

ORIGINAL RESEARCH

A comparative evaluation of endodontically treated root canals obturated using Gutta-percha with two different protocols: An In-vitro Study

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ABSTRACT

Background: To evaluate endodontically treated root canals obturated using gutta percha with two different techniques. **Materials & Methods:** A total of 20 individual single-rooted teeth were partitioned into two groups through a simple randomization process based on the chosen filling technique. Ultimately, a statistical analysis, specifically Student's t-test, was conducted to determine whether there existed any disparities between the various filling methods. The results were analysed using SPSS Software. **Results:** In terms of radiographic density assessment, the lateral condensation obturation technique exhibited an average of 178.32, while the modified lateral condensation technique displayed the highest average at 188.48. Upon comparing both groups, no statistically significant differences were observed ($P = 0.2$). **Conclusion:** No significant differences were found between the techniques.

Keywords: gutta percha, obturation, lateral condensation.

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INTRODUCTION

Endodontically treated teeth are more susceptible to fracture than vital teeth because of excessive loss of tooth tissue, dehydration of the dentin, and pressure during obturation procedures. Previous clinical studies have shown that 11-13% of extracted teeth with endodontic treatment are associated with vertical root fractures, rendering it the second most frequent identifiable reason for loss of root-filled teeth.^{1,2} Some authors have indicated that endodontically treated teeth get desiccated and inelastic while others have suggested that root fractures most often occur in teeth after root canal treatment due to loss of tooth structure, use of irrigants and medicaments, and excessive widening of root canals.³ The obturation of root canal system needs a lot of attention. Many failures in root canal treatment in long term are related to incomplete obturation.⁴ A good filling should be perfectly dense and creates a complete seal in all three dimensions of the root canal.⁵ Root canal obturation should be ended to the apical constriction.⁶ Many

obturation techniques and equipments are presented so far to enhance and improve the quality of root canal seal. These include cold lateral condensation, vertical condensation, obtura II, System B, Ultrafill, Thermafill, Successfill, Simplifill, thermomechanical condensation, and chloroform dip technique.⁷⁻⁹ Lateral condensation technique is one of the most common methods of root canal obturation. In conventional obturation methods, the tug-back in the gutta-percha master cone is recommended in order to create and maintain the apical seal.¹⁰ Tug-back is the slight back-pull or resistance to dislodgement of the guttapercha master cone that is felt when it is removed from the canal. If coming from the apical third, this tug-back would be an indication of good fit.¹¹ Separation of root canal instrument is troublesome, if the fragment cannot be retrieved. A number of treatment protocols for removing separated instruments have been described in the literature.¹² Many authors have suggested to leave the separated fragment in the canal followed by the precise

endodontic obturation to achieve a fluid tight seal using separated fragment as a part of obturation.¹³ Hence, this study was done to evaluate endodontically treated root canals obturated using gutta percha with two different techniques.

MATERIALS & METHODS

A total of 20 individual single-rooted teeth were partitioned into two groups through a simple randomization process based on the chosen filling technique. Subsequent to the completion of the endodontic treatment, a periapical radiograph was captured to evaluate quality based on radiographic density. Additionally, tomographic images were obtained to assess quality by comparing the volume of spaces with the biomechanical tomography post-preparation. Ultimately, a statistical analysis, specifically Student's t-test, was conducted to

determine whether there existed any disparities between the various filling methods. The results were analysed using SPSS Software.

RESULTS

In terms of radiographic density assessment, the lateral condensation obturation technique exhibited an average of 178.32, while the modified lateral condensation technique displayed the highest average at 188.48. Upon comparing both groups, no statistically significant differences were observed ($P = 0.2$). Conversely, concerning tomographic volume analysis, the lateral condensation technique exhibited a value of 4.12, while the modified lateral condensation technique displayed the lowest mean of 2.78. Nevertheless, no statistically significant difference was identified between the two techniques ($P = 0.1$).

