An evaluation of the sealing ability of different obturation and gutta-percha removal techniques (A Comparative Study)

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ABSTRACT

Background: Removing gutta-percha (GP) during post space preparation is common in dental practice. The aim of this study was to compare the effect of using two types of rotary instruments (peeso reamers and Core-Remover) for GP removal on the apical sealing ability of GP in three obturation techniques (lateral condensation, thermafil, and softcore) using dye penetration method.

Materials and method: Sixty palatal roots of freshly extracted human maxillary first molars were sectioned and prepared with ProTaper manual system in crown-down manner to size F4. Samples divided randomly into 3 groups (20 roots each) according to the method of obturation; group A: Lateral condensation, group B: Soft-Core and group C: Thermafil. All samples received GP removal after 7 days incubation (37°C and 100% humidity) either using Peeso reamer (groups A1, B1 and C1) or Core Remover (groups A2, B2 and C2) (10 roots each group). The samples were sealed coronally, immersed in Indian ink and incubated for a week. Roots were demineralized with a 5% nitric acid solution, cleared in methyl salicylate and examined using a stereomicroscope under 40X magnification with calibrated grid to establish the degree of apical dye penetration in millimeters.

Results: Data were collected and subjected to descriptive and inferential statistical analysis (ANOVA and t-test) and there was no significant difference between using peeso reamer and core remover.

Conclusion: Apical sealing ability of remaining GP is less affected by the technique of GP removal.

Key words: Core remover, Protaper, Thermafil, Soft core, Apical leakage, clearing. (J Bagh Coll Dentistry 2011;23(4):7-9)

INTRODUCTION

Intraradicular posts are commonly used to restore endodontically treated teeth when their remaining coronal tissue can no longer provide adequate support and retention for the restoration material. (1) To make room for a custom or prefabricated dowel GP must be removed from the root canal space. (2) Depending on the technique of GP removal the residual filling material may become displaced, which creates a pathway for bacterial invasion and re-infection of the root canal system. (3,4)

Various methods are used for the removal of endodontic filling material, but dentists often use mechanical preparation techniques for post spaces because it is faster. When mechanical preparation is preferred it has been established that drills used on low speed hand piece are the safest instruments. Examples of these drills include; Peeso reamers and Gates Glidden which are considered "safe-tip" instruments because they are not end-cutting burs. (5)

Until recently all the rotary instruments used for removing GP to prepare post space were designed to be used in low speed handpiece. CMS Dental Aps (Copenhagen, Denmark); the manufacturing company of Soft-Core had introduced a new rotary instrument for the removal of GP which is designed to be used in high speed handpiece named it Core-Remover (figure 1).

Figure 1: Core Remover drills.
MATERIALS AND METHOD

Sample description. Sixty freshly extracted human teeth (maxillary first molar) with straight completely formed palatal roots were used in this study. After extraction, all teeth were stored in normal saline solution (at room temperature) changed daily to avoid fungal growth. Roots surfaces were inspected with a magnifying eye lens (X10) and light curing unit for any visible cracks or fractures.66

Using a diamond disc and water coolant the palatal roots were sectioned perpendicular to their long axis at a length of 14 mm from the apex to facilitate straight line access for canal instrumentation and filling procedure and to get flat reference point for measurement.7 Then the roots were embedded in acrylic blocks surrounded by a delicate layer of light body silicon impression material to simulate the bony socket.8

Root canal instrumentation. The roots were prepared with ProTaper manual system in crown-down manner with copious irrigation with 2.5% NaOCl solution to size F4.

The Protaper instruments were used according to the manufacturer instructions in balanced force technique. After instrumentation of each sample by the size F4, 0.5ml of EDTA 17% solution was applied into the canal for two minutes followed by 1ml of NaOCl, then 1ml of distilled water was used as final irrigant to avoid the development of NaOCL crystals and finally the samples were dried with absorbent paper points.9

Obturation. Samples were divided randomly into 3 groups according to the method of obturation 20 roots for each group.

Group A: The roots were obturated with GP cones size 40 (0.02 taper) and Apexit plus sealer in cold lateral condensation technique using size 25 finger spreader and size 20 accessory cones.

Group B: In this group roots were obturated by Soft-Core obturators (regular heat) size 40 according to the manufacturer instructions using the Soft-Core oven.

Group C: In this group roots were obturated by Thermafil cones with plastic carrier size F4 according to the manufacturer instructions using the Thermaprep plus oven.

All the samples were stored in 100% humidity at 37°C in an incubator for seven days.

Gutta-percha removal. Eight millimeters of coronal gutta-percha were removed leaving only six millimeters apically. Each group was subdivided randomly into 2 subgroups according to the technique of gutta-percha removal; groups A1, B1 and C1 using peeso reamers and groups A2, B2 and C2 using Core Remover drills (table 1). 10 teeth for each subgroup. The handpieces were assembled to the swiveling arm of a modified dental surveyor to ensure alignment to the long axis of the root.

Table 1: Samples grouping.

