EVALUATION OF POSTOPERATIVE PAIN AFTER USING DIFFERENT FILE SYSTEMS: A RANDOMIZED CLINICAL STUDY

ABSTRACT

Objectives: This study evaluated the effect of instrumentation techniques on the postoperative pain after single-visit root canal treatment.

Materials and Methods: Sixty patients having an indication of endodontic treatment were included. Only single rooted teeth were selected. The patients were randomly divided into 2 groups. In group 1; the root canals were instrumented using ProTaper Next instruments with rotational motion, in group 2; TF Adaptive instruments with adaptive motion were used during instrumentation. Treatments were completed in a single appointment. Postoperative pain questionnaires were scored by patients using a four-point pain intensity scale for 12, 24, and 48 hours. Mann Whitney-U, Friedman and Wilcoxon tests were used for analyzing the final data.

Results: The comparison of time intervals between groups demonstrated no difference between both groups (p>0.05). In both groups, the postoperative pain values of 12h time period were significantly higher than both other periods, and significant difference was found between 24h and 48h time periods (p<0.05). The postoperative pain values of 48h time period were significantly lower than the other two time periods (p<0.05).

Conclusions: Both instrumentation techniques caused postoperative pain. The pain scores indicated that both techniques caused limited discomfort associated with slight pain which did not require any additional treatment and medication.

Keywords: Pain, root canal preparation, root canal treatment.
INTRODUCTION

Postoperative pain is a common complication after root canal treatment. The reasons for such pain may include apical debris extrusion, inadequate preparation, preoperative pain, and the presence of periapical pathology. Apical debris extrusion affects the postoperative comfort of patients without any significant impact on the outcome of treatment.

Root canal shaping kinematics and file design can affect the amount of extruded debris. Recently, endodontic motors using combined motions, instead of rotational and reciprocal motions solely, were used to reduce the complications that may occur during treatment. However, these new instruments and movements tend to create more debridement.

ProTaper Next (Dentsply Maillefer, Ballaigues, Switzerland) instruments have an asymmetric rectangular cross section and were manufactured from M-WIRE nickel-titanium (NiTi) alloy. The files operate with a rotational movement that makes a snakelike motion during preparation. The rotation of the asymmetric section creates a larger area for the transportation of debris. Twisted-File (TF) Adaptive (Kerr Endodontics, Orange, CA, USA) instruments accommodates torsional force in the canal by performing rotational or reciprocal movements depending on the pressure on the file. The adaptive movement provides less compression on file.

Limited information is available comparing the effects of TF Adaptive and ProTaper Next systems on postoperative pain formation. Thus, the aim of this study is to compare the severity of postoperative pain following root canal treatment by using rotational and adaptive techniques. Our hypothesis is that different techniques affect the severity of postoperative pain.

MATERIALS AND METHODS

The plan of the study was registered at www.clinicaltrial.gov (ClinicalTrials.gov Identifier NCT number: NCT03708081). This study was accomplished under the standing orders of the ethics committee (protocol number: 2017-98-20/09). Patients having teeth with asymptomatic irreversible pulpitis or pulp necrosis, who referred to Faculty of Dentistry, Department of Endodontics were included. Only single rooted teeth were selected. The patients with sinus tract, periradicular abscess or facial cellulitis, who had previously taken any medication, and who had previously undergone root canal treatment with the related tooth were excluded. After the detailed written medical and dental history were obtained, the written consent form was taken from the patients who wanted to participate in the study. The patients having any systemic disease or any medication related to a systemic condition were excluded. Age, gender, and the location of teeth were recorded. Incisors and canine teeth having single root and canal were included. An electric pulp test (Elements pulp vitality tester, SybronEndo, Orange, CA, USA) was applied to determine the vitality of the teeth. An initial pilot study was conducted on overall 30 patients (15 individuals per group). The power analysis, performed for the pilot study, indicated that a minimum of number of 28 patients was required for each group to identify significant differences. Therefore, 30 patients were included for each group to ensure a significative exemplary.

Overall, 60 patients were included. The ages of participants ranged between 18 and 63 years. For the elimination or limitation of any variables, a single operator completed all treatment procedures. After the teeth were isolated and the access cavities were prepared, the working length was determined by an electronic apex finder (Root ZX mini; J. Morita, Tokyo, Japan).

