation method, Group B uses warm vertical condensation, and Group C uses cold lateral condensation. Without the use of sealers, obturation was carried out using particular methods. With the use of a double-sided diamond disc, the teeth were cross-sectioned horizontally at 2 to 3 mm from the tip after obturation. Sections were captured on camera and measured using a stereomicroscope at a 50x magnification. The area of the canals and the gutta-percha were measured using a KS 100 imaging system. The percentage of gutta-percha filled area (PGFA) was also computed. ANOVA and the student 't' test were used in the statistical analysis of the observations that were thus obtained. **Results:** Group A (Thermafil) had significantly higher mean value as compared to the two study groups (groups II and III) and group B (WVC) had significantly higher mean value as compared to group C (CLC). Thus, the differences among all the groups were statistically significant. **Conclusion:** This study shows that compared to the Thermafil Obturation technique, the warm vertical condensation technique and cold lateral condensation approach both create substantially lower percentages of gutta-percha filled area (PGFA).

**Keywords:** obturation, root canal, thermafil

## **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.<sup>1</sup>

Various techniques have been developed to achieve the proper obturation of root canal system including the vertical compaction, lateral compaction and carrier based obturation.<sup>2,3</sup> Over the years, pitfalls with one technique have often led to the development of newer methods of obturation. Lateral compaction of GP is the gold standard technique.<sup>4</sup> Thermafil provides a void free obturation along with minimal sealer thickness and a higher degree of homogeneity. Hence, this study was conducted to assess the Comparison of Efficacy of Different Obturation Techniques used in Root Canal Treatment.

## **Material and methods**

For this investigation, 90 single-rooted permanent teeth with single straight canals were extracted and used. After gathering and cleaning the teeth, they were kept in a 3-percent sodium hypochlorite solution for two weeks. All of the teeth's pulp chambers were opened, and a number 15 K-file was placed in the access cavity to determine the canal's patency. Using radiovisiography, the working length of each tooth was measured. Step-back approach was used to prepare the biomechanically. With a K-file number 50, all the teeth were instrumented at their working length. According to the filling method utilised (n = 30), the teeth were randomly divided into three groups: CLC technique, WLC technique, and Thermafil technique. Without the use of sealers, obturation was carried out using particular methods. With the use of a double-sided diamond disc, the teeth were cross-sectioned horizontally at 2 to 3 mm from the tip after obturation. Sections were photographed using a stereomicroscope at a 50x magnification for colour investigations. As tagged image file format (TIFFA) images, the slides were scanned. The area of the canals and the gutta-percha were measured using a KS 100 imaging equipment, and the PGFA was computed. To ensure measurement reliability, the measurements were repeated at random in at least two sections for each group.

The resulting observations were then put through statistical analysis using analysis of variance (ANOVA).

## **Results**

Table 1 shows the mean percentage of gutta-percha filled area in Thermafil technique, WVC technique and CLC technique at apical third of root canals. It was observed that the mean PGFA was maximum in group A (Thermafil technique) followed by group B (WVC) while group C (CLC technique) revealed the minimum percentage. Group A (Thermafil) had significantly higher mean value as compared to the

two study groups (groups II and III) and group B (WVC) had significantly higher mean value as compared to group C (CLC). Thus, the differences among all the groups were statistically significant.

**Table 1: Mean percentage of gutta-percha filled area in different study groups**

Group	Number of samples	Mean
Group A	30	85.63
Group B	30	83.47
Group C	30	81.29

**Table 2: Between group comparisons of percentage of gutta-percha filled area in different groups**

Comparison	Mean difference	P-value
Group A vs Group B	2.478	0.001 (Significant)
Group A vs Group C	4.569	
Group B vs Group C	3.014	

## Discussion

The root canal is a complex system with many surface irregularities, fins, accessory and lateral canals, and isthmuses.<sup>5</sup> To seal this system, the filling material must adapt to all portions of the root canal. Incomplete obturation of the canal system may result in failure of the endodontic treatment.<sup>6</sup> Root canal filling materials are intended to prevent micro-organisms and toxins in the canal from passing along the root canal space into the periradicular tissues.<sup>7</sup>

