

The Differences Results Of Root Canal Filling Between The Thermafil Technique And The Gutta Perca Lateral Condensation Technique

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Abstract: The Thermafil obturation technique is relatively new. The working time and materials used in this technique are more efficient so that the thermafil obturation technique is more environmental-friendly. The objective of this study was to determine the differences of the root canal leakage between the techniques of thermafil and the lateral condensation root canal fillings. Seventy extracted single teeth straight roots were prepared with step back techniques. The diameter of the apical foramen were standardized by using number 15 file and the length of the teeth were reduced by 1 mm. The root canals were prepared until no.40 as MAC and the last file was no.55. The teeth were randomized and filled with the guttapercha thermafil and lateral condensation technique. The calculation of the leakage was measure by microscope with 30 times enlargement, and statistically analized using the Chi Square test of $P < 0.05$. The study showed that the leakage of the guttapercha lateral condensation technique was not better than guttapercha thermafill technique. The thermafill had more leakage distance than lateral condensation technique.

Keywords: Thermafil technique, Lateral Condensation Technique, Leakage

1. Introduction

1.1. Background

One of the most common problems with endodontic failure is incomplete obturation, many different obturation techniques have been developed in order to increase the success of root canal treatment.¹ It has been well documented for years since Hess's research in 1925 that root canals varied and were complex. Ingle and Beveridge found 60% endodontic failure due to apical leakage due to improper filling.²

Apical leakage can cause anachoresis, which is the entry of germs through the bloodstream to areas that have inflammation or to necrotic tissue during the onset of bacteremia, as well as the pathway to periapical microorganisms which may still be trapped inside the root canal.

1.2. Problem

Based on the background of the problem above, it is known that the evaluation of the results of root canal filling which only through the buko-lingual radiographic picture does not adequately describe the actual condition. With the presence of various filling techniques, this study will be evaluated in a laboratory manner as a result of the filling between the lateral condensation technique and the relatively new composite technique in Indonesia, so the following questions are arranged:

What is the result of root canal filling in the thermafil technique compared to the gutta perca lateral condensation technique against leakage?, What is the leak in the orifice after two days and seven days of root canal filling in the thermafil technique and the gutta perca lateral condensation technique?, What is the leak at the apex after two days and seven days of root canal filling in the thermafil technique and the gutta perca lateral condensation technique?

1.3. Research Purposes

The aim of this study was to obtain information on the ability of root canal closure using the thermafil technique compared to the lateral gutta perca at the apex and orifice condensation in two and seven days after root canal filling.

1.4. Root Canal Filling

The purpose of root canal filling is to close the root canal area properly to prevent the penetration of bacteria and its products into the periradicular tissues and create a good biological environment for healing periapical tissue. While the purpose of root canal treatment is a thorough cleansing and root canal formation, as well as a hermetic three-dimensional obturation of the root canal system.⁹

1.5. Root Canal Sealer

Sealer is a root canal filling material that has the main function of coating the surface of gutta percha and root canal so that there is no access between the root canals with the apical, lateral, and coronal roots of the teeth and can cover the remaining bacteria access in the root canal.

Root canal cement is used in conjunction with biocompatible root canal filling materials as adequate adhesives and fill gaps between the main filling material, the additional cone. Today, root canal cement is classified into four groups: based on zinc oxide eugenol (Grossman, Roth, Tubliseal) based on calciumhydroxide (Sealapex, Apexit), glass ionomer based, and resin based (AH Plus, AH26, Epiphany, Diaket)¹⁰

1.6. Root Canal Filling Technique

The lateral condensation technique is a technique that uses the main cone of the gutta perca, then the main cone is adjusted to the length of work so that it can enter throughout the work. The selected con must match and there is a tugback if it is moved. Spreaders are used to penetrate along the main con side to work length or less than 1mm.

The thermafil technique is a method of using a warm gutta perca, aiming to produce a homogeneous root canal closure that is not long after obturation compared to other root canal filling techniques such as Johnson (1978). This filling technique uses a file-size gutta patch with a carrier core device made of plastic, stainless steel and titanium which is inserted into a

root canal in a specified temperature and time¹⁷ The right Thermophilic Obturator size is selected using a verified Thermafil Kit size.