Patients were randomly divided 2 groups as follows;

In group 1, the root canals were instrumented using ProTaper Next files with a full sequence of X1 to X5 (50/.06), respectively.

In group 2, instrumentation was performed with TF Adaptive ML1, ML2, ML3 (50/.04) instruments. An adaptive motion was expected for each specimen during instrumentation. In case of lacking of any adaptive motion occurrence, the specimen was excluded. A total of 4 specimens was excluded due to this reason.
During the instrumentation, the root canals were irrigated with a total of 10 ml of 2.5% sodium hypochloride. Final irrigation was performed with 5 ml of 2.5% sodium hypochloride, 5 ml of 17% Ethylenediaminetetraacetic acid, 5 ml of 2% chlorhexidine. 5 ml of distilled water was applied after each solution to prevent any reaction that might occur between the solutions.

The root canals were obturated with cold lateral compaction method using matched gutta-percha cones and resin-based canal sealer (Adseal, Meta Biomed, Korea), and the quality of obturation was confirmed with radiographs. Finally, the access cavity was sealed with composite resin (Estelite Σ Quick, Tokuyama Dental Corp. Tokyo, Japan), and the occlusion was checked.

Postoperative pain questionnaires were scored by patients using a four-point pain intensity scale for 12, 24, and 48 hours. The pain scores were as follows;

1- no pain;
2- mild pain (slight discomfort, no treatment required);
3- moderate pain (pain relieved by medication);
4- severe pain (pain and/or swelling not relieved by simple analgesic medication and the requirement of an unscheduled appointment).

All scores were processed on the patient’s treatment charts and statistical analysis of the results was performed after the planned number of patients had been treated.

The statistical analysis of the data was performed with SPSS 19.0 software. Mann–Whitney U test was used to compare between groups for each time period. Friedman test followed by Wilcoxon signed rank test used for the comparison of time periods in each group. The significance level was set at p<0.05.

RESULTS
The mean, standard deviations, minimum and maximum values of two groups, including time periods were presented in Table 1.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Time</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTX</td>
<td>12h</td>
<td>1.63</td>
<td>.890</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>24h</td>
<td>1.43</td>
<td>.728</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>48h</td>
<td>1.20</td>
<td>.484</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>TFA</td>
<td>12h</td>
<td>1.50</td>
<td>.731</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>24h</td>
<td>1.23</td>
<td>.430</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>48h</td>
<td>1.10</td>
<td>.305</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Severe pain was only recorded in 12 hours period, whilst the 48 time period did not demonstrate any moderate or severe pain scores for both groups. The comparison of time intervals between groups demonstrated no difference between both groups (p>0.05). The total number of patients experiencing pain for both groups in 12, 24, and 48 hours were recorded as 16, 11, and 9, respectively. In both groups, the highest postoperative pain values were found in 12h time periods. In both groups, the postoperative pain values of 12h time period were significantly higher than both other periods, and significant difference was found between 24h and 48h time periods (p<0.05). The postoperative pain values of 48h time period were significantly lower than the other two time periods (p<0.05). No differences were found between female and male patients, similarly, between maxilla and mandibula (p>0.05) (Table 2). The demographic features were presented in Table 3.
Table 2. Mean pain scores according to gender and localization

<table>
<thead>
<tr>
<th>Gender of patient/ Location of tooth</th>
<th>12h</th>
<th>24h</th>
<th>48h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (Std Dev)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female (n=24)</td>
<td>1.54 (.884)</td>
<td>1.38 (.711)</td>
<td>1.21 (.509)</td>
</tr>
<tr>
<td>Male (n=36)</td>
<td>1.28 (.701)</td>
<td>1.28 (.615)</td>
<td>1.14 (.424)</td>
</tr>
<tr>
<td>Mandibular (n=29)</td>
<td>1.41 (.780)</td>
<td>1.31 (.604)</td>
<td>1.17 (.468)</td>
</tr>
<tr>
<td>Maxillary (n=31)</td>
<td>1.45 (.798)</td>
<td>1.32 (.702)</td>
<td>1.16 (.454)</td>
</tr>
</tbody>
</table>