Fogel (1995) and Wu et al (1998) proposed that the quality of root canal filling at the apical third is important because after post space preparation only the apical root filling of 3 or 4 mm in length is left and the cemented post may leak.<sup>8,9</sup> According to various investigators [Senia et al (1971), Coffae and Brilliant (1975), Littman (1977)]<sup>10,11,12</sup> the apical root canal has been found to be less clean than the middle and coronal portions of the root canal suggesting that bacteria remain in the apical canal. 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.<sup>13,14</sup> 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. In this study, Group A (Thermafil) had significantly higher mean value as compared to the two study groups (groups II and III) and group B (WVC) had significantly higher mean value as compared to group C (CLC). Thus, the differences among all the groups were statistically significant.

Canakci et al<sup>15</sup> evaluated the amount of apically extruded debris removed from a root canal filled with cold lateral condensation (CLC), and warm vertical compaction (WVC) techniques, using b or a phase

gutta-percha with AH-Plus (Dentsply DeTrey, Konstanz, Germany) or Resilon (Resilon Research LLC, Madison, WI) with RealSeal SE (SybronEndo, Amersfoort, The Netherlands). About 100 human incisor teeth were prepared with a #25.06 NiTi rotary system and divided into five groups according to the filling material used: Group 1: CLC (gutta-percha, AH-Plus); Group 2: WVC (b phase gutta-percha, AH-Plus); Group 3: WVC (a phase gutta-percha, AH-Plus); Group 4: CLC (Resilon, RealSeal SE); and Group 5: WVC (Resilon, RealSeal SE). Extruded debris during the retreatment procedure was collected in preweighed Eppendorf tubes. The times required for retreatment were recorded. The amount of debris extrusion was significantly greater with WVC than CLC in the gutta-percha and Resilon groups ( $P < 0.001$ ). Using a phase gutta-percha resulted in significantly more debris extrusion than b phase gutta-percha ( $P < 0.001$ ). In the WVC groups, Resilon caused significantly more debris extrusion than gutta-percha ( $P < 0.05$ ). Retreatment was faster for CLC than WVC ( $P < 0.05$ ).

Gupta et al<sup>16</sup> compared the quality of three different root canal obturation techniques: lateral compaction, Thermafil and Calamus by using cone beam computed tomography. A total of 30 central incisors were selected. Biomechanical preparation was done by Reciproc file no 25. Teeth were divided into 3 groups of 10 teeth each according to the obturation technique i.e. Calamus, Thermafil and lateral compaction. Cone beam computed tomography was used to measure filling area and voids at coronal, middle and apical third of the root canal after obturation by different techniques. Data was statistically analysed by One-Way Anova and multiple comparison of Tukey HSD tests. The maximum amount of obturating material was observed in Calamus group followed by Thermafil and lateral compaction. Minimum voids were seen in obturation by Calamus technique. Within the limitations of this study, it was concluded that Calamus may be a good obturation technique.

Cold lateral condensation technique is a common method for obturation. According to Gordon et al<sup>17</sup> and Xu et al,<sup>18</sup> CLC technique serves as the gold-standard against which new techniques are compared. In this study, though the density of gutta-percha was found to be relatively good, but obvious voids and spreader tracts were apparent in the cross-sections.

## **Conclusion**

Based on the findings and statistical analysis, it is possible to draw the conclusion that the cold lateral obturation approach produced clear holes and gaps at the gutta-percha and canal interface in the apical third of root canals. In comparison to cold lateral obturation, warm vertical condensation produces a homogenous mass of gutta-percha with fewer cavities and greater adaptability. In comparison to other evaluated approaches, the Thermafil obturation technique showed the fewest gaps and voids. In comparison to the cold lateral obturation technique and the WVC approach, the obturation of root canals using alpha-phase gutta-percha on a plastic core-carrier, Thermafil, produced a more dense and well-adapted root canal filling at the apical third.

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