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The influence of two instrumentation techniques with two sealers on post-operative pain after endodontic treatment "randomized clinical trial"

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ABSTRACT

Introduction: Postoperative pain is one of the primary problems in endodontic therapy and an unpleasant situation for both patient and clinician. Purpose: The aim of this Study was to assess degree of Post-Operative Pain after Endodontic Treatment done using two different instrumentation techniques with combination of two different sealers. Materials and methods: 84 mandibular first and second molars were selected and randomly divided into four groups, Group 1 was prepared using Protaper Next and obturated using AH Plus Sealer. Group 2, the molars were prepared using Protaper Next and obturated using Total Fill Sealer. Group 3, the molars were prepared using WaveOne Gold and obturated using AH Plus Sealer and Group 4, the molars were prepared using WaveOne Gold and obturated using Total Fill Sealer. Assessment of post-operative pain by using The Visual Analogue Scale Pain evaluation was done 3 times for each patient, Post-operatively after 12, 24 and 48 h respectively. Finally the data was tabulated and statistically analyzed using Kolmogorov-Smirnov and Shapiro-Wilk tests. Results: Neither the type of file nor the type of sealer affected the post-operative pain, however time showed statistically significant difference between (12 h), (24 h) and (48 h) respectively. Conclusions: Protaper next versus WaveOne Gold was found to have no influence regarding post-operative pain, The pain intensity showed significant decrease by time in all groups especially after 24 h post-operatively.

1. Introduction

Postoperative pain is one of the primary problems in endodontic therapy and an unpleasant situation for both patient and clinician. According to patients, pain is a strong predictor for performance of Root Canal Treatment. When an unexpected pain is experienced, patient's confidence to dentist is undermined. However, etiology of pain is multifactorial and has not been determined precisely yet [1]. It is well known that a small, inadvertent extrusion of debris and irrigants into periapical tissues is a frequent complication during the cleaning and shaping procedures, both with manual stainless steel and nickel-titanium rotary instrumentation techniques. However, recent studies have shown that reciprocating instrumentation techniques seem to significantly increase the amount of debris extruded beyond the apex and, consequently, the risk of postoperative pain [2]. So, it was of prime importance to shed a light on assessment of post-operative pain after using two different instrumentation techniques with two different sealers.

2. Materials and methods

A total of 84 patients were selected from the faculty of oral and dental medicine, Future University. Sixty patients were selected with Asymptomatic non-vital lower first and second molars with three separate canals and without periapical lesion and patients with medically compromised patients were excluded.

2.1. Clinical procedures

2.1.1. Pre-operative procedure

Preoperative instructions were given to the patient about type of the procedure, discomfort as well as benefits of this procedure and their informed consent was obtained prior to the procedure. The patients were randomized by pulling numbered slips out of a hat and divided into four groups according to techniques of instrumentation and type of sealer used.
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2.1. Methods of evaluation

Assessment of post-operative pain by using The Visual Analogue Scale (VAS) described by Pinkham et al. The VAS consists of a list of adjectives describing different levels of pain intensity with scores assigned to each of the levels of pain intensity (Table 1). The VDS was translated in to Colloquial Arabic.

3. Statistical analysis

The data was tabulated and statistically analyzed using Kolmogorov-Smirnov and Shapiro-Wilk tests. Friedman test was used to test the difference between more than two groups in related samples and Wilcoxon test was used to compare the difference between two groups in related samples. While Mann-Whitney U test was used to compare the difference between two groups in non-related samples.

> Pain score results:

A) Effect of time on pain scores in each sealer with different types of files (Table 2, Fig. 1)

a) For AH Plus groups:

i) Protaper next:

The highest mean value of pain score was found in (12 h) (5.93 ± 0.88) followed by (24 h) (3.33 ± 0.89) while the least mean value of pain scores was found in (48 h) (1.00 ± 0.92).

ii) Wave One Gold:

The highest mean value of pain score was found in (12 h) (6.53 ± 1.06) followed by (24 h) (3.66 ± 0.89) while the least mean value of pain scores was found in (48 h) (1.00 ± 0.65).

b) For Total Fill groups:

i) Protaper next:

The highest mean value of pain score was found in (12 h) (6.06 ± 0.88) followed by (24 h) (3.46 ± 0.99) while the least mean value of pain scores was found in (48 h) (1.00 ± 0.92).

ii) Wave One Gold:

The highest mean value of pain score was found in (12 h) (6.53 ± 1.06) followed by (24 h) (3.80 ± 0.77) while the least mean value of pain scores was found in (48 h) (1.06 ± 0.70).