1.7. Density of Root Canal Filling

Ideal root canal filling is solid, well adapted and root canal filling in three dimensions with homogeneous core material, covering the entire root canal space to the extent of apical constriction or approaching the cemento dentinal junction histologically.¹⁸ Dumsha (2000), states that filling root canals with gutta perca material and cement on the radiographic picture look solid, there is no excess material periapeks (over filling), or less (underfilling).

1.8. Border of Root Canal Filling

Levy and Glatt, states that the foramen apex deviates from the root tip of two thirds of all teeth, and deviations that occur in the buccal and lingual direction are twice as often as mesial and distal. Wein, states the apical foramen is usually found 0.5-1 mm from the radiographic apex.^{7,20} To overcome the many factors that affect the cemento dentinal junction boundary, there is something that determines the root canal filling limit between 0.5-1 mm.^{7,20} and 0.5-2 mm based on radiographic images.¹

2. Leak Through Apical And Orifice

Many researchers have compared materials and techniques to obtain "impermeable sealing" at the apical end. The question then arises if apical leakage is the cause of failure of endodontic treatment, is the role of orifice leakage in endodontic treatment. Because endodontic treated canals with dense filling can undergo recontamination in the following circumstances: late permanent restoration, temporary restriction not tight, temporary spills and broken tooth structure²¹.

3. Hypothesis

The results of root canal filling in the thermafil technique are better than the gutta perca lateral condensation technique.

Leakage at the apex on two (2) and seven (7) days with a thermafil technique was less than the gutta perca lateral condensation technique, Leakage at the orifice on two (2) and seven (7) days with a thermafil technique was less than the gutta perca lateral condensation technique

4. Research Methods

Research Design : Experimental Laboratories, **Research Sites :** FKG-UI Microbiology Laboratory, FT-UI metallurgical laboratory, **Population and number of samples,** Number of samples : 70 straight root teeth.

Criteria : Human permanent teeth that have been extracted from intact teeth from the root of a tooth have grown perfectly straight root canals never treated endodontically. **Sample preparation :** The newly extracted teeth are soaked in saline solution, All teeth are cut to the extent of cervix ($\pm$ 12mm), **Tools** for preparation and filling materials are used the same brand and size, Root canal preparation is carried out conventionally using the step bctc preparation criteria: the smallest diameter funnel shape at the meeting dentine and cementum, the largest diameter in the orifice, To allow the dye to enter the root canal through the foramen at the apex, uniform diameter of the foramen and file no. 15, To prevent the entry of natural

substances through the outer surface of the root of the tooth, coated with colorless nail polish, except the area to be measured (orifice / apex), Sticky wax is used to cover the apex and orifice area while waiting for the settings in the incubator and when the thermocycling is done so that the liquid or ink does not enter the filler before measurement.

Materials And Tools, Materials : 70 straight root teeth, the apical foramen is closed, Dental film (Kodak, Japan) with millimeter grade, Root canal cement, Endomethasone (Septodont Saint Maur, France), Gutta perca no. 20 - 40 (De Trey Dentsply ASH-USA, Pennsylvania), Paper suction (Dentsply ASH-USA, Pennsylvania), Termafil Plus (Tulsa Dental Product, Dentsply, Milford, DE), 2.5% NaOCl, Aquadest is sterile, 0.9% NaCl is sterile, Colorless nail polish, Chinese ink (black), Night adhesive (G. C Dental Industrial Corp Tokyo).

Tools : Incubator cupboard with a temperature of 37 ° C, Cutter / cutter, Digital microscope, Plastic bowl for soaking samples, Diamond disk, Extirpation needle, file size No.15 - 55 (Mann. Japan), High speed hand piece, bur diamond round DM fissure, Tweezers, Plastic filling, spreaders, root canal plugger, Termaprep Plus (Tulsa Dental product. Tulsa Oklahoma), Endodontic ruler, Lamp of spirits, Water bath temp 5°-55° C.

