

Original Research

Analysis of efficacy of two root canal obturation techniques

Dr Prashant Acharya¹, Dr Neesha Kumari²

¹Medical officer dental, PHC Roura Bilaspur

²MDS student, prosthodontics, 2nd year, Himachal Dental college, Sundernagar, HP

ABSTRACT:

Background: To compare the efficacy of root canal obturation techniques. **Materials & Methods:** Twenty participants were recruited for the study, with each of the two obturation methods applied to ten individuals. Following obturation, radiographs were taken for evaluation, and the filling of the canals was assessed using the Chi-squared test. The obtained results were analyzed utilizing SPSS software. **Results:** In Group I, the average percentage of gutta-percha filling was 99.20%, whereas in Group II, it was 92.85%. **Conclusion:** The warm vertical condensation technique exhibits fewer voids and greater adaptation in comparison to the cold lateral obturation technique.

Keywords: obturation technique, warm vertical, cold lateral.

Received: 18 September, 2023

Accepted: 21 October, 2023

Corresponding Author: Dr. Prashant Acharya, Medical officer dental, PHC Roura Bilaspur

This article may be cited as: Acharya P, Kumari N. Analysis of efficacy of two root canal obturation techniques. *Int J Res Health Allied Sci* 2023; 9(3):53- 56

INTRODUCTION

Successful endodontic treatment plays a critical role in tooth preservation. Over the last decades, there have been major developments in materials and techniques, which have improved the quality of endodontic treatment. However, there is still potential for further improvement.^{1,2} The aim of root canal treatment is to completely access the endodontic system, disinfect the dentin, and seal the entire endodontic space. After proper chemo-mechanical preparation, the endodontic system must be adequately sealed to prevent reinfection and promote apical healing.^{3,4} For this reason, various types of obturation techniques and materials have been developed.

A root canal filling generally consists of a core material (usually gutta-percha) and a low-viscosity sealing material (sealer), which should both compensate for irregularities in the prepared root canal and seal the dentinal tubules, ramifications, and accessory root canals.⁵ The amount of sealer used should ideally be as low as possible, since most sealers are soluble in liquids and dimensional changes occur during their setting.⁶ Various techniques have been developed to achieve the proper obturation of root canal system including the vertical compaction, lateral compaction and carrier based obturation.⁷ 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.⁸ Thermafil provides a void free obturation along with minimal sealer thickness and a higher degree of homogeneity.⁸ Calamus is a recent technique of obturation of root canal system.⁹ The ability to provide fluid tight apical seal determines the efficacy of a particular obturation technique.¹⁰ 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.

A reduced microbial load in the absence of a subsequent apical and coronal seal can cause recurrence of infection.¹¹ Persistent bacteria can use tissue remnants from unprepared areas as nutrients, leading to bacterial proliferation that is sustained if tissue fluids move into the canal from the periapical region.^{12,13} This occurs by one or a combination of these mechanisms: the inability of the immune system to reach these bacteria, a supply of nutrients from the periapical region, and new bacteria entering from the coronal orifice.¹⁴ Proponents of the multiple visit endodontic treatment favor the use of intra-canal medicaments to overcome this problem. However, it is ineffective in eliminating bacteria.¹⁵ Hence, this study

was conducted to compare the efficacy of root canal obturation techniques.

MATERIALS & METHODS:

Twenty participants were recruited for the study, with each of the two obturation methods applied to ten individuals. The subjects were organized into two groups, with Group 2 receiving obturation through the cold lateral condensation technique and Group 1 through the warm vertical condensation technique. A thorough medical history was obtained from each participant. Following obturation, radiographs were taken for evaluation, and the filling of the canals was assessed using the Chi-squared test. The obtained results were analyzed utilizing SPSS software.

RESULTS:

A total of 20 participants were included in the study, with the subjects being split into two groups. Group I underwent obturation using the warm vertical condensation technique, while Group II underwent obturation using the cold lateral condensation technique. In Group I, the average percentage of gutta-percha filling was 99.20%, whereas in Group II, it was 92.85%. Warm vertical condensation demonstrated fewer voids compared to the cold lateral condensation technique.

