



## Original Study

# Comparative evaluation of rotary and reciprocating single file systems on post-operative pain – a randomised controlled clinical trial

T. Vigneshwar Sambandam<sup>1</sup>, Deepak Selvam<sup>2</sup>, Manish Ranjan<sup>3</sup>

<sup>1,2,3</sup>Department of Conservative Dentistry and Endodontics, Saveetha Institute of Medical and Technical sciences, Chennai, India

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### ABSTRACT

#### Introduction

Post endodontic pain is intelligibly multifactorial, and the instrumentation procedure has been identified as a significant contributor. Debris and bacterial extrusion during chemo-mechanical preparation may be the cause of this, which exacerbates the inflammatory response and results in periradicular inflammation. Depending on the instrument design and instrumentation technique, the amount of extruded debris varies.

#### Aim

To compare and evaluate post-operative pain using rotary and reciprocating single file system

#### Methodology

Two groups of 27 reciprocating files (WAVEONE GOLD) and 27 rotary files, totaling 54 teeth, were created (One Shape). The entire root canal procedure was completed in a single appointment. VAS pain score was used to measure and evaluate post-operative pain at 6, 12, 24, 36, 48, and 72 hours.

#### Results

There was no discernible difference between the two groups' pre-operative mean pain levels when compared across various time periods ( $P > 0.05$ ). However, there was no significant difference in pain levels between the groups at 6, 12, 24, 48, or 72 hours after surgery.

#### Conclusion

In this investigation, there was no substantial difference in post-operative outcomes across the groups. The amount of pressure exerted on a tooth during cleaning and shaping with a single file is more than with a multiple file system, which will lead to post-operative discomfort. As the number of files decreases, debris extrusion decreases. Therefore, further research is required to fully understand the advantages and disadvantages of a single file system against numerous file systems.

**Keywords:** Root canal treatment, post-operative pain, Waveone gold, One shape

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#### Address for Correspondence:

Dr. T. Vigneshwar Sambandam

Department of Conservative Dentistry & Endodontics, Saveetha Institute of Medical and Technical sciences, Chennai, India.

Ph No : 979078761

Email: dr.vigneshwart@gmail.com

## **INTRODUCTION**

The development of a suitable treatment plan, the application of knowledge of tooth anatomy and morphology (shape), and the performance of debridement, disinfection, and obturation of the complete root canal system are all necessary for the success of root canal therapy. The radicular gap was first sealed and obturated. Since neither a method nor a substance can create a barrier that is impermeable to moisture coming from the coronal or apical regions. Early prognostic studies suggested that failures were caused by insufficient obturation<sup>1</sup>. This demonstrates that inaccurate obturation solely reflects how well the cleaning and shaping were done. Inadequately obturated canals are frequently incompletely cleansed and shaped. The essential factors of a successful procedure are adequate cleaning, shaping, and creation of a strong coronal seal, with obturation being less critical for immediate success<sup>2</sup>.

Following root canal therapy (RCT), pain is an undesired but sadly frequent sensation that starts a few hours or days after the procedure and is always uncomfortable for both patients and clinicians. One of the most painful dental operations is reportedly root canal therapy. Less than 12% of patients suffered severe pain following RCT, with post-operative pain incidence reported to vary from 3% to 58%, mostly in the form of moderate discomfort.<sup>3</sup>

Chemical, mechanical, or microbial injuries to the periapical tissues that cause acute inflammation are some of the causes of postoperative pain. When a one-visit RCT was compared to a two-visit treatment, no discernible difference in post-operative pain was discovered. Mechanical variables, like over instrumentation or the extrusion of root-filling materials, have been linked to postoperative pain, indicating that root canal instrumentation and obturation procedures may have an impact on postoperative pain. The study's objective was to compare and assess post-operative discomfort using a reciprocating single file system and a rotary system.

## **MATERIALS AND METHODS**

A thorough medical and dental history was gathered prior to the therapy. Age, sex, and tooth number were among the pre-operative details that were documented for each patient in the predesigned patient's chart. Informed consent was received from the willing patients who volunteered to participate in the trial after the therapy and study design were described to the qualified patients.

