

# Persistence of Residues after Endodontic Retreatment related to the Obturation Technique and to the Solvent

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## ABSTRACT

**Objective:** To quantify the persistence of residues after endodontic retreatment related to the root canal obturation technique (lateral compaction or single cone) previously performed and the solvent used (xylol or Endosolv-R) in the cervical and root apical segment using digital radiograph.

**Materials and methods:** Forty root canals were prepared using the F2 instrument and filled with gutta-percha and AH Plus, 20 canals using #25 point by lateral compaction and the other 20 using F2 point by single cone. The root canals were transversely sectioned, and two segments (cervical and apical) were obtained. Radiographs were taken from the segment in buccolingual and mesiodistal direction, as well as the area that was originally filled with the root canal obturation was measured using ImageJ. After the specimens were set on special devices, the obturations were removed using the rotary system and divided into four groups (n = 10): G1 – lateral compaction and xylol; G2 – lateral compaction and Endosolv-R; G3 – single cone and xylol; and G4 – single cone and Endosolv-R. A new radiograph was taken and the area occupied by residues was measured. The persistence of residues was obtained from the obturation remaining in the root canal in percentage. The data were analyzed using Kruskal–Wallis test (p = 0.05).

**Results:** There was no difference among the examined groups, regardless of the radicular segment or the radiograph direction (p > 0.05).

**Conclusion:** The endodontic retreatment using xylol or Endosolv-R in the obturations previously performed by lateral compaction or single cone technique presented similar persistence of residues in the root canal, regardless of the radicular segment.

**Keywords:** Endodontic, Retreatment, Root canal, Rotary Instruments, Solvents.

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## INTRODUCTION

The residues persistence from the obturation material is a frequent problem in the endodontic retreatment cases.<sup>1,2</sup> The persistence of these residues can negatively interfere on the sealer adhesion to the root dentin, compromising the success of endodontic treatment and favoring the infection in the root canal.<sup>3,4</sup>

New technological resources have been recommended to optimize the surgical procedures and to facilitate the root canal cleaning.<sup>5</sup> Despite the rotary instruments facilitate the gutta-percha removal, these instruments do not eliminate the gutta-percha completely.<sup>1,6</sup> Therefore, rotary instruments associated with organic solvents have been indicated to improve the residues removal.<sup>7,8</sup>

ProTaper retreatment instruments associated with xylol is one of the most effective and rapid techniques to reach working length.<sup>9</sup> The chloroform is another solvent recommended to be associated with reciprocating, and with the rotary instruments.<sup>8</sup> However, the solvent effect and residues removal capacity of the root canal of these substances are insignificant.<sup>10</sup>

Endosolv-R is a solvent for phenolic resin-formaldehyde sealers.<sup>11</sup> Its chemical composition presents formamide and 2-phenylethanol with the former being the major ingredient.<sup>12</sup> It is more effective in softener epoxy-based sealer, such as AH 26, AH Plus, and Adseal, in relation to xylol.<sup>13</sup> The residue removal of the epoxy-based sealer (AH Plus) from the dentin preventing the adhesion deterioration of the self-etch adhesive systems is another favorable property.<sup>12</sup>

By the other side, the previous obturation techniques and organic solvent used can influence on the persistence of residues in the root canal after endodontic retreatment.<sup>14,15</sup> This situation occurs in previously obturated canals by single cone technique.<sup>16</sup>

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So, there is possible relation between the chemical nature of the employed solvent and the retreatment rotary instruments with the root canal obturation technique that was previously performed. However, there are no studies evaluating the effects of xylol or Endosolv-R solvents associated with retreatment rotary instrument in root canals previously obturated by lateral compaction or single cone technique.

Therefore, the aim of this study was to quantify the persistence of residues after the endodontic retreatment in root canal previously filled by lateral compaction or single cone with the use of solvent (xylol or Endosolv-R) associated with ProTaper retreatment system, in the cervical and root apical segments.