Table 1: mean percentage of gutta-percha filled area

Groups	No. of samples	Mean (%)	SD
Group I	10	99.20	0.1
Group II	10	92.85	0.5

DISCUSSION:

In recent years, a number of plasticized gutta-percha techniques have been introduced that have purported to seal the root canal better, like Warm Vertical Compaction technique (WVC) and Thermafil obturation technique which incorporate the use of thermal or frictional heat to plasticize the gutta-percha, allowing for better adaptation to canal walls, higher degree of homogeneity and provide optimum apical and coronal sealing when compared to lateral condensation.^{16,17} The WVC technique takes advantage of excellent gutta-percha filling as close as possible to the apex. The Thermafil obturation technique produces higher radiopacity, excellent viscosity and fluidity and produces a high degree homogenous mass of gutta-percha in the canal unlike lateral condensation.¹⁸ Hence, this study was conducted to compare the efficacy of root canal obturation techniques.

In the present study, a total of 20 participants were included in the study, with the subjects being split into two groups. Group I underwent obturation using the warm vertical condensation technique, while Group II underwent obturation using the cold lateral condensation technique. A study by Samadi F et al, evaluated the percentage of gutta-percha-filled area (PGFA) using microscopic analysis of the cross-

sections in the apical third of root canals when filled either with Thermafil technique, Warm Vertical Condensation technique and Cold Lateral Condensation technique without using sealers. 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. Sections were digitally photographed and measured under Stereomicroscope at magnification of 50x. Using a KS 100 imaging system the area of canals and the gutta-percha was recorded, also the percentage of gutta-percha filled area (PGFA) was calculated. The observations thus obtained were subjected to statistical analysis using ANOVA and student ‘t’ test. 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. This study supports the belief that the Thermafil Obturation technique produces significantly higher percentage of gutta-percha filled area (PGFA) than the warm vertical condensation technique or cold lateral condensation technique.¹⁹

In the present study, in Group I, the average percentage of gutta-percha filling was 99.20%, whereas in Group II, it was 92.85%. Warm vertical condensation demonstrated fewer voids compared to the cold lateral condensation technique. Another study by Bhandi S et al, compared the completeness of root canal obturation between the two most prevalent methods—cold lateral condensation and warm gutta-percha techniques—using micro-CT (PROSPERO reg no. 249815). Articles that compared both techniques and were published in English were included. Data was extracted and the risk of bias was assessed using an adapted tool based on previous studies. A total of 141 studies were identified by the search. Following the screening and selection of articles, 9 studies were included for review. Data was extracted manually and tabulated. Most studies had a moderate risk of bias. None determined operator skill in both methods before comparison. The data extracted from the included studies suggests that both techniques produce voids in the obturation. The thermoplasticized gutta-percha techniques may result in fewer voids compared to cold lateral condensation. Considering the limitations of the included studies, it was concluded that neither technique could completely obturate the root canal. Thermoplasticized gutta-percha techniques showed better outcomes despite a possible learning bias in favor of cold lateral condensation.²⁰ Many studies considered cold lateral compaction as a standard

procedure in endodontic obturation.²¹ It is a cost-effective, predictable, and safe obturation technique with good long-term results.²² However, cold lateral compaction is also known to be difficult and error prone and is particularly susceptible to the presence of voids, underfilling of curved root canals, and vertical root fractures associated with the application of high compaction forces.^{23,24} As a simple alternative, matching-taper single-cone obturation was introduced. A tapered gutta-percha master cone corresponding to the final shaping file is used without the need for accessory cones. This method was found to produce results comparable to the cold lateral compaction technique.²⁵ However, since root canals are rarely circular, the spaces adjacent to the prepared round canals are only filled with sealer, which may lead to less dense root canal fillings compared to other techniques.²⁶ In this context, the sealer is of great importance. The characteristics of epoxy-resin-based sealers like AH Plus® (Dentsply Sirona, Charlotte, NC, USA) are reported to represent the benchmark in root filling materials.²⁷ Cold lateral condensation technique is a common method for obturation. According to Gordon et al (2005) and Xu et al (2007) CLC technique serves as the gold-standard against which new techniques are compared. In the present 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.^{28,29} Warm vertical condensation technique should result in the plasticizing of the gutta-percha apical to the heat carrier. It can be concluded that after WVC 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. Venturi and Breschi (2004) reported that multiple heating has shown to produce high levels of gutta-percha shrinkage.³⁰

CONCLUSION:

The warm vertical condensation technique exhibits fewer voids and greater adaptation in comparison to the cold lateral obturation technique.

