Evaluation of apical and lateral extrusion of sealer using different sized thermoplastized obturators.

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ABSTRACT

Background: A new product of thermoplasticized obturators (thermafill and soft core) had been used instead of cold gutta percha. The aim of this study was to measure and compare the apical and lateral extrusion of two types of sealers (zinc oxide eugenol, apexit plus) used in cold lateral condensation, thermafill and soft core obturation methods.


Result: The groups obturated using apexit plus sealer showed higher mean of apical extrusion than groups obturated using zinc oxide eugenol sealer. The mean of the apical extrusion was higher in all thermoplasticized obturators groups than cold gutta percha group. Thermafill group size 35 showed lower mean of lateral extrusion than soft core size 35, 40 and lateral condensation.

Conclusion: Cold gutta percha group showed the lowest mean of apical extrusion. Thermafill obturators size 35 group showed the lowest mean of lateral extrusion.

Key words: Apical, lateral, extrusion, sealer.

INTRODUCTION

After a suitable instrumental preparation and disinfection, root canals must be obturated therefore blocking the path between oral cavity and periradicular tissue (1). Therefore, providing barrier to canal infection and re-infection by inhibiting the introduction of new bacteria.

Different materials and methods are available for root canal obturation: cold lateral condensation in which Gutta-percha points made of viscous, rigid β-phase getta percha. A number of thermoplasticized gutta-percha methods have been developed like Thermafil obturators (Dentsply/Maillefer) consist of plastic carriers coated with α-phase gutta-percha. In a single insertion Thermafil achieves a rapid three-dimensional obturation of the root canal system. During insertion the gutta-percha precedes the carrier apically, filling available lateral and accessory canals at the same time. At the heart of the Thermafil there is a flexible 25mm plastic carrier with 0.04 taper. All Thermafil carriers are fully biocompatible and radiopaque. The Thermaprep Plus oven is specifically designed to meet the heating requirements of Thermafil obturators.

Obturators
1. Cold gutta percha: It is made of viscous, rigid β-phase gutta percha and used in lateral condensation.
2. Thermafill obturators size 35, 40. Thermafill offers a unique, patented, central carrier that is uniformly pre-coated with α-phase gutta-percha. In a single insertion Thermafil achieves a rapid three-dimensional obturation of the root canal system. During insertion the gutta-percha precedes the carrier apically, obturating the canal to the apex, filling available lateral and accessory canals at the same time. At the heart of the Thermafil there is a flexible 25mm plastic carrier with a 0.04 taper. All Thermafil carriers are fully biocompatible and radiopaque. The Thermaprep Plus oven is specifically designed to meet the heating requirements of Thermafil obturators.
3. Soft core obturators (low heat) size 35, 40. It consists of biocompatible plastic core carries α-phase gutta-percha. The carrier has 0.3 taper and the smaller diameter makes carrying gutta percha to the apex easier. Soft-Core has a simple twist-
off handle due to a metallic insertion pin that is removed with a slight twisting action. This leaves the coronal portion of the plastic core hollow, thus facilitating post space preparation and retreatment.

Sealers
   Zinc Oxide is one of the most used, and tested of all root canal sealers.
2. Apexit plus. It is suitable for use in conjunction with all obturation techniques involving gutta-percha. Its properties are: biologically balance, easy flowing composition allows the material to adapt well to morphologically complicated canals, slight setting expansion, low solubility, enables good and durable sealing of the root canal.

Methods
The acrylic blocks have two apical foramenae (two sides). We blocked one of them by cold cure acrylic to collect in one direction the extrusion of the sealer.

1. Ten groups were divided according to the type of sealer and obturator that had been used as shown in the table:

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of samples</th>
<th>Type of sealer</th>
<th>Type of obturator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>ZOE</td>
<td>Cold G.P</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>A.P</td>
<td>Cold G.P</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>ZOE</td>
<td>Thermafill Size(35)</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>A.P</td>
<td>Thermafill Size(35)</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>ZOE</td>
<td>Thermafill Size(40)</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>A.P</td>
<td>Thermafill Size(40)</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>ZOE</td>
<td>Soft core Size (35)</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>A.P</td>
<td>Soft core Size (35)</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>ZOE</td>
<td>Soft core Size (40)</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>A.P</td>
<td>Soft core Size (40)</td>
</tr>
</tbody>
</table>

In group 1, 2 the samples were obturated by Cold lateral condensation.

