

Original Research

Analysis of efficacy of root canal obturation techniques

¹Ajay Kumar, ²Pragati Agarwal, ³Harpreet Kaur, ⁴Shubham Sharma, ⁵Pawan Gupta

^{1,2}Senior Lecturer, Swami Devi Dyal Hospital and Dental College, Golpura Barwala, Panchkula, Haryana, India;
^{3,4,5}BDS, Sri Guru Ramdas Institute of Dental Sciences and Research, Amritsar, Punjab, India

ABSTRACT:

Background: A crucial aspect for achieving successful endodontic treatment is ensuring effective obturation. To compare the efficacy of root canal obturation techniques. **Materials & Methods:** A total of 20 participants were included in the study, divided into two groups, each comprising five samples. The first group, labeled Group I, received obturation using the warm vertical condensation technique, while the second group, labeled Group II, underwent obturation using the cold lateral condensation technique. **Results:** In Group I, the average gutta-percha filling percentage was calculated to be 98.49%, whereas in Group II, the corresponding figure was 93.24%. **Conclusion:** The warm vertical condensation technique results in fewer voids when compared to the cold lateral obturation technique.

Keywords: obturation, warm lateral condensation, root canal.

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Corresponding Author: Ajay Kumar, Senior Lecturer, Swami Devi Dyal Hospital and Dental College, Golpura Barwala, Panchkula, Haryana, India

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INTRODUCTION

Good obturation is a key requirement in successful endodontic treatment.¹ Cleaning and shaping of the canals affects proper debridement and removal of tissue remnants—an essential step in endodontic therapy. However, an incomplete filling can jeopardize the success of root canal treatment. Inadequate endodontic filling is linked to the development of periapical pathology and considered a failure of the endodontic treatment.^{2,3} In a systematic review, Ng et al., found four factors that significantly improve the outcome of primary root canal treatment, and one of these was the presence of a root filling with no voids.⁴

Root canal therapy is one of the most common procedures, as well as one of the most feared dental procedures.⁵ Therefore, managing pain is a challenge in the clinical practice of endodontics, and the main aspect by which the skill of the clinician is often judged.⁶ However, managing the pain and distress of patients can be frustrating, especially when the root canal treatment (RCT) itself appears to initiate its onset. Indeed, the result can be distressing to both the patient and the operator.⁷ In contrast, the elimination of pain enhances the confidence of patients. The filling

of root canals, commonly referred to as obturation, is a critical step in successful root canal treatment (RCT). The goals of obturation are twofold: to create an apical seal and fill the root canal without incorporating voids within the filling material.^{8,9} Successful obturation eliminates leakage of contaminants into the channel, such as saliva, bacteria, and periapical tissue fluid, and entraps any residual microorganisms within the canal space.⁹ The ability to adequately obturate a root canal is directly related to the preceding step of cleaning and shaping. Cleaning and shaping refer to the mechanical and chemical preparation of a root canal to remove organic and inorganic matter. A canal that has been poorly cleaned and shaped will result in equally poor obturation and is one of the strongest indicators of treatment failure.⁹ The long-term success of endodontic treatments is based on adequate 3-dimensional (3D) cleaning, shaping, and 3-dimensional obturation of the complex root canal system.¹⁰ The role of endodontic sealers in combination with different types of endodontic obturation techniques was investigated and BS were proposed into the market as indicated only in combination with single-cone technique because the

BS are inadvisable to come into contact with heat.¹¹ Otherwise, they can harden instantly. However, a recent study evaluated the use of several BS in combination with warm gutta-percha techniques, showing promising results.¹²

Various techniques have been developed to achieve the proper obturation of root canal system including the vertical compaction, lateral compaction and carrier based obturation.¹³ 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.¹³ Thermafil provides a void free obturation along with minimal sealer thickness and a higher degree of homogeneity.¹³ Calamus is a recent technique of obturation of root canal system.¹⁴ The ability to provide fluid tight apical seal determines the efficacy of a particular obturation technique.¹⁵ Although the sealing properties of different obturation systems have been investigated, the effect of overall sealing performance with calamus obturating system in various levels of root canal is still unknown. Hence, this study was done to compare the efficacy of root canal obturation techniques.

MATERIALS & METHODS

A total of 20 participants were included in the study, divided into two groups, each comprising five samples. The first group, labeled Group I, received obturation using the warm vertical condensation technique, while the second group, labeled Group II, underwent obturation using the cold lateral condensation technique. Detailed individual histories were collected from all participants. Following the obturation procedures, radiographs were taken to facilitate evaluation. The Chi-squared test was employed to assess the quality of canal fillings. Subsequently, the gathered data were subjected to analysis using SPSS software.

RESULTS

Twenty participants were included in the study and were segregated into two distinct groups. Group I received obturation utilizing the warm vertical condensation technique, while Group II underwent the cold lateral condensation technique. In Group I, the average gutta-percha filling percentage was calculated to be 98.49%, whereas in Group II, the corresponding figure was 93.24%. The incidence of voids was notably lower in the warm vertical condensation group in comparison to the cold lateral condensation group.