REFERENCES:

1. Connert T., Truckenmüller M., ElAyouti A., Eggmann F., Krastl G., Löst C., Weiger R. Changes in periapical status, quality of root fillings and estimated endodontic treatment need in a similar urban German population 20 years later. *Clin. Oral Investig.* 2019;23:1373–1382.
2. Laukkanen E., Vehkalahti M.M., Kotiranta A.K. Radiographic outcome of root canal treatment in general dental practice: Tooth type and quality of root filling as prognostic factors. *Acta Odontol. Scand.* 2021;79:37–42.
3. Ng Y.L., Mann V., Rahbaran S., Lewsey J., Gulabivala K. Outcome of primary root canal treatment: Systematic review of the literature—Part 2. Influence of clinical factors. *Int. Endod. J.* 2008;41:6–31.
4. Wesselink P. Root filling techniques. In: Bergenholtz G., Hørsted-Bindslev P., Reit C., editors. *Textbook of Endodontology*. 2nd ed. Wiley-Blackwell, John Wiley & Sons Ltd; Oxford, UK: 2010. pp. 219–232.
5. Ørstavik D. Materials used for root canal obturation: Technical, biological and clinical testing. *Endod. Top.* 2005;12:25–38.
6. Ørstavik D., Nordahl I., Tibballs J.E. Dimensional change following setting of root canal sealer materials. *Dent. Mater.* 2001;17:512–519.
7. Robberecht L, Colard T, Claisse-Crinquette A. Qualitative evaluation of two endodontic obturation techniques: tapered single-cone method versus warm vertical condensation and injection system. an in vitro study. *J Oral Sci.* 2012;54:99–104. [PubMed] [Google Scholar]
8. Gencoglu N. Comparison of 6 different gutta-percha techniques (partII): Thermafil, JS Quick-fill, soft core, Microseal, system B, and lateral condensation. *Oral Surg Oral Med Oral Pathol Endod.* 2003;96:91–95.
9. Ruddle CJ. Filling root canal systems: the Calamus 3-D obturation technique. *Dent Today.* 2010;29(4):76, 78–81.
10. Emmanuel S, Shantaram K, Sushil KC, Manoj L. An in-vitro evaluation and comparison of apical sealing ability of three different obturation technique - lateral condensation, obtura ii, and thermafil. *J Int Oral Health.* 2013;5(2):35–43.
11. Dioguardi M., Di Gioia G., Illuzzi G., Arena C., Caponio V.C.A., Caloro G.A., Zhurakivska K., Adipietro I., Troiano G., Lo Muzio L. Inspection of the Microbiota in Endodontic Lesions. *Dent. J.* 2019;7:47.
12. Siqueira Junior J.F., Rôças I.d.N., Marceliano-Alves M.F., Pérez A.R., Ricucci D. Unprepared Root Canal Surface Areas: Causes, Clinical Implications, and Therapeutic Strategies. *Braz. Oral Res.* 2018;32:e65.
13. Van der Sluis L.W.M., Wu M.-K., Wesselink P.R. An Evaluation of the Quality of Root Fillings in Mandibular Incisors and Maxillary and Mandibular Canines Using Different Methodologies. *J. Dent.* 2005;33:683–688.
14. Ducret M., Fabre H., Celle A., Mallein-Gerin F., Perrier-Groult E., Alliot-Licht B., Farges J.-C. Current Challenges in Human Tooth Revitalization. *Bio Med. Mater. Eng.* 2017;28:S159–S168.
15. Kim D., Kim E. Antimicrobial Effect of Calcium Hydroxide as an Intracanal Medicament in Root Canal Treatment: A Literature Review—Part II. in *Vivo Studies*. *Restor. Dent. Endod.* 2015;40:97–103.
16. Leonardo MV (Clinical Research Academic Group, São José dos Campos School of Dentistry, São Paulo State University, SP, Brazil) Goto EH, Torres CR, Borges AB, Carvalho CA, Barcellos DC. Assessment of the apical seal of root canals using different filling techniques. *J Oral Sci.* 2009 Dec;51(4):593–599.
17. Shahriari S (Department of Endodontics, Dental School, Hamadan University of Medical Sciences, Hamadan, Iran), Jalalzadeh SM, Moradkhany R, Abedi H. A comparative study of apical microleakage using the conventional lateral condensation and mechanical lateral condensation techniques. *Iran Endod J.* 2008 Summer;3(3):79–82.
18. Fogel HM (Department of Restorative Dentistry, Faculty of Dentistry, University of Manitoba, Canada). Microleakage of posts used to restore endodontically treated teeth. *J Endod.* 1995 Jul;21(7):376–379.
19. Samadi F, Jaiswal JN, Saha S, Garg N, Chowdhary S, Samadi F, Tripathi VP. A Comparative Evaluation of Efficacy of Different Obturation Techniques used in