Table 1: Assessment of Radiodensity and Tomographic Volume of Root Canal Fillings Following Endodontic Treatment

Parameter	Technique	Mean	P – value
Radiodensity	Lateral condensation	178.32	0.2
	Modified lateral condensation	188.48	
Volume	Lateral condensation	4.12	0.1
	Modified lateral condensation	2.78	

DISCUSSION

Gutta percha is the most commonly used obturating material, and cold lateral condensation of gutta percha is one of the most common obturating techniques used in endodontics. Its ability to replicate the internal surface of the root canal has been questioned because of the voids, spreader tracts, and incomplete fusion of the gutta percha cones and lack of surface adaptation. To overcome the drawback of lateral condensation, thermoplasticized injectable obturation technique was introduced to improve the homogeneity and surface adaptation of gutta percha.¹⁴ Many studies have shown that despite the enhanced adaptation of thermoplasticized gutta percha to the dentine of root canal, the use of a root canal sealer is essential to achieve the optimal seal.¹⁵ Hence, this study was done to evaluate endodontically treated root canals obturated using gutta percha with two different techniques.

In the present study, in terms of radiographic density assessment, the lateral condensation obturation technique exhibited an average of 178.32, while the modified lateral condensation technique displayed the highest average at 188.48. Upon comparing both groups, no statistically significant differences were observed ($P = 0.2$). A study by Munive- Degregori A et al, radiographic radiodensity was 182.89 ± 9.81 and 186.72 ± 6.97 HU for teeth treated with the lateral condensation technique and modified lateral condensation technique, respectively. The void volume was 3.75 ± 2.35 and 2.43 ± 1.18 mm³ for teeth treated with the lateral condensation technique and modified lateral condensation technique,

respectively. No significant differences were found between the techniques for both filling quality parameters.¹⁶

In the present study, conversely, concerning tomographic volume analysis, the lateral condensation technique exhibited a value of 4.12, while the modified lateral condensation technique displayed the lowest mean of 2.78. Nevertheless, no statistically significant difference was identified between the two techniques ($P = 0.1$). Another study by Rangappa KG et al, examined sixty-two mandibular premolars were divided into 2 groups of 30 teeth each, and 2 teeth served as negative controls. In Groups A and B, roots were prepared using RACE and K3 system, respectively, and were further subdivided into 4 subgroups. In subgroups A1, B1 and A2, B2 ($n = 10$ each), files were separated at 3 mm from the tip in apical 3rd of the canal. In subgroups A3, B3 and A4, B4 ($n = 5$), instruments were not separated. Subgroups A1, A3, B1, B3 and A2, A4, B2, B4 were obturated by lateral condensation method and Obtura II techniques, respectively. Group A1 showed significantly less leakage than B1. No statistical significant difference between Groups A2 and B2 and Groups A3 and B3, respectively, were observed. Group A4 showed significantly less leakage than B4. Groups obturated with Obtura II showed less leakage than the lateral condensation technique irrespective of presence or absence of fractured NiTi rotary system.¹⁷ According to Yushkevich et al., ITK-SNAP is a software tool that provides a graphical user interface for manual and user-guided semi-automatic segmentation of three-dimensional medical image

datasets. This program was used by Schloss et al. to evaluate the volume changes in apical lesions after endodontic surgeries. In the present study, this program was used to perform the segmentation and volumetric measurement of the canal after biomechanical preparation and post filling to determine the magnitude of the void volume.^{18,19} The research by Huang et al. aimed to evaluate voids in different root canal sealants using micro-CT and nano-CT and to explore the feasibility of using nano-CT for the quantitative analysis of the quality of the sealant filling and had an average void volume of 0.243 mm³. In contrast, the study by Iglecias et al., which aimed to evaluate the presence of voids in the mesial root canals of the mandibular molars filled by using single-cone filling techniques and continuous condensation wave, obtained average values of 5.16 ± 1.85 and 5.42 ± 1.89 mm³, respectively. Similar to the present study, it was determined that both evaluated techniques did not present significant differences between both techniques subjected to evaluation.^{20,21} To measure bulk density on a digital radiograph, Geiger et al. used the ImageJ software (Wayne Rasband, NIH, USA), in which the procedure consisted of selecting the evaluation area, also known as the region of interest, and subsequently assigned a grayscale value to each pixel and obtained an average of all the values that make up the selection. The tomographic density allows us to determine the density of a given material. As long as the value is close to 255, the evaluated material will be highly radiopaque; consequently, it will have a higher density.²² Bhandi S et al, 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. Establishing operator skills before comparison may help reduce this bias.²³

CONCLUSION

No significant differences were found between the techniques.

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