Ways Of Working : 70 root teeth with a straight root canal and foramen at the closed apex of the new tooth removed. The teeth are cleaned from the tissue attached to 2.5% NaOCL solution and then 70% alcohol and soaked in distilled water, Cutting is limited to cervical ($\pm$ 12 mm), Length measurements are carried out using X-ray photos with millimeters of grid, Conventional preparation with a length of 0.5 - 1 mm shorter than the length of the tooth, up to file No. 55 and each tool replacement is irrigated with NaOCL solution, 2.5%, Apical contours are removed by using file no.15, this is to homogenize the diameter and facilitate the entry of the dye liquid into the root canal, **distribution of sample groups:** Teeth that have met the criteria are randomly selected as many as 64 teeth, The 64 teeth were randomly divided into 2 groups, each 32 teeth, which would be filled with a thermafil technique and a lateral condensation technique, 32 teeth were randomly divided into 2 groups, each of 16 teeth, which were distinguished by the orifice and apex regions, 16 teeth were randomly divided into 2 groups, each of 8 teeth distinguished by day 2 and day 7

Table 1. Frequency distribution of root canal filling results with a thermaphile technique and lateral gutta perca condensation technique after two (2) days and seven (7) days of root canal filling

	Leaking		Not leaking		Total
	n	%	n	%	
2 days					
Thermafil					
Orifice	8	100	0	0	8
Apex	7	87,5	1	12,5	8
Total	15		1		16
lateral condensation					
Orifis	8	100	0	0	8

Apeks	7	87,5	1	12,5	8
Total	15		1		16
7 days					
thermafil	8	100	0	0	8
Apeks	7	87,5	1	12,5	8
Total	15		1		16
lateral condensation					
Orifis	8	100	0	0	8
Apeks	8	100	0	0	8
Total	16				16

5. Research Result

Time-based filling results, In table 1, the frequency distribution of root canal filling results with the thermaphile technique and the lateral gutta perca condensation technique after two (2) days of root canal filling showed that all samples had leakage in orifice (100%), but in root canal filling at the apex that was not leak from both techniques is only 12.5%. This means that the results of the two root canal filling techniques in two good days were only at 12.5%.

Whereas after seven (7) days it also showed leak in the orifice (100%). The root canal filling with termafil technique that does not leak at the apex is only 12.5%, whereas lateral condensation techniques are found to leak at the apex and orifice (100%). This shows that (12.5%) the results of root canal filling at the apex in seven (7) days in termilized techniques still did not leak, whereas in the gutta perca lateral condensation technique there was a leak.

In table 2, it can be seen that the average distance of leakage in the orifice in the two (2) days termafil technique after root canal filling reached 3.371 mm which is equal to seven (7) days (3.372 mm). The average distance of orifice leakage in the termafil filling technique was not significantly different from the increase in time after root canal filling ($p > 0.05$)

Table 2. The average distance of leakage in the orifice and apex after 2 days and 7 days of root canal filling (in mm).

	2 Days	7 Days	p value
Orifis			
Thermafil	3,371	3,372	0,834
Lateral condensation	2,130	1,931	0,006
Apeks			
Termafil	2,347	2,334	0,674
Lateral condensation	0,971	1,947	0,074

* $p < 0,05$ = signifikan

In the gutta lateral condensation technique the average leakage distance after two (2) days of root canal filling reached 2.130 mm, relatively equal to seven (7) days after root canal filling (1,931 mm). The mean distance of orifice leakage in the gutta perca lateral condensation technique was not significantly different from the increase in root canal filling time ($p > 0.05$).

The average distance of leakage in the apex in the termafil gutta perca technique after two (2) days of root canal filling reached a distance of 2,347 mm, equal to the distance after seven (7) days of root canal filling (2,334 mm). It was seen that the average distance of leakage at the apex in the termafil filling technique was not significantly different from the increase in time after root canal filling ($p > 0.05$).

