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Original Research

Assessing Postoperative Pain in Teeth with Asymptomatic Irreversible Pulpitis: A Comparative Study of Manual and Rotary Instrumentation

[1]Chaitanya Chappidi, [2]Sudhakar Babu Buma

[1]General Dentist, NMC Speciality Hospital, Al Ain, UAE;
[2]Specialist Periodontics, NMC Speciality Hospital, Al Ain, UAE

ABSTRACT:
Background: One of the most common complications following root canal treatment is postoperative pain. This study aimed to assess and compare the severity of postoperative pain following root canal preparation using the RaCe rotary system and hand K Flexofile. **Materials and methods:** The study included a total of 120 subjects, with 60 mandibular molars in each group. These participants required endodontic treatment for asymptomatic irreversible pulpitis in either their mandibular first or second molars and exhibited normal periapical radiographic images. Specialized equipment, including a scanner and software interface, was employed to process and archive periapical radiographs for further examination using Rinn XCP devices and a digital radiography system. Following subject selection by a physician, the 120 subjects were divided into two equal groups, each consisting of 60 subjects. Gender distribution and the prevalence of mandibular first and second molars with three or four root canals were closely matched between the two groups. **Results:** In both the manual and rotary groups, there was a significant reduction in the severity of postoperative pain from the beginning to the end of all assessed time intervals ($P<0.001$). However, when comparing the pain severity between the RaCe rotary and hand K-Flexofile groups, no statistically significant differences were observed ($P=0.78$). Specifically, the mean pain severity scores at four hours post-treatment were 26.34±4.61 in the RaCe group and 34.47±5.21 in the K-Flexofile group. At the eight-hour mark, the pain severity scores were 22.32±4.56 in the rotary group and 29.45±4.72 in the hand file group. Although pain severity was lower in the rotary group at both intervals, the difference did not reach statistical significance ($P>0.05$). **Conclusion:** No significant differences in pain severity were observed between the two groups at any of the assessed intervals.
Keywords: Manual Instrumentation, Postoperative Pain, Root Canal Preparation, Rotary Instrumentation

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Corresponding Author: Chaitanya Chappidi, General Dentist, NMC Speciality Hospital, Al Ain, UAE

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INTRODUCTION

Postoperative pain is a frequent complication in endodontic treatment, occurring in the range of 1.6% to 18% of cases[123]. Various factors, including age, gender, tooth type, pulp status, the presence of sinus tracts, and preoperative pain sensitivity, have been identified as potential risk factors that can influence the incidence of postoperative pain following root canal therapy.[2]Several contributing factors are implicated in post-endodontic pain (PEP), including inadequate cleaning and shaping of the root canals, missed canals, and improper obturation. Among these factors, the primary cause of pain is often associated with the extrusion of debris into the apical region, which is largely influenced by the technique used for canal preparation. It has been suggested that the inadvertent extrusion of contaminated debris during chemomechanical instrumentation of root canals can intensify the inflammatory response and potentially lead to periapical inflammation [4].It's worth noting that all instrumentation techniques have been linked to the extrusion of infected debris, even when canal preparation stops short of the apical terminus. Specifically, among manual techniques, stainless steel files, particularly K-files, have been found to extrude a greater amount of debris apically.This study was undertaken to assess the differences in postoperative pain between manual and rotary instrumentation in teeth with asymptomatic irreversible pulpitis.

MATERIAL AND METHOD

The study involved a total of 120 subjects, with 60 mandibular molars in each group. These participants required endodontic treatment for asymptomatic irreversible pulpitis in their mandibular first or second molars and displayed normal periapical radiographic images. Patients with periapical abscesses and sinus tracts were excluded from the trial. The assessment of pulp vitality and periradicular health of each tooth was conducted using thermal and electric pulp tests, followed by palpation, percussion, and periodontal charting.

To analyze the radiographic data, specialized equipment, including a scanner and software interface, was employed to process and preserve periapical radiographs. Additional examinations were performed using Rinn XCP devices and a digital radiography system. A physician then divided the 120 subjects into two groups of 60 subjects each, ensuring that gender distribution and the prevalence of mandibular first and second molars with three and four root canals were matched between the two groups.

RESULTS

In both the manual and rotary instrumentation groups, there was a significant reduction in the severity of postoperative pain observed from the beginning to the end at all evaluated time intervals ($P<0.001$). However, when comparing the pain severity between the RaCe rotary and hand K-Flexofile groups, no statistically significant differences were found ($P=0.78$).

Specifically, four hours after treatment, the mean pain severity scores were 26.34±4.61 in the RaCe group and 34.57±5.21 in the K-Flexofile group. After eight hours, the pain severity scores were 22.32±4.56 in the rotary group and 29.45±4.72 in the hand file group. Although the pain severity was lower in the rotary group at both intervals, the difference did not reach statistical significance ($P>0.05$).

TABLE: Pain severities in 2 groups based on VAS

INTERVAL	ROTARY	MANUAL
4 hours	26.34±4.61	34.57±5.21
8 hours	24.32±4.56	29.45±4.72
12 hours	20.32±3.96	24.45±4.01
24 hours	18.94±3.11	12.77±3.26
48 hours	9.87±2.11	7.36±2.15
1 week	2.45±1.76	2.79±1.63

During the initial 24-hour postoperative period, 60% of patients in the hand file group (30 patients) and 40% in the rotary file group (20 patients) required analgesics. Importantly, there were no statistically significant differences between the two groups in terms of the need for analgesics.

DISCUSSION

Traditionally, root canal therapy often required multiple visits. However, with the advent of recent advances in dentistry, such as NiTi rotary instrumentation, improved apex locators, ultrasonics, microscopic endodontics, digital radiography, advanced obturation systems, and biocompatible sealing materials, practitioners are now equipped to perform single-visit endodontic procedures in their dental clinics.

This treatment approach offers several advantages, including reduced patient stress, the use of a single anesthesia application, time efficiency, and a decreased risk of contamination between appointments.Endodontic pain can be attributed to various factors, which can be categorized as preoperative and intraoperative factors. Preoperative factors include conditions such as acute exacerbation of a chronic lesion, nonvital tooth status, previous access openings, atypical canal anatomy, periapical cyst abscess, or fractured teeth. Intraoperative factors encompass issues like inadequate isolation, apical extrusion of intracanal medicaments, irrigating solution, and the presence of infected debris. These factors collectively contribute to the development of severe post-endodontic pain (PEP) [9].Assessing pain can be inherently challenging; therefore, in our study, we took steps to ensure that subjects received comprehensive explanations regarding postoperative pain and the use of the Visual Analog Scale (VAS). VAS is generally well-understood by most subjects and allows them to rate the severity of their pain accurately. It is considered a reliable and valid method for evaluating pain relief [10].

To minimize potential confounding factors, both study groups were carefully matched in terms of age, gender, tooth type, and the pulp and periapical status of their teeth. Furthermore, we maintained strict control over technique- and operator-related variables. All root canal therapy (RCT) procedures were performed by a single operator, with the only variations being the type of file and instrumentation technique used in the two separate groups. This approach ensured that the differences observed could be attributed to the specific file type and instrumentation technique.

In our current study, we observed a significant reduction in the severity of postoperative pain over time in both the manual and rotary instrumentation groups, with statistical significance noted ($P<0.001$). However, when we compared the pain severity between the RaCe rotary and hand K-Flexofile groups, we did not find any significant differences ($P=0.78$). This suggests that both instrumentation methods were similarly effective in managing postoperative pain.

In a study conducted by Shandilya A et al., ninety patients who presented with asymptomatic irreversible pulpitis in their maxillary anterior teeth were chosen to undergo single-visit endodontic treatment. These patients were randomly divided into two groups, with 50 participants in each group. Group A received treatment using K files and the step-back technique,

while Group B underwent treatment with ProTaper Next using the crown-down technique, both in conjunction with passive ultrasonic irrigation.

After the treatments, patients were scheduled for follow-up appointments at 24 hours, 48 hours, and 8 days post-treatment. During these visits, patients were examined, and they completed questionnaires regarding their experiences. The study aimed to assess the incidence, duration, and intensity of post-endodontic pain (PEP) based on the responses obtained from the feedback forms.

Statistical analysis of the data was conducted using the Chi-square test, and the level of significance was set at $P < 0.05$. The results revealed a higher incidence of pain in Group A compared to Group B, and this difference was found to be statistically significant. In other words, there was a notable disparity in pain occurrence between the two groups, with Group A experiencing a greater incidence of pain.

In a study conducted by Makanjuola JO et al. [14], a total of 220 consecutive subjects who willingly participated were enrolled. The inclusion criteria for this study encompassed individuals who were medically fit and had anterior, premolar, or first molar teeth that were deemed restorable and diagnosed with irreversible pulpitis, pulp necrosis, or apical periodontitis. These individuals exhibited no to moderate pain and had periodontally sound teeth that were not excessively curved.

The subjects were randomly assigned to one of two groups, either the rotary or manual group, through a randomized allocation process using sealed envelopes. The allocation ensured that an equal number of subjects were placed in each group for the study.

The subjects were closely monitored after their respective treatments, and their clinical and radiographic parameters were assessed at multiple time points: 1 day, 1 week, 1 month, 3 months, and 6 months post-treatment. Data analysis was conducted using SPSS version 20.0, and differences were deemed significant if the p-value was less than 0.05.

The study findings revealed that at the 1-day review, 55% of teeth in the manual group and 39% in the rotary group exhibited pain.

The study's results indicated a notably more favorable treatment outcome in the rotary group compared to the step-back technique in canal preparation, as assessed through both clinical and radiographic criteria.

CONCLUSION

Given the absence of significant differences in the severity of postoperative pain between the RaCe rotary and hand K-Flexofile groups, it seems that the crown-down technique may play a more crucial role in mitigating postoperative pain than the choice of file type. Consequently, it is recommended that future studies explore the use of both hand and rotary files with the same crown-down technique in both groups for a more comprehensive comparison.

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