The 54 teeth were split into two groups at random. Depending on the endodontic file used, Group 1 (Waveone Gold) had n=27 and Group 2 (One Shape) had n=27. For all the chosen teeth, whether they were found in separate patients or the same patient, the endodontic files were randomly chosen using the envelope draw method. After administering local anaesthesia, a rubber dam was placed to isolate the tooth. An endo-access bur was used to open the access. A #10 k File was used to measure the working length with the aid of an apex finder, and a periapical radiograph was utilized to confirm it. After the establishment of the glide path with the aid of the #20 K file, coronal enlargement was performed. After finalizing with the master cone radiograph following the cleaning and shaping the obturation were performed using the single-matched taper cone obturation technique and the AH plus sealer, depending on which group the patient was allocated to. After 6 hours, 12 hours, 24 hours, 48 hours, and 72 hours following surgery, VAS pain score was used to measure and evaluate postoperative pain.

## RESULTS

The questionnaire was completed by 17 men and 37 women, with a mean age of  $51.92 \pm 14.61$  and  $45.14 \pm 14.05$  years, respectively. 8 men and 19 women competed in Group I, while 9 men and 18 women took part in Group II. In statistical analysis, the Chi Square Test was employed.

Comparison of the mean pain levels experienced by the groups at various time points: There was no discernible difference ( $P > 0.05$ ) in the two groups' pre-operative mean pain scores at different time intervals. At 6, 12, 24, 48, and 72 hours after surgery, there was no substantial difference in pain levels across the groups. According to Tables 4 and 8, group II reported the highest mean pain ( $4.14 \pm 1.29$ ) at 6 hours after surgery whereas group II experienced the lowest mean pain ( $0.22 \pm 0.42$ ) at 72 hours.

Figure 1: Pre-op difference between Group A and Group B

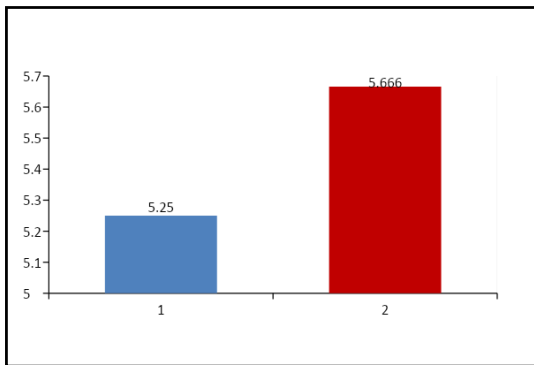


Figure 2: Post op pain scores in 6 hours between Group A and Group B

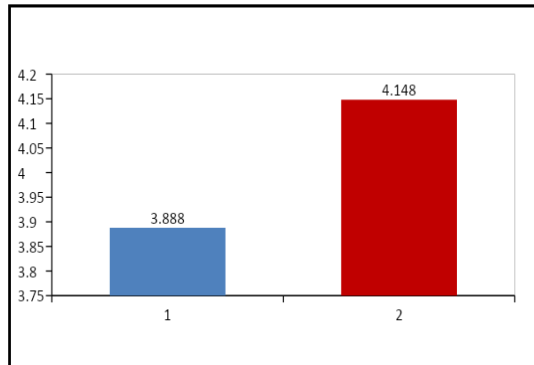


Figure 3: Post op pain scores in 12 hours between Group A and Group B

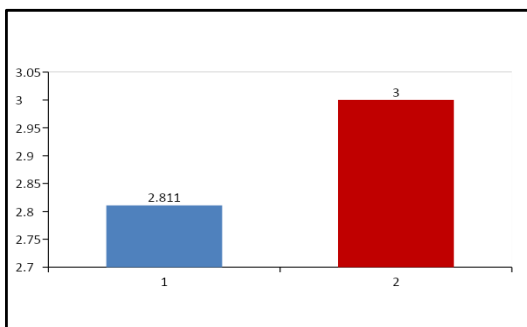
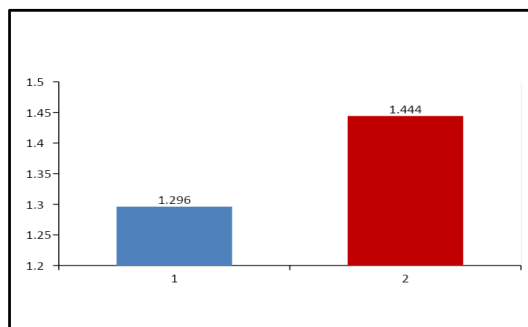