**MATERIALS AND METHODS**

Forty human uniradicular teeth with single root canal, extracted for periodontal reasons, with similar anatomy, were selected and maintained in 0.1% thymol solution at 4°C. The crowns were removed with a diamond disk (KG Sorensen, Barueri, São Paulo, Brazil), leaving 16 mm of radicular length. A #15K file (Maillefer, Ballaigues, Switzerland) was introduced in the root canal until it was visible at the radicular apex. The working length was established 1.0 mm shorter than the total radicular length and was confirmed radiographically.

The root canals were prepared by ProTaper Rotary System technique to F2 instrument (Maillefer, Ballaigues, Switzerland) in accordance with manufacturer recommendations. The root canals were irrigated with 5.0 mL of 2.5% sodium hypochlorite (Asfer, São Caetano do Sul, São Paulo, Brazil) at each instrument change. After chemical-mechanical preparation, an additional irrigation with 17% ethylenediaminetetraacetic acid (EDTA) was performed for 1 minute followed by a final flush with 5 mL of 2.5% sodium hypochlorite solution.

The root canals were dried using paper points. In sequence, 20 root canals were filled with #25 gutta-percha master point (Dentsply, Petropolis, Rio de Janeiro, Brazil) by lateral compaction technique, and 20 root canals were filled with F2 ProTaper gutta-percha point (Dentsply, Petropolis, Rio de Janeiro, Brazil) by single cone technique.<sup>17</sup> A epoxy-based sealer (AH Plus, Dentsply DeTrey GmbH, Konstanz, Germany) was used in all root canals. The coronal radicular access was closed with temporary restorative material (Cavit, 3M, St. Paul, MN, USA). The roots were immersed in artificial saliva that was renewed to each 2 weeks and maintained at 37°C for 6 months.

After this period, the roots were embedded in acrylic resin and transversely sectioned 7.5 mm from the radicular cervical face and two root segments (cervical and apical) were obtained and individually placed in a plastic

device. Radiographs were taken from each segment in the buccolingual and mesiodistal direction using digital radiography system.

After the initial radiographic image (R1) was obtained, the teeth were randomly divided into four groups (n = 10) and submitted to several endodontic retreatment protocol. In G1 (lateral compaction and xylol), D1, D2, and D3 instruments (ProTaper Universal Retreatment, Dentsply Maillefer, Ballaigues, Switzerland) were used sequentially, in crown-down direction, until the apical working length previously established, as described by Só et al.<sup>5</sup> At each instrument change, 0.1 mL of xylol (Synth, Diadema, São Paulo, Brazil) was introduced in the root canal. In G2 (lateral compaction and Endosolv-R), the sequence was similar to G1, but by using Endosolv-R (Septodont, Saint-Maur-des-Fossés, Cedex, France) as organic solvent. Same procedures were performed in G3 (single cone and xylol) and G4 (single cone and Endosolv-R), but using xylol and Endosolv-R, root canal previously filled by single cone technique.

In sequence, the root canals were irrigated with 5.0 mL of 2.5% sodium hypochlorite, aspirated and dried with paper point. A new radiographic (R2) was taken in both directions similar to the first radiograph. The area occupied by the root canal obturation in R1 and the area occupied by residues after the retreatment protocols in R2 were measured (µm<sup>2</sup>), using ImageJ program. The area occupied by residues (R2) was transformed into percentage in relation to the original area occupied by the root canal obturation (R1). The data were statistically analyzed by Kruskal-Wallis test (p = 0.05).