- Root Canal Treatment of Anterior Teeth: An in vitro Study. *Int J Clin Pediatr Dent* 2014;7(1):1-5.
20. Bhandi S, Mashyakhy M, Abumelha AS, Alkahtany MF, Jamal M, Chohan H, Raj AT, Testarelli L, Reda R, Patil S. Complete Obturation-Cold Lateral Condensation vs. Thermoplastic Techniques: A Systematic Review of Micro-CT Studies. *Materials* (Basel). 2021 Jul 18;14(14):4013.
 21. Whitworth J.M. Methods of filling root canals: Principles and practices. *Endod. Top.* 2005;12:2–24.
 22. Pirani C., Camilleri J. Effectiveness of root canal filling materials and techniques for treatment of apical periodontitis: A systematic review. *Int. Endod. J.* 2022
 23. Schäfer E., Schrenker C., Zupanc J., Bürklein S. Percentage of Gutta-percha Filled Areas in Canals Obturated with Cross-linked Gutta-percha Core-carrier Systems, Single-Cone and Lateral Compaction Technique. *J. Endod.* 2016;42:294–298.
 24. Krug R., Krastl G., Jahreis M. Technical quality of a matching-taper single-cone filling technique following rotary instrumentation compared with lateral compaction after manual preparation: A retrospective study. *Clin. Oral Investig.* 2017;21:643–652.
 25. Wu M.K., Bud M.G., Wesselink P.R. The quality of single cone and laterally compacted gutta-percha fillings in small and curved root canals as evidenced by bidirectional radiographs and fluid transport measurements. *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.* 2009;108:946–951.
 26. Schäfer E., Nelius B., Bürklein S. A comparative evaluation of gutta-percha filled areas in curved root canals obturated with different techniques. *Clin. Oral Investig.* 2012;16:225–230.
 27. McMichen F.R., Pearson G., Rahbaran S., Gulabivala K. A comparative study of selected physical properties of five root-canal sealers. *Int. Endod. J.* 2003;36:629–635.
 28. Gordon MP (Department of Oral Rehabilitation, University of Otago School of Dentistry, Dunedin, New Zealand.), Love RM, Chandler NP. An evaluation of 0.06 tapered gutta-percha cones for filling of 0.06 taper prepared curved root canals. *Int Endod J.* 2005 Feb;38(2):87–96.
 29. Xu Q (Department of Endodontics, Guanghua School of Stomatology, Sun Yat-sen University, Guangzhou, Guangdong, China. xuqionggz@yahoo.com.cn), Ling J, Cheung GS, Hu Y. A quantitative evaluation of sealing ability of 4 obturation techniques by using a glucose leakage test. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2007 Oct;104(4):e109–e113.
 30. Venturi M (Department of Surgical Sciences, University of Trieste, Via Stuparich 1, 34129 Trieste, Italy), Breschi L. Evaluation of apical filling after warm vertical guttapercha compaction using different procedures. *J Endod.* 2004 Jun;30(6):436–440.