The average distance of apex leakage in the gutta perca lateral condensation technique after two (2) days of root canal filling was 0.971 mm, relatively equal to seven (7) days after root canal filling (1,997 mm). The average distance of the leak at the apex in the lateral condensation filling technique was not significantly different from the increase in time after root canal filling.

Filling Results Based on leakage distance, In table 3, it can be seen that filling with the termafil technique reached the average distance of leakage in the orifice at 2 days after root canal filling (A1) was $3.371 \text{ mm} \pm 0.942 \text{ mm}$, while the lateral condensation technique was $2.130 \text{ mm} \pm 1.861 \text{ mm}$ (B1). Statistically there was no difference in the distance of leakage in the orifice after two days of root canal filling between the two techniques (chi square test, $p > 0.05$). This shows the distance of leakage that occurs in the orifice between the two techniques is relatively the same.

Table 3. Average distance of root canal filling leakage in the termafil technique and gutta perca lateral condensation technique in the orifice and apex after two and seven days of root canal filling (in mm)

		Thermafil technique		Lateral Condensation Technique		p value
		X	SD	X	SD	
2 days						
Orifis						
	leak	3,371	0,942	2,13	1,861	0,600
Apeks						
	leak	2,347	1,912	0,971	0,481	0,018*
7 days						
Orifis						
	leak	3,372	0,845	1,931	0,789	0,006*
Apeks						
	leak	2,334	1,897	1,997	1,176	0,753

Keterangan :

X : average distance

SD : Standar Deviasi

n : number of samples

* $p < 0,05$ = Signifikan

6. Discussion

The success of root canal treatment based on the results of tight filling in the apical and orifice by comparing various root canal filling techniques has been widely reported.^{5,24,25} Root canal filling techniques that are commonly used, namely lateral condensation and other relatively new techniques in Indonesia still cause differences of opinion regarding the quality of root canal closure. This may be due to the non-homogeneous gutta perca mass of the lateral condensation technique so that the adaptation that occurs on the root canal wall is not good so that it can increase ink penetration, while the thermal technique using heated gutta perca filler

has better adaptation to the root canal wall and can fill the entire space of additional root canals. Gutmann et al. Evaluated the technique of termile obturation with lateral condensation techniques and reported that thermafil produced denser root canal filling and was well adapted throughout the root canal system compared to other obturation techniques.

Vertical / lateral condensation in the apical region cannot be carried out on thermafil techniques, because the presence of metal / plastic carriers from the gutta perca prevents the insertion of spreaders and cones to fill space, (Taylor 1995, Gutmann 2002). In addition, the nature of the hot gutta perca filler will experience shrinkage as soon as the gutta perca returns to cold.²⁶

The thermafil filling technique uses heated gutta perca fillers, heated to shrink after cold (from α to phase β)²⁶ Shrinkage of the filler causes a gap between the gutta perca and the root canal wall which increases ink penetration. The greater the volume of the gutta perca in the root canal the greater the shrinkage that occurs and vice versa^{26,27,28}.

Leaks that occur in the thermafil technique and the lateral gutta perca condensation technique do not increase / remain with increasing time after root canal filling. The results of the study are in accordance with Gutmann's (1999) study which stated that the distance of root canal filling leaks in the non-increasing / fixed thermafil gutta perca technique in the short term (1-10 days). From the results of the research that has been done, the evaluation of the results of root canal filling is done by making a buco-lingual x-ray photo that looks dense at the apical, orifical and lateral, but it turns out that the leak still occurs.

7. Conclusion

The results of root canal filling with the thermafil and gutta perca lateral condensation techniques are as follows : In the thermafil filling technique and the lateral gutta condensation, the leak in the orifice after two (2) and seven (7) days root canal filling are all leaking (100%). In both techniques after two days root canal filling that did not leak at the apex was 12.5%, while after seven (7) days root canal filling in the thermafil technique that did not leak remained / did not change (12.5%), and in the technique lateral condensation after seven (7) days of root canal filling all leak (100%), The average distance of leakage in the orifice and apex in the thermafil technique is greater than the gutta perca lateral condensation technique.

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