**RESULTS**

Table 1 presents the median, maximum, and minimum values in percentage of persistence of residues from the

**Table 1:** Median, maximum, and minimum values in percentage of persistence of residues from the root canal obturation after different solvents associated with the obturation technique previously performed, in the mesiodistal and buccolingual direction in the cervical segment revealed by radiographic analysis

		<i>Median</i>	<i>Min/Max values</i>
G1	MD	50.11	33.33–80.00
	VL	36.66	20.00–66.66
G2	MD	30.30	0.00–62.50
	VL	17.30	2.00–50.00
G3	MD	41.42	0.00–100.00
	VL	36.66	14.28–75.00
G4	MD	48.07	33.33–66.66
	VL	20.85	6.66–32.53

\*There were no differences among the groups. G1 – lateral compaction and xylol; G2 – lateral compaction and Endosolv-R; G3 – single cone and xylol; and G4 – single cone and Endosolv-R. MD, mesiodistal radiograph; VL, buccolingual radiograph; Min, minimum; Max, maximum



**Table 2:** Median, maximum, and minimum values in percentage of persistence of residues from the root canal obturation after different solvents associated with the obturation technique previously performed, in the mesiodistal and buccolingual direction in the apical segment revealed by radiographic analysis

		Median	Min/Max values
G1	MD	50.00	10–100
	VL	36.50	9–82
G2	MD	37.50	2–100
	VL	26.00	2–83
G1	MD	28.77	7–100
	VL	17.50	11–96
G1	MD	18.71	1–100
	VL	16.50	2–45

\*There were no differences among the groups. G1 – lateral compaction and xylol; G2 – lateral compaction and Endosolv-R; G3 – single cone and xylol; and G4 – single cone and Endosolv-R. MD, mesiodistal radiograph; VL, buccolingual radiograph; Min, minimum; Max, maximum

root canals obturation after different protocols of endodontic retreatment related to the obturation technique previously performed, showed by radiographic analysis in mesiodistal and buccolingual directions in the cervical segment. Table 2 shows similar results of the apical segment.

There were no significant differences among the groups ( $p > 0.05$ ), regardless of the analyzed cervical or apical root segment, the radiographic direction, the endodontic retreatment protocol, or the root canal obturation technique previously performed.

## DISCUSSION

Regardless the obturation technique previously performed, the xylol solvents and Endosolv-R presented similar persistence of residues from root canal obturation, regardless of the root segment and radiographic direction.

This study showed that the persistence of residues using Endosolv R was not different from using xylol, regardless of the root canal obturation was previously performed by lateral compaction or by single cone technique. Shenoi et al<sup>13</sup> observed that the Endosolv-R presented higher solubilization potential of epoxy-based sealers (AH 26 and AH Plus) than xylol. On the contrary, in the root canal obturation the principal material present is the gutta-percha and the solvent action of these substances on the gutta-percha are similar.<sup>12,17</sup> Therefore, this fact favored the results from the retreatment protocols were similar.

Intracanal residues persistence is related to the local anatomy. After endodontic retreatment, these residues tend to persist especially in the radicular apical third and in the root canal irregularities.<sup>18</sup> All root canals used in the present study were previously instrumented and

standardized using F2 instrument, facilitating the D3 rotary instrument access until the working length. This phenomenon was also contributed by the fact that the gutta-percha to be the main filling material.<sup>17-19</sup>

As the root canals were previously standardized using F2 instrument, a root canal circular shape was obtained favoring the rotary instruments action.<sup>18,19</sup> The persistence of gutta-percha residues and/or endodontic sealer tends to be similar in the buccolingual and mesiodistal direction once the root canal anatomy is circular.<sup>20</sup>

Therefore, regardless of root canal obturation technique previously performed, the solvents associated with rotary retreatment instruments were ineffective for the complete removal of root canal obturation. Further studies should be conducted to assess the effects of the complementation of the chemical-mechanical to removal residues of root canal filling after endodontic retreatment.

## CONCLUSION

The persistence of residues from the root canal obturation was similar after endodontic retreatment using retreatment ProTaper system associated with xylol or Endosolv-R, in lateral compaction and single cone techniques, regardless of the root segment analyzed.

## CLINICAL SIGNIFICANCE

The persistence of residues in the root canal compromises the success of the endodontic treatment. Only rotary retreatment instruments and solvents (xylol or Endosolv-R) were ineffective for the root canal obturation removal performed by lateral compaction or single cone technique.

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