Table 3. The demographic features of individuals

<table>
<thead>
<tr>
<th>Demographic features</th>
<th>ProTaper Next (n=30)</th>
<th>TF Adaptive (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female 35%</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>Male 65%</td>
<td>60%</td>
</tr>
<tr>
<td>Age</td>
<td>Mean 39.65</td>
<td>31.75</td>
</tr>
<tr>
<td></td>
<td>Range 19-63</td>
<td>18-59</td>
</tr>
<tr>
<td>Localization</td>
<td>Maxilla 15</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Mandibula 15</td>
<td>14</td>
</tr>
</tbody>
</table>

DISCUSSION

The aim of this clinical study was to compare the intensity and duration of postoperative pain after single-visit root canal treatment with rotational and adaptive motions. In general, patients and clinicians prefer single-visit treatments due to their advantages such as low cost, fewer operative procedures, elimination of interappointment leakage and less chair time. Therefore, a single visit treatment was selected for all patients. Additionally, final apical file diameter, type and amount of irrigation solution, obturation method were standardized to eliminate any bias in both groups.

Various scales were used to evaluate the severity of postoperative pain after root canal treatment. In this study, a four-point pain intensity scale, which was considered to be an adequate and reliable method, was used. This scale method was also used in various recent studies for measuring the severity of postoperative pain after root canal treatment. Different time intervals can be selected to evaluate the intensity of pain. The evaluation of postoperative pain was performed for different time periods in recent studies. Comparin et al. and Gambarini et al. evaluated the first 72 hours, whereas the first 120 hours was selected by Yaylali et al. after treatment. In the present study, the postoperative pain was evaluated in three different time intervals. The prevalence and severity of pain after root canal treatment decreases after the first 48 hours. Therefore, 12, 24, and 48 hours were selected similar to previous clinical studies. The highest postoperative pain values were recorded at 12 h period in both groups. No increase in pain scores was recorded as time progresses, similar to previous clinical studies.

An unscheduled appointment for emergency treatment of acute apical abscess formation was recorded for only 1 patient. The associated tooth was directed for the extraction due to the patient's request and excluded from the study. Other than this patient, no symptoms such as postoperative swelling or paresthesia were recorded.

Various factors, such as age, gender, pulpal and periapical condition, type of tooth, preoperative pain, and technical characteristics, may affect postoperative pain. In the present study, gender did not affect the incidence of postoperative pain, despite the female patients demonstrated slightly higher scores for all time intervals in accordance with other studies. Additionally, the location of the tooth was not found to be a determinant on the pain scores, since no difference was found between mandibular and maxillary teeth. Besides, asymptomatic teeth were included to eliminate a possible preoperative variation. The relationship between age and...
Postoperative Pain After Instrumentation

Postoperative pain demonstrated contradictory results. In the present study, no difference was found in terms of age between groups similar to previous studies. However, Azim et al. reported higher risk for the patients >50 years in developing flare-ups.

Various instruments and instrumentation techniques are available in the market for clinicians to use in daily endodontic practice. All instruments and techniques may be related to postoperative pain. Several studies compared ProTaper Next system with other instruments and techniques. ProTaper Next demonstrated similar results with various reciprocal instruments in regard to the incidence of postoperative pain. However, limited data are available for the TF Adaptive system and adaptive motion in terms of postoperative pain occurrence. Similar to ProTaper Next system, TF Adaptive resulted in significantly less incidence of severe pain symptoms than reciprocal technique. Çiçek et al. reported less postoperative pain with modified step-back technique than rotational and reciprocal technique. However, no difference was reported between the rotation and reciprocation techniques. The results of the present clinical trial also corroborate the clinical findings of Relvas et al. who reported low and similar occurrence of postoperative pain between the reciprocating and rotary techniques. According to the present results, the null hypothesis was rejected. The ProTaper Next instruments demonstrated higher pain scores compared to the TF Adaptive system without any significance. The occurrence of adaptive motion, including rotational and reciprocal movements may lead to prevent the movement of debris to apical direction. Other possibilities related to this finding could be higher taper of the files which may result in the occurrence of more debris, and the requirement of more files to complete the instrumentation in ProTaper Next system during the root canal shaping procedures.

CONCLUSIONS

Both instrumentation techniques caused postoperative pain. The pain scores indicated that both techniques caused limited discomfort associated with slight pain which did not require any additional treatment and medication.

ACKNOWLEDGEMENTS

None

CONFLICT OF INTEREST STATEMENT

None

REFERENCES

3. Sathorn C, Parashos P, Messer H. The prevalence of postoperative pain and flare-up in single- and multiple-