B) Effect of File type on pain scores in each sealer with different time factor: (Table 3, Fig. 2)

a) For AH Plus groups:

i) 12 h:

There was no statistically significant difference between (Protaper next) and (Wave One Gold) where (p = 0.137). The highest mean value of pain score was found in (Wave One Gold) (6.53 ± 1.06) while the least mean value of pain scores was found in (Protaper next) (5.93 ± 0.88).

ii) 24 h:

There was no statistically significant difference between (Protaper next) and (Wave One Gold) where (p = 0.325). The highest mean value of pain score was found in (Wave One Gold) (3.66 ± 0.89) while the least mean value of pain scores was found in (Protaper next) (3.33 ± 0.89).

iii) 48 h:

There was no statistically significant difference between (Protaper next) and (Wave One Gold) where (p = 0.137). The highest mean value of pain score was found in (Wave One Gold) (6.53 ± 1.06) while the least mean value of pain scores was found in (Protaper next) (5.93 ± 0.88).

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\[ \text{Endo Z Bur FG. Chemin du Verger 3 | 1338 Ballaigues – Suisse Tél. 021 843 92 92 | info@dentsplymaillefer.com} \]

\[ \text{K-FILE SKU: A 012D. Chemin du Verger 3 | 1338 Ballaigues – Suisse Tél. 021 843 92 92 | info@dentsplymaillefer.com} \]

\[ \text{Root ZX mini 680 Higashihama Minami-cho, Fushimi-ku, Kyoto, 612–8533 Japan, ttp://www.jmorita-mfg.com.} \]

\[ \text{x-smart plus endomotor. Chemin du Verger 3 | 1338 Ballaigues – Suisse Tél. 021 843 92 92 | info@dentsplymaillefer.com} \]
There was no statistically significant difference between (Protaper next) and (Wave One Gold) where \( p = 0.870 \). The mean value of pain score was (Protaper next) \( (1.00 \pm 0.92) \) and (Wave One Gold) \( (1.00 \pm 0.65) \).

b) For Total Fill groups:

i) 12 h:
There was no statistically significant difference between (Protaper next) and (Wave One Gold) where \( p = 0.250 \). The highest mean value of pain score was found in (Wave One Gold) \( (6.53 \pm 1.06) \) while the least mean value of pain scores was found in (Protaper next) \( (6.06 \pm 0.88) \).

ii) 24 h:
There was no statistically significant difference between (Protaper next) and (Wave One Gold) where \( p = 0.436 \). The highest mean value of pain score was found in (Wave One Gold) \( (3.80 \pm 0.77) \) while the least mean value of pain scores was found in (Protaper next) \( (3.46 \pm 0.99) \).

iii) 48 h:
There was no statistically significant difference between (Protaper next) and (Wave One Gold) where \( p = 0.713 \). The highest mean value of pain score was found in (Wave One Gold) \( (1.06 \pm 0.70) \) while the least mean value of pain scores was found in (Protaper next) \( (1.00 \pm 0.92) \).

C) Effect of Sealer on pain scores in each file with different time factor: (Table 4, Fig. 3)
a) For Protaper groups:

Table 2
The mean, standard deviation (SD) values of pain scores of time in each sealer with different types of files (Friedman test).

<table>
<thead>
<tr>
<th>Variables</th>
<th>AH Plus sealer</th>
<th>Total Fill sealer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean SD Median</td>
<td>Mean SD Median</td>
</tr>
<tr>
<td>12h</td>
<td>5.93b 0.88 6.00</td>
<td>6.53b 1.06 7.00</td>
</tr>
<tr>
<td>24h</td>
<td>3.33b 0.89 3.00</td>
<td>3.66h 0.89 4.00</td>
</tr>
<tr>
<td>48h</td>
<td>1.00h 0.92 1.00</td>
<td>1.00h 0.65 1.00</td>
</tr>
<tr>
<td>P-value</td>
<td>( \leq 0.001^* )</td>
<td>( \leq 0.001^* )</td>
</tr>
</tbody>
</table>

Mean with different letters in the same column indicate statistically significance difference *; significant \( (p < 0.05) \) ns; non-significant \( (p > 0.05) \).