<table>
<thead>
<tr>
<th>Group</th>
<th>Method of obturation</th>
<th>Technique of gutta-percha removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Lateral condensation tech.</td>
<td>Peeso reamer</td>
</tr>
<tr>
<td>A2</td>
<td>Lateral condensation tech.</td>
<td>Core Remover</td>
</tr>
<tr>
<td>B1</td>
<td>Soft-Core cones</td>
<td>Peeso reamer</td>
</tr>
<tr>
<td>B2</td>
<td>Soft-Core cones</td>
<td>Core Remover</td>
</tr>
<tr>
<td>C1</td>
<td>Thermafil cones</td>
<td>Peeso reamer</td>
</tr>
<tr>
<td>C2</td>
<td>Thermafil cones</td>
<td>Core Remover</td>
</tr>
</tbody>
</table>

Leakage study

Each root coated with one layer of nail varnish and two layers of sticky wax except for the apical 2mm was immersed in a glass vial containing Indian ink and deposited in an incubator at 37°C for a week.

Clearing Process

The roots were decalcified with 5% nitric acid for a period of 5 days, renewing the acid daily. The roots were then washed under running tap water and dehydrated by 99-100% ethyl alcohol for 3 days with daily change of alcohol, and then all the roots became transparent by immersion in methyl salicylate for 24 hours.10

RESULTS

The mean values for linear measurement of apical dye penetration measured in millimeters for each group are listed in table 2.

Table 2: Descriptive statistics.

<table>
<thead>
<tr>
<th>groups</th>
<th>No.</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A1</td>
<td>10</td>
<td>0.45</td>
<td>0.71</td>
<td>0.5850</td>
<td>0.07821</td>
</tr>
<tr>
<td>Group A2</td>
<td>10</td>
<td>0.45</td>
<td>0.69</td>
<td>0.5690</td>
<td>0.07923</td>
</tr>
<tr>
<td>Group B1</td>
<td>10</td>
<td>0.40</td>
<td>0.63</td>
<td>0.5030</td>
<td>0.07602</td>
</tr>
<tr>
<td>Group B2</td>
<td>10</td>
<td>0.38</td>
<td>0.57</td>
<td>0.4870</td>
<td>0.06651</td>
</tr>
<tr>
<td>Group C1</td>
<td>10</td>
<td>0.35</td>
<td>0.58</td>
<td>0.4720</td>
<td>0.07871</td>
</tr>
<tr>
<td>Group C2</td>
<td>10</td>
<td>0.36</td>
<td>0.57</td>
<td>0.4500</td>
<td>0.07572</td>
</tr>
</tbody>
</table>

The highest mean value for apical dye penetration was seen in group A1 followed by A2, then groups B1 and B2, and the least values were seen in groups C1 and C2.

The ANOVA-test showed that there is statistically a significant difference (p<0.05) among the experimental groups. Student t-test (table 3) showed that:
1. Within the same technique of obturation there was no significant difference between using peeso reamer and core remover.
2. There was significant difference between lateral condensation and soft core groups with both peeso reamer and core remover.
There was highly significant difference between lateral condensation and thermofil groups with both peeso reamer and core remover.

There was non-significant difference between soft core and thermofil groups with both peeso reamer and core remover.

The results of this study showed that mean values of apical dye penetration for groups used Core-Remover (A2,B2 and C2) were slightly lower than mean values for groups used peeso reamer (A1,B1 and C1). This difference could be attributed to the much higher speed of the high speed handpiece and less vibration when compared to the low speed handpiece, thus the integrity of the sealer might be less affected.

**DISCUSSION**

Intraradicular posts are commonly used to restore endodontically treated teeth when their remaining coronal structure can no longer provide adequate support and retention for the restoration material. To make room for a custom or prefabricated post that will retain a core or crown, gutta-percha must be removed from the root canal space. This may affect the quality of the seal of the root canal filling.

Until recently all the rotary instruments used for removing GP to prepare post space were designed to be used in low speed contra angle hand piece. CMS Dental Aps (Copenhagen, Denmark); the manufacturing company of Soft-Core had introduced a new rotary instrument for the removal of GP which is designed to be used in high speed handpiece (turbine) named it Core-Remover. This study was conducted to compare the effect of using Core-Remover on the apical sealing quality of gutta-percha to the use of the conventional instrument (peeso reamer). Peeso reamer was chosen because it is commonly used and has minimal influence on the apical seal.11

This study showed that removing GP with Core-Remover in high speed hand piece gives nearly similar results (statistically non significant) to using peeso reamer in low speed handpiece from the point of apical dye penetration for obturation techniques (Thermofil, Soft-Core and lateral condensation).

These results agree with previous studies of Hiltner, Prado et al & Grecca et al;12-14 who studied the effect of different methods of post space preparation on sealing ability of remaining root filling material by different leakage evaluation methods and they found that there was no significant difference in the sealing ability of the remaining root filling material related to the technique of GP removal. In this study, Core-Remover rotary instruments were used for GP removal, but no leakage studies involving this instrument were found in a search of the literature.

**REFERENCES**