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Original Research

Comparison of Postoperative Pain after Root Canal Preparation with Two Reciprocating and Rotary Single-File Systems

[1]Dr. Rohit Wadhwa, [2]Dr. Shelly Singh, [3]Dr. Ashish Lanjekar, [4]Dr. Prachi Dave, [5]Dr. Vishal Sharma

[1]Reader, Department of Conservative Dentistry and Endodontics, Desh Bhagat Dental College and Hospital, Mandi Gobindgarh, India;
[2]DDS (CU School of Dental Medicine, University of Colorado Anschutz Medical Campus, Aurora-80045, USA), BDS, MDS (Department of Conservative Dentistry & Endodontics, India);
[3]Professor and HOD, Department of Oral Medicine and Radiology, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India;
[4]BDS, MBA, A.J. Shetty Dental Institute, Mangalore, Karnataka, India;
[5]Reader, Department of Orthodontics, Desh Bhagat Dental College and Hospital, Mandi Gobindgarh, India

ABSTRACT:
Aim: The aim of this study was to compare the intensity of postoperative pain following root canal preparation using two different single-file systems: reciprocating and rotary. **Materials and methods:** The study enrolled 60 healthy patients aged 18-50 years with symptomatic irreversible pulpitis in a single molar. Patients were randomly assigned to one of three groups: OneShape rotary files, Reciproc files, or traditional stainless steel K-files (control). The study aimed to compare pain outcomes between the different instrumentation techniques, with results providing insight into the impact of single-file systems versus conventional K-files on postoperative discomfort. Data analysis was done using SSPS software**. Results:** The control group included 12 males and 8 females with a mean age of 37.9 ± 6.4 years, while the Reciproc group had 9 males and 11 females with a mean age of 36.2 ± 3.5 years, and the OneShape group comprised 10 males and 10 females with a mean age of 31.4 ± 4.5 years. In terms of treated teeth, the control group had 9 maxillary and 11 mandibular molars, the Reciproc group had 13 maxillary and 7 mandibular molars, and the OneShape group had 8 maxillary and 12 mandibular molars. **Conclusion:** The intensity of postoperative pain was not affected by the instrumentation kinematics, whether single-file reciprocating or single-file rotary.
Keywords: single-file rotary, instrumentation, pain

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Corresponding author: Dr. Rohit Wadhwa, Reader, Department of Conservative Dentistry and Endodontics, Desh Bhagat Dental College and Hospital, Mandi Gobindgarh, India

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INTRODUCTION

Post-endodontic pain remains a significant concern despite advancements in instrumentation and pharmacologic interventions, with reported prevalence ranging from 2% to 50% due to variations in study design and pain definitions. Even under optimal conditions, mild pain occurs in 10–32% of cases, while severe pain is reported in 5–15%. Contributing factors include preoperative pain, inadequate canal debridement, hyperocclusion, periapical disease, and debris extrusion into periapical tissues, with the latter being a major cause. Hand files generally extrude more debris than engine-driven files due to the Archimedes screw effect. Studies indicate that single-file reciprocating systems like Reciproc produce more debris extrusion than rotary systems such as OneShape and F360. Reciprocating systems use M-wire alloy for enhanced flexibility and fatigue resistance, while OneShape incorporates variable cross-sections and an orifice shaper to improve cleaning efficiency and reduce extrusion. Although in vitro studies have extensively examined debris extrusion across different systems, clinical outcome studies remain limited.[1,2,3,4]

The mechanical instrumentation of root canals requires stainless-steel hand files to establish a glide path before using rotary NiTi files. These K-files, ideally up to size 15 with a 2% taper, must be compact, robust, and resistant to torsional forces to ensure effective dentin removal, manoeuvrability, and durability. However, their limited flexibility makes them unsuitable for highly curved or calcified canals, increasing the risk of fracture and procedural delays. While mechanized NiTi glide path files offer advantages, many clinicians still prefer manual stainless-steel files due to familiarity and stiffness. To enhance performance, manufacturers have modified file geometry, rigidity, and material composition. Despite these advancements, few studies have systematically compared the physical and mechanical properties of different brands of stainless-steel K-files.[5,6,7]

Hence in our study we aimedto compare the intensity of postoperative pain following root canal preparation using two different single-file systems: reciprocating and rotary.

MATERIALS AND METHODS

The study enrolled 60 healthy patients aged 18-50 years with symptomatic irreversible pulpitis in a single molar. Patients were randomly assigned to one of three groups: OneShape rotary files, Reciproc files, or traditional stainless steel K-files (control). Treatment followed a standardized protocol, including local anesthesia, rubber dam isolation, working length determination with an apex locator, and canal instrumentation per manufacturer guidelines. Post-instrumentation, irrigation with NaOCl and EDTA was performed, followed by obturation with lateral condensation of gutta-percha and AH-26 sealer. Patients were advised to take 400 mg Ibuprofen as needed for pain management.

