

**COMPARATIVE EVALUATION TO CHECK SEALING ABILITY OF  
DIFFERENT OBTURATION TECHNIQUES BY CONFOCAL MICROSCOPE:  
AN IN-VITRO STUDY**

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**ABSTRACT**

**Aims:** The aim of this study is to compare the sealing ability of two root canal filling materials using a confocal microscope.

**Methods and Materials:** Twenty human first premolars with intact roots, extracted for orthodontic purpose, were selected for the study. Root canal treatment was done in all the specimens and randomly divided into two groups (ten teeth in each group) and obturated with two different obturating materials (i.e. Thermafill and Pro-Points). All the specimens were subjected to thermocycling and then stored in 100% humidity at 37°C for 48 hours. Sealing ability was checked using stereomicroscope.

**Statistic analysis:** Done by using tukey test and ANOVA.

**Result:** The sealing penetration into dentinal tubules were observed more in Thermafil as compared to Pro-Point.

**Conclusion:** Study concluded that Thermafill is the better material for obturation as it exhibits higher depth of sealing penetration than Pro- Points.

**KEYWORD:** Sealing, Pro-Points, Thermafil, Confocal Microscope, Obturation

## INTRODUCTION

The clinical success of endodontic treatment dependent on proper access, cleaning, shaping, disinfection and sealing of root canals. Three dimensional sealing ability of obturating material leads to decrease the risk of apical microleakage & hence increases the success rate of endodontic treatment.<sup>[1]</sup>

Ben Johnson (1978) introduced concept of carrier based thermoplasticized gutta-percha obturation technique involving the obturation of the root canal with heated alpha phase guttapercha on a carrier. In early 1990s it was introduced into the market as a K-file covered by gutta-percha that was inserted into the canal after bunsen flame heating. The “Thermafil” is a patented endodontic obturator consisting of flexible central carrier made of stainless steel, titanium, or plastic uniformly coated with a layer of  $\alpha$ -phase gutta-percha. When heated the gutta-percha becomes thermoplasticized and adheres to the carrier.<sup>[1]</sup>

Pro-Points have a two component design, with a central core to provide good handling characteristics and a hydrophilic polymer coating, which radially expands to seal the canal when hydrated in the root canal. This gentle expansion occurs within the first 4 hours after placing the point into the canal.<sup>[2]</sup>

## METHODS

The selected samples were de-coronated at twelve millimeter from the apex for standardization with a low-speed diamond disc under continuous water spray. Chemo- mechanical debridement of the root canal was done by removal of pulp and canal patency was maintained by passing with an ISO size 15 K-file. The working length was established by reducing 0.5 mm from the radiographic apex. Instrumentation was performed with a crown down technique using Hyflex EDM rotary instrument system. All canals were prepared to ISO size 30. The canal is irrigated between each instrument with 2 ml 5% NaOCl for 1 minute and final flush of 2 ml 17% EDTA (pH7.7) was done for 3 minute. Finally, the canals were washed with 2 ml of normal saline with 27 gauze leur-lock syringe. After completion of instrumentation, the root canals were dried with ISO size 20 paper points and checked for patency.

The prepared teeth were randomly divided into 2 groups of 10 samples each i.e:

- 1. Group I:** Thermafil with AH Plus Sealer
- 2. Group II:** Pro-Points with AH Plus Sealer

The canals were dried with paper points and coated with AH Plus sealer using lentulo spiral. Master cone was selected, checked for tug back and coated with sealer which was mixed with Rhodamine B fluorescent dye to an approximate concentration of 0.1%, and placed in the canal. All the specimens were obturated

with Thermafil obturators and Pro-point syringe according to manufacturer’s instructions.

After the completion of obturation, all the teeth were wrapped with moist gauze to maintain the relative humidity at 37<sup>0</sup>C for 48 hrs for the proper setting of the sealer. The specimens were transversely sectioned at the mid-point of the coronal, middle and apical third of each root.

Samples were examined with a Confocal Laser Scanning Microscopy (CLSM) (Carl Zeiss, Germany) at magnification of 10X. The depth and penetration of sealer into dentinal tubules is measured and evaluated.

**Statistics**

Data were summarized as Mean ± SD (standard deviation). Groups were compared by one way analysis of variance (ANOVA) and the significance of mean difference between the groups was done by Tukey’s post hoc test. Mean microleakage of three groups were compared which was p<0.001- as compared to Thermafil.