Group 2
Apexit plus sealer was manually mixed by one press on the handle of cartridge. Equal amount of base and catalyst was mixed till homogeneity and small amount of methylene blue added to get light blue color (This was done to all the Apexit groups).

For both groups the tip of file size 35 was dipped in sealer and coated the canal wall by a counter clockwise rotation. A master gutta-percha cone was coated with the sealer and gently seated to the full working length and laterally condensed with a finger spreader. Accessory gutta-percha cones coated with the same sealer were inserted until the canal completely filled. Excess gutta-percha was removed and apically condensed with a hand plugger.

In groups 3-6 the samples were obturated by thermafill obturators.

Group 3
Apexit plus sealer was mixed as mentioned before. We placed the selected size 35 in one of the heating chamber of Thermaprep plus oven. Fifteen seconds were needed to heat gutta percha, and during this time apexit plus sealer introduced to the canal by file size 30. The cone was inserted inside the canal firmly and slowly to the working length without any twisting or rotation.

Group 4
Zinc oxide eugenol sealer was mixed as mentioned before. We placed the selected size 35 in one of the chamber of oven. Fifteen seconds was needed to heat gutta percha, during this time apexit plus sealer was introduced to the canal by file size 30. The cone was inserted inside the canal firmly and slowly to working length without any twisting or rotation.

Group 5
Apexit plus sealer was mixed as mentioned before. We placed the selected size 40 in one of the chamber of the oven. The same procedure was done as the previous groups.

Group 6
Zinc oxide eugenol sealer was mixed as mentioned before. We placed the selected size 40 in one of the hole of oven. The same procedure was done as the previous groups.

In group 7-10 the samples were obturated by soft core obturators.

Group 7
Apexit plus sealer was mixed as mentioned before. We placed the selected size 35 in its specific hole. While soft core obturator was heating, we placed a thin coating of apexit plus on the wall of the canal. The obturator removed from the oven...
without twisting the handle. Immediately we inserted the obturator into the canal to the working distance and allow the gutta percha to cool for 3-4 minutes.

**Group 8**

Zinc oxide eugenol sealer was mixed as mentioned before. We placed the selected size 35 in its specific hole. As the obturator was heating, we placed a thin layer of apexit plus on the wall of the canal. Immediately before heating, we inserted the obturator into the canal to the working distance and the gutta percha was allowed to cool for 3-4 minutes.

**Group 9**

Apexit plus sealer was mixed as mentioned before. We placed the selected size 40 in its specific hole. The same procedure was done as the previous groups.

**Group 10**

Zinc oxide eugenol sealer was mixed as mentioned before. We placed the selected size 40 in its specific hole. The same procedure was done as the previous groups.

**RESULTS**

Table 1 represented the statistical values of the linear measurement of both apical and lateral extrusions of sealers.

<table>
<thead>
<tr>
<th>Type of obturator</th>
<th>Type of sealer</th>
<th>Mean of apical extrusion</th>
<th>Mean of lateral extrusion</th>
<th>S.D of apical extrusion</th>
<th>S.D. of lateral extrusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold gutta percha</td>
<td>Apexit plus</td>
<td>0.54</td>
<td>4.43</td>
<td>0.439</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>ZOE</td>
<td>0.34</td>
<td>3.13</td>
<td>0.196</td>
<td>0.34</td>
</tr>
<tr>
<td>Thermafill size 35</td>
<td>Apexit plus</td>
<td>1.83</td>
<td>1.58</td>
<td>0.622</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>ZOE</td>
<td>1.78</td>
<td>2.45</td>
<td>0.368</td>
<td>1.23</td>
</tr>
<tr>
<td>Thermafill size 40</td>
<td>Apexit plus</td>
<td>1.88</td>
<td>3.5</td>
<td>0.212</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td>ZOE</td>
<td>1.76</td>
<td>3.81</td>
<td>0.01</td>
<td>1.02</td>
</tr>
<tr>
<td>Soft core size 35</td>
<td>Apexit plus</td>
<td>1.88</td>
<td>3.1</td>
<td>0.36</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td>ZOE</td>
<td>1.53</td>
<td>2.3</td>
<td>0.394</td>
<td>0.82</td>
</tr>
<tr>
<td>Soft core size 40</td>
<td>Apexit plus</td>
<td>1.96</td>
<td>3.14</td>
<td>0.166</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>ZOE</td>
<td>1.55</td>
<td>2.98</td>
<td>0.190</td>
<td>0.50</td>
</tr>
</tbody>
</table>