Fig. 1. Bar chart representing effect of time on pain scores in each sealer with different types of files.

Table 3
The mean, standard deviation (SD) values of pain scores of file types in each sealer with different time factor (Mann–Whitney U test).

<table>
<thead>
<tr>
<th>Variables</th>
<th>AH Plus sealer</th>
<th>Total Fill sealer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean SD Median</td>
<td>Mean SD Median</td>
</tr>
<tr>
<td>Protaper next Wave One Gold</td>
<td>6.53a 1.06 7.00</td>
<td>3.66a 0.89 4.00</td>
</tr>
<tr>
<td>P-value</td>
<td>0.137ns 0.325ns</td>
<td>0.870ns 0.250ns</td>
</tr>
</tbody>
</table>

Mean with different letters in the same column indicate statistically significance difference *; significant \( (p < 0.05) \) ns; non-significant \( (p > 0.05) \).
i) 12h:
There was no statistically significant difference between (AH Plus) and (Total Fill) where \( p = 0.713 \).
The highest mean value of pain score was found in (Total Fill) \( (6.06 \pm 0.88) \) while the least mean value of pain scores was found in (AH Plus) \( (5.93 \pm 0.88) \).

ii) 24h:
There was no statistically significant difference between (AH Plus) and (Total Fill) where \( p = 0.713 \).
The highest mean value of pain score was found in (Total Fill) \( (3.46 \pm 0.99) \) while the least mean value of pain scores was found in (AH Plus) \( (3.33 \pm 0.89) \).

iii) 48h:
There was no statistically significant difference between (AH Plus) and (Total Fill) where \( p = 1 \).
The mean value of pain score for both (AH Plus) and (Total Fill) was \( (1.00 \pm 0.92) \).

b) For Wave One Gold groups:

i) 12h:
There was no statistically significant difference between (AH Plus) and (Total Fill) where \( p = 1 \).
The mean value of pain score for both (AH Plus) and (Total Fill) was \( (6.53 \pm 1.06) \).

ii) 24h:
There was no statistically significant difference between (AH Plus) and (Total Fill) where \( p = 0.870 \).
The highest mean value of pain score was found in (Total Fill) \( (3.80 \pm 0.77) \) while the least mean value of pain scores was found in (AH Plus) \( (3.66 \pm 0.89) \).

iii) 48h:
There was no statistically significant difference between (AH Plus) and (Total Fill) where \( p = 0.806 \).
The highest mean value of pain score was found in (Total Fill) \( (1.06 \pm 0.70) \) while the least mean value of pain scores was found in (AH Plus) \( (1.00 \pm 0.65) \).

5. Discussion

This study design was a randomized clinical trial (RCT) [4–7]. This design is regarded as the most reliable method of evaluating the effects of interventions in health care. A sample of 60 patients, which was nearly equal to the similar clinical trials [8–10], were included and randomly assigned into four equal groups each of 15 patients. Randomization keeps study groups as similar as possible from the outset to minimize bias. In this study, Single visit root canal treatment was done as Single visit root canal treatment fulfill patient's needs because of the inherited advantages. This technique has gained popularity, this can be credited to favourable reports which showed no difference in treatment complications or success rates when compared with teeth treated in multiple visits [11–13]. In the present study, Reciprocation versus linear motion were used to assess the difference in post-operative pain level. One of the important reasons of post-operative pain is the extrusion of debris that obtain virulent bacteria into the periapical tissues. If the infected debris is extruded into periapical region during root canal instrumentation, it may cause or increase the various of periradicular inflammation [14,15]. In the result of the present study, There was no statistically significant difference between Protaper next and Wave One Gold. This came in the agreement of the work of Relvas et al. (2015) [16] and Kherlakian et al. (2016) [17] whom, they found that The Wave One Gold and ProTaper next groups extruded the least amount of debris in comparison to the other groups in their studies. This may be explained with the assessments of metallurgy, design features and kinematics of these systems. It has been shown that heat-treated alloys have less stiffness [18] and a lower ultimate tensile strength than conventional super-elastic wires [19]. Both of Gold systems are produced with using different alloys and a new proprietary thermal process named Gold wire in which the ground NiTi files are heat-treated and slowly cooled to obtain super-elastic NiTi files. It could be attributed to the 2-stage transformation behaviour and the high temperatures from which PTN and WOG is produced; as this material has greater flexibility [12,20] with an elastic modulus lower than that of the austenitic phase [21,22]. Consequently, it could be supposed that the martensitic NiTi wire may ensure a lower amount of apical extrusion at a similar torque.

Table 4
The mean, standard deviation (SD) values of pain scores of file types in each sealer with different time factor (Mann–Whitney U test).

<table>
<thead>
<tr>
<th>Variables</th>
<th>12h Mean</th>
<th>SD</th>
<th>24h Mean</th>
<th>SD</th>
<th>48h Mean</th>
<th>SD</th>
<th>12h Mean</th>
<th>SD</th>
<th>24h Mean</th>
<th>SD</th>
<th>48h Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>AH Plus</td>
<td>5.93</td>
<td>0.88</td>
<td>6.00</td>
<td>0.99</td>
<td>6.00</td>
<td>0.99</td>
<td>5.93</td>
<td>0.88</td>
<td>6.00</td>
<td>0.99</td>
<td>5.93</td>
<td>0.88</td>
</tr>
<tr>
<td>Total Fill</td>
<td>6.06*</td>
<td>0.88</td>
<td>4.00</td>
<td>0.70</td>
<td>3.00</td>
<td>1.00</td>
<td>6.06*</td>
<td>0.88</td>
<td>4.00</td>
<td>0.70</td>
<td>3.00</td>
<td>1.00</td>
</tr>
<tr>
<td>P-value</td>
<td>0.713ns</td>
<td>0.713ns</td>
<td>1ns</td>
<td>0.870ns</td>
<td>0.806ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
than austenitic NiTi alloy [23]. These metallurgical superior properties that provide less stiffness and reduced restoring force to the instruments [24,25] may explain the least amount of apical extrusion after instrumentation performed by Gold systems.

The design of Gold systems also play a crucial role on apically bacterial extrusion. First of all, the roundly tapered, and semi-active features of Wave One Gold reduce the mass of the center of the tip and contribute to less debris extrusion compared with all other groups [25]. The ProTaper Next system has a different geometry; smaller dimensions, an off-centered mass, and a regressive taper. The centering ability of ProTaper Next instruments may ensure that a greater percentage of dentin thickness is retained in the root canal and may facilitate greater bacteria elimination [26]. The convex triangular cross-section and progressive taper enhance the cutting efficacy of ProTaper Next, while decreasing rotational friction between the file blade and dentin. ProTaper Next had a significantly lower torsional resistance. The non-cutting tip design allows each instrument to safely follow the secured portion of the canal, while the small area at the tip enhances its ability to find its way through soft tissue and debris [27]. In the result of the present study, it was found that pain records after root canal treatment with two different sealers is statistically insignificant. This comes in the accordance of the work of Kousalya Vuyyuru et al. [28], Tayfun Alacam et al. [29] and Fox J et al. [30] that stated there is no significant with the pain level with the sealer material used for obturation. In this study, Pain assessment was done by the patients. The time Intervals were recorded at 12, 24 & 48 h and compared as Genet and Wesselin (1986) [31]. Ercan and kaya who showed that most post-operative pain occurred on the first day after initiating endodontic treatment., post-obturation, as postoperative pain episodes are usually caused by the pressure inherent in the insertion of the root canal filling materials or by the chemical irritation from the ingredients of the root canal cements or pastes. Also the occurrence of periapical inflammation results in pain in the periodontal ligaments which usually is a short-lived effect and abate within a 24–48 h period. Seltzer and Naidorf, 2004 [32] and Yoldas et al., 2004 [33]. Furthermore, in the result A statistically significant difference was found between (12h) on one hand and each of (24h) and (48h) on the other hand. this comes in accordance with the work of M. Gotler [34] and Daniel Kherlakian [35] in where they found that there is statistically significant difference in pain level recorded at different intervals.

6. Conclusion

There was no difference in post-operative pain between the ProTaper Next and the WaveOne Gold. The pain intensity showed significant decrease by time in all groups especially after 24 h post-operatively. Total Fill sealers was found to be promising regarding post-operative pain.

References