**RESULTS**

The amount of microleakage was minimum with Thermafil (0.01-0.12 mm) as compared to ProPoint (0.17-0.30 mm).

**Table 1 : Comparison of microleakage.**

<b>Thermafil</b>	<b>Propoint</b>	<b>F value</b>	<b>P value</b>
0.050±0.029 (0.01-0.12)	0.230±0.035 (0.17-0.30)	212.60	<0.001

Numbers in parenthesis indicates the range (min-max) On comparison of mean microleakage between the groups Thermafill has got minimum micro leakage (P<0.001).

**Table 2: Comparison of microleakage of groups thermafill.**

<b>Comparison</b>	<b>Mean difference</b>	<b>Q</b>	<b>P value</b>	<b>95% ci of difference</b>
Thermafil vs Pro-Point	-0.18	28.54	P<0.001	-0.2018 to – 0.1590

**DISCUSSION**

Root canals have a complex anatomy which can result in endodontic failure due to inappropriate sealing of lateral or accessory canals, voids or curved roots. Herbert Schilder described the final objective of endodontic procedure as being the “total obturation of root canal space” or filling the radicular space three dimensionally”.

To fulfil the criteria several newer obturating materials have been introduced which have successfully reduced the rates of endodontic failures.<sup>[3]</sup>

In this research Pro-Point and Thermafil obturating materials have been used which shows efficacious results after obturation of root canal.

In Pro-Point an expansion (44%) was seen after four hours of obturation. Pro-Point being hydrophilic in nature is a unique obturating system. It can form hydrogen bond to the polar sites present, enabling expansion within the polymer chains. The rate and extent of this expansion is controlled as a part of manufacturing process. The expansion occurs with a miniscule force that is claimed to be well below the reported tensile Strength of dentin. The slight positive pressure against the canal wall that is created forms a seal that is believed to be virtually impermeable to bacterial microleakage.<sup>[4]</sup>

An active polymer is there in AH Plus sealer which controls the degree of swelling. The sealer is dimensionally stable and non-resorbable inside the canal.

Calcium hydroxide and hydroxyapatite are the by-products of the setting reaction of the sealer, rendering the material both anti-bacterial while setting and very biocompatible once set.<sup>[5]</sup>

The Thermafil carrier is a flexible 25mm biocompatible radiopaque plastic material with a 0.04 taper. It is coated with alpha phase gutta-percha which expands just after the setting and then contracts. When cooled down to the beta phase, shrinkage occurs and the degree of shrinkage was greater than the degree of expansion according to the statistical analysis in the present study (9.8%). When heated, alpha phase becomes exceedingly sticky and tacky, and has excellent flow characteristics. This heated gutta-percha exhibits a wetting phenomenon that causes it to adhere to the carrier. The flow properties allow the gutta-percha to obturate available lateral and accessory canals. AH Plus (Dentsply, Switzerland) sealer has a self-adhesive properties and dimensional stability. The setting reaction of a sealer was not

adversely affected by thermoplastic obturation. Confocal Microscope is an ultra latest and important diagnostic aid in determining the sealing ability and to analyse the changes three dimensionally.<sup>[8]</sup>

The physical measurements revealed that the measurement procedures using Conofocal Microscope is an easy and conservative approach that allows accurate calculation of obturating material in the canal. The proposed approach based on geometric approximation of pulp of first premolars volumes measured by Conofocal microscope remarkably reduced the operating time in comparison to other more complex and expensive techniques. The validation procedure in which real volumes are compared with those calculated using Conofocal microscope supports the accuracy of the obturated canal.<sup>[9]</sup>

The result of this study showed that Thermafil seems to be promising material and sealer (AH Plus) because of its easy handling, adhesion, creates good apical sealing ability, and high penetration into dentinal tubule, where as Pro-Points showed good adhesion but apical sealing ability is compromised as compared to Thermafil.<sup>[5]</sup>

However, in clinical conditions, there is presence of dynamic nature of periapical tissue which could be different from the in-vitro situation. Further long- term studies are needed for these methods.

## **CONCLUSION**

Study concluded that Thermafil showed statistically significant higher depth and percentage of sealer penetration into dentinal tubules followed by Pro-Point technique.

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