Table: mean percentage of gutta-percha filled area

Groups	No. of samples	Mean (%)	SD
Group I	10	98.49	0.1
Group II	10	93.24	0.7

DISCUSSION

Obturation is the filling and sealing of a prepared root canal with a root canal sealer and a core material. The

core material occupies space while the sealer flows to areas of irregularities or those unaffected by mechanical preparation. An obturation must achieve a high level of adaptability to the prepared canal walls and the filling material must penetrate the dentinal tubules, if possible.¹⁶ Sealers are essential to form an impervious barrier between the core material and the root canal walls.¹⁷ The importance of sealers was realized in the early 20th century when obturations with gutta-percha alone frequently led to apical periodontitis.¹⁸ They can flow into areas where the core filling materials do not reach and help obtain an adequate seal regardless of the technique used.¹⁹ Sealers can penetrate dentinal tubules and have inhibitory effects on *E. fecalis*.²⁰ However, it is possible that sealer in the dentinal tubules offers no advantage in achieving a hermetic seal in the root canal.²¹ Hence, this study was done to compare the efficacy of root canal obturation techniques.

In the present study, twenty participants were included in the study and were segregated into two distinct groups. Group I received obturation utilizing the warm vertical condensation technique, while Group II underwent the cold lateral condensation technique. In Group I, the average gutta-percha filling percentage was calculated to be 98.49%. A study by Gupta R et al, 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. 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. It can be concluded that Calamus may be a good obturation technique.²²

In the present study, in Group II, the corresponding figure was 93.24%. The incidence of voids was notably lower in the warm vertical condensation group in comparison to the cold lateral condensation group. Another study by Samadi F et al, studied sixty single rooted extracted per-manent teeth were collected. After crown amputation, the teeth were randomly divided into three experimental groups of 20 specimens each. Group I–Thermafil obturation technique, group II–warm vertical condensation obturation technique and group III–cold lateral condensation obturation technique. Obturation was performed by specific techniques without using sealers. After obturation, the teeth were cross-sectioned horizontally at 2 to 3 mm from apex with the help of double sided diamond disk. Maximum group difference was observed between groups I and III (3.558 ± 0.138) while minimum difference was observed between groups I and II (1.223 ± 0.137). Thus, all the between group differences were

statistically significant.²³ Vadachkoria O et al, studied to determine the quality of canal filling in apical third of root using 3 techniques: lateral condensation, and thermoplastic Gutta Master and Gutta Fussion obturators. The quality of obturation was evaluated on 36 extracted human teeth. Teeth were divided into 3 groups according to the obturation technique (A, B, C study groups). In each group, the roots of the tooth were sectioned by 2 transverse cuts (perpendicular to the long axis) into 3 segments - apical, middle and coronal thirds. The study revealed that absolutely no hermetic obturation of the canal system was recorded in any of the study groups. In all cases, microleakage of different degree and localization between the filling material and the canal wall was observed. However, the worst results were revealed in group A, where interphase weakening was the most frequent. Gutta-Master and Gutta-Fussion thermoplastic obturation showed better adhesion to the walls, but the degree of obturation in group C teeth was better than the results in specimens where the canals had been filled with Gutta-Master.²⁴ The cold lateral condensation technique involves the selection of a master GP cone, the use of spreaders, and the insertion of secondary GP cones.^{25,26} The master cone is a GP cone with a taper and diameter that matches the prepared root canal at the working length. This master cone is measured to the working length and inserted into the canal, where it will display slight resistance to removal, aptly referred to as "tug back" if the correct size cone was selected.²⁵ After confirming with a radiograph, the canal is irrigated and dried, and sealer is applied to the walls. At this point, a finger spreader or a hand spreader is pre-fit in the canal to reach within 1 to 2 mm short of the working length, and appropriately sized secondary GP cones are selected that closely match the size of the spreader.²⁴ The master cone is inserted into the canal to the working length, followed by the spreader, which, if properly selected, should reach 2 mm shorter. The spreader is then rotated and withdrawn from the canal, and the matching GP cone is inserted into the vacant space.²⁴ The process is repeated until the operator is unable to insert the spreader deeper than the coronal third of the prepared canal. At this point, the excess GP is seared off with a heated instrument and compacted using a root canal plugger.^{24,25} An ideal obturation needs to be well adapted, void-free, provide an adequate seal for all canals connecting the pulp to the periodontium, and adapt to the prepared canal walls.²⁷ Neither technique can provide an obturation free of voids in the root canal according to the findings in this review. The quantitative measurement of voids differed among the techniques. The results of one of the studies differed from the rest—it found fewer voids in the cold lateral condensation group.²⁸ These differences were not significant. Two other studies that found no significant difference between the techniques did not measure the volume of voids directly but derived it

based on cross-sections of the root. One of these studies found significant difference in the apical third of the canal and fewer voids—internal and external—with the thermoplastic technique.²⁹

CONCLUSION

The warm vertical condensation technique results in fewer voids when compared to the cold lateral obturation technique.

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