**Figure 1: Apical extrusion.**

**Figure 2: Lateral extrusion.**
DISCUSSION

Many investigators only classify whether extrusion occur or not, other investigators measure it either in length \( (2) \), weight or contact surface \( (3) \). Length is the most used method, so that we measured the length of sealer extrusion by mm.

Methylene blue dye was completely soluble in both types of sealers (zinc oxide eugenol, apexit plus) and did not affect the handling or setting time characteristics of sealers. It provided sufficient contrast among gutta percha, sealers and acrylic resin blocks for measuring the linear apical and lateral extrusion of both sealers under stereomicroscope.

Apical extrusion

The groups obturated using Apexit plus sealer showed higher mean of apical extrusion than those obturated using zinc oxide eugenol sealer due to the flowing composition and slight setting expansion of apexit plus. In addition to the setting shrinkage of zinc oxide eugenol sealer, Ørstaviketal \( (4) \) stated that Zinc-oxide-eugenol based sealers generally showed shrinkage ranging from 0.3 to 1%, while one product (Proco-Sol) exhibited expansion exceeding 6% after prolonged storage. The epoxy-based materials, AH 26 and AH 26 silver free, exhibited a large, initial expansion of 4–5%. AH Plus expanded from 0.4% after 4 weeks up to 0.9%. Apexit, a Ca (OH)\(_2\)-based material, showed only minor variation round baseline value, \(-0.14\) to \(+0.19\)%.

We attributed apical extrusion to a combination of several factors:

- The direction of condensation forces using thermoplasticized gutta percha was apically while cold gutta percha cones condensed laterally.
- Thermoplasticized gutta percha obturators flow extremely higher than cold gutta percha.
- A straight canal of Acrylic resin blocks may be increased the apical extrusion. EIDeeb \( (6) \) compared small curved canal and large straight canals and perceived that large, straight canals have a slightly increased predisposition for extrusion.

Lateral extrusion

The groups obturated using thermafill size 35 had lower mean of lateral extrusion than soft core size 35, 40 and lateral condensation groups. It is related to several factors like the thickness and taperness of the plastic carrier of thermafill differ from soft core plastic carrier. It is thinner and less tapered in soft core than thermafill obturators leaded to increasing the amount of gutta percha material. Cold lateral condensation groups had the higher mean of lateral extrusion due to the direction of condensation pressure, consequence placement of auxiliary cones pushed sealer laterally than thermoplasticized gutta percha.

Gençoğlu and Nimet \( (8) \) stated that core techniques (Thermafill, JS Quick-Fill, and Soft Core) produced higher gutta-percha content than the Microseal, System B, and lateral condensation techniques \( (P<0.05) \). The lateral condensation technique produced the least gutta-percha content \( (P<0.05) \). Boussetta et al \( (9) \) concluded that a significant less leakage for the Herofill™ Soft-Core system compared to lateral condensation in terms of total mean dentinal surface and at the 500 \( \mu \)m level. In comparison of thermafill size 35, 40 we concluded that size 35 had less lateral extrusion than size 40 because increasing the size of obturator leads to increase the amount of gutta percha material and more pressure applied on the canal wall. More adaptability to the walls and filling accessory canals occur but lateral extrusion of both types of sealer also increase. This occurred especially when we used zinc oxide eugenol sealer.

REFERENCES

8. Gençoğlu, Nimet. Comparison of 6 different gutta-percha techniques (part II): Thermafil, JS Quick-Fill, Soft Core, Microseal, System B, and lateral condensa-