The effectiveness of four irrigation techniques to remove debris from simulated irregularities.

Eijsvogels LM, Lak B, Jiang L, Van der Sluis LWM

Introduction
The goal of root canal irrigation is to remove pulp tissue and/or microorganisms (planktonic or biofilm) from the root canal system (Haapasalo et al. 2005). Irrigation should also remove dentin debris and the smear layer that is formed after mechanical instrumentation from the root canal (Baugh & Wallace 2005). In order to become effective, the irrigant has to be brought in contact with those structures and materials, which have to be removed from the root canal system (Rosenfeld et al. 1978, Chow 1983).

The purpose of this study was to evaluate the effectiveness of different irrigation methods to remove artificially placed dentin debris from an apical root canal extension.

Materials & Methods
The root canals in twenty maxillary and mandibular canines were adjusted to create a standardized groove-model. This model was introduced to standardize the root canal anatomy and the amount of dentinal debris present in the root canal before the irrigation procedure, in order to increase the reliability of dentinal debris removal evaluation. The methodology is sensitive and the data are reproducible (van der Sluis et al. 2005, 2007). The following irrigation methods were tested: see table on the right.

The irrigation methods used in this experiment:
- Endo-Vac System: “negative pressure” system, suction of irrigant at the tip of the cannula
- Ultrasonic Bypass System: new ultrasonic irrigation needle, with delivery of irrigant at the tip of the needle
- Safety irrigator: “negative pressure” system, flexible needle tip, with direct suction at orifice cavity
- Syringe: irrigation with a syringe

The amount of debris left in the grooves was scored on an ordinal scale 0-3. score 0: the entire groove was free of debris; score 1: less than half of the groove was filled with debris; score 2: half or more than half of the groove was filled with debris; and score 3: the entire groove was filled with debris.

There was no debris removal seen with syringe irrigation using NaOCl as the irrigant. The EndoVac system, the Safety-irrigator and the manual-dynamic technique with a non-tapered cone all performed better than syringe irrigation but there was no significant difference between these systems. The manual dynamic technique with a tapered cone had significantly better results than the previously mentioned techniques. The ultrasonic Bypass-system was significantly better than all other systems tested in this study.

The use of ChlorXtra instead of NaOCl did not lead to a better cleaning efficiency of syringe irrigation or the safety-irrigator.

Results

<table>
<thead>
<tr>
<th>Groups</th>
<th>Irrigation device</th>
<th>Irrigant</th>
<th>Time (sec)</th>
<th>Volume (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (n=20)</td>
<td>EndoVac</td>
<td>6% NaOCl</td>
<td>30</td>
<td>0.6</td>
</tr>
<tr>
<td>2 (n=20)</td>
<td>Manual-dynamic, non tapered cone</td>
<td>6% NaOCl</td>
<td>30</td>
<td>6.0</td>
</tr>
<tr>
<td>3 (n=20)</td>
<td>Manual-dynamic, tapered cone</td>
<td>6% NaOCl</td>
<td>30</td>
<td>6.0</td>
</tr>
<tr>
<td>4 (n=20)</td>
<td>Ultrasonic Bypass system</td>
<td>6% NaOCl</td>
<td>30</td>
<td>3.0</td>
</tr>
<tr>
<td>5 (n=20)</td>
<td>Safety Irrigator</td>
<td>6% NaOCl</td>
<td>30</td>
<td>3.0</td>
</tr>
<tr>
<td>6 (n=20)</td>
<td>Safety Irrigator</td>
<td>6% NaOCl</td>
<td>60</td>
<td>6.0</td>
</tr>
<tr>
<td>7 (n=10)</td>
<td>Safety Irrigator</td>
<td>ChlorXtra</td>
<td>60</td>
<td>6.0</td>
</tr>
<tr>
<td>8 (n=10)</td>
<td>Syringe</td>
<td>ChlorXtra</td>
<td>60</td>
<td>6.0</td>
</tr>
<tr>
<td>9 (n=10)</td>
<td>Syringe</td>
<td>6% NaOCl</td>
<td>60</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Conclusions
- The use of the Ultrasonic Bypass™ system resulted in significantly better cleaning than all other systems
- Manual-dynamic irrigation technique works better with a tapered cone
- Cleaning efficacy of EndoVac® system is better then syringe irrigation but not better then other systems tested in this study.
- Syringe irrigation has very poor cleaning efficacy in oval extensions of the root canal

References