Pain levels were assessed using a visual analog scale (VAS) at 6, 12, 24, 48, and 72 hours post-treatment. Allocation was concealed, with the treating clinician and patients blinded to group assignments. The study aimed to compare pain outcomes between the different instrumentation techniques, with results providing insight into the impact of single-file systems versus conventional K-files on postoperative discomfort. Data analysis was done using SSPS software.

RESULTS

Table 1: General characteristics and demographic data of patients

	Control group (n=20)	Reciproc (n=20)	One shape (n=20)
Male	12	9	10
Female	8	11	10
Mean(SD of age)	37.9 (6.4)	36.2 (3.5)	31.4 (4.5)
Max molar	9	13	8
Man. Molars	11	7	12

The control group included 12 males and 8 females with a mean age of 37.9 ± 6.4 years, while the Reciproc group had 9 males and 11 females with a mean age of 36.2 ± 3.5 years, and the OneShape group comprised 10 males and 10 females with a mean age of 31.4 ± 4.5 years. In terms of treated teeth, the control group had 9 maxillary and 11 mandibular molars, the Reciproc group had 13 maxillary and 7 mandibular molars, and the OneShape group had 8 maxillary and 12 mandibular molars.

Table 2: Mean (SD) of pain intensity in study groups during the first 72 h after treatment

	Control	Reciproc	OneShape	P-value*
Pre-treatment	7.21 (4.81)	7. 82 (5.82)	6.23 (4.02)	0.073
After 6 h	5.32 (3.92)	4.23 (5.03)	4.16 (3.55)	0.007
After 12 h	4.53 (3.34)	3.97 (4.25)	3.12 (2.09)	<0.003
After 24 h	3.86 (2.21)	1.12 (2.27)	2.51 (1.88)	<0.003
After 48 h	2.77 (1.38)	0.97 (1.73)	1.64 (1.06)	<0.003
After 72 h	1.91 (1.01)	0.45 (1.52)	0.86 (0.86)	<0.003
P value	<0.002	<0.002	<0.002	

P-value*: Kruskal Wallis Test; P-value: Friedman Test

DISCUSSION

Postoperative pain following root canal treatment remains a major concern despite advancements in instrumentation and techniques. The choice of endodontic file system plays a crucial role in influencing pain levels, with reciprocating and rotary single-file systems being widely used for their efficiency and simplicity. While reciprocating systems offer enhanced flexibility and resistance to cyclic fatigue, they are often associated with increased debris extrusion, a key factor contributing to post-treatment discomfort. In contrast, rotary single-file systems operate with continuous motion, potentially reducing debris extrusion and postoperative pain.[8]

Farhad Mollashahi N et al.,[9] aimed to compare postoperative pain intensity following endodontic treatment using hand files, single-file rotary (OneShape), and single-file reciprocating (Reciproc)

systems. In this single-blind, parallel-group randomized clinical trial, 150 healthy patients aged 20 to 50 years with symptomatic irreversible pulpitis in a maxillary or mandibular molar were randomly assigned to three groups based on instrumentation technique. Treatment was performed in a single visit by an endodontist, and postoperative pain severity was assessed using the visual analogue scale (VAS) at 6, 12, 24, 48, and 72 hours. Statistical analysis using the Kruskal-Wallis and Mann-Whitney U tests revealed that the control group (hand files) experienced significantly higher postoperative pain at 12, 24, 48, and 72 hours compared to the other two groups ($P<0.05$). However, no significant difference in postoperative pain intensity was observed between the Reciproc and OneShape groups at any time point ($P>0.05$). The study concluded that instrumentation kinematics, whether single-file reciprocating or single-file rotary, did not affect postoperative pain intensity.

It is well established that debris extrusion into the periapical region can irritate periradicular tissues, leading to inflammation, postoperative pain, and flare-ups. While some studies have reported that full-sequence rotary files produce more debris extrusion than reciprocating rotary files, others have found the opposite. These variations may be due to differences in file characteristics such as cross-section, cutting-edge design, taper, tip type, configuration, flexibility, alloy composition, number of files used, kinematics, or cutting efficiency.[10,11,12]

In the study by Talebzadeh B et al.,[13] the clinical trial aimed to compare the severity of postoperative pain following root canal preparation using the RaCe rotary system and hand K-Flexofile. A total of 96 mandibular first and second molars were divided into two groups (n=48) based on the instrumentation technique. All teeth underwent single-session root canal treatment, and postoperative pain severity was assessed using the visual analog scale (VAS) at 4, 8, 12, 24, and 48 hours, as well as at a one-week interval. Additionally, the type and dosage of analgesics consumed were recorded. Data analysis using repeated-measures ANOVA showed no significant differences between the two groups across all time points ($P>0.05$). Furthermore, no significant differences were observed in the type or number of analgesics used by pain-free subjects ($P=0.12$ and $P=0.61$, respectively). The study concluded that there were no statistically significant differences in pain severity between the two instrumentation techniques at any interval.

CONCLUSION

The intensity of postoperative pain was not affected by the instrumentation kinematics, whether single-file reciprocating or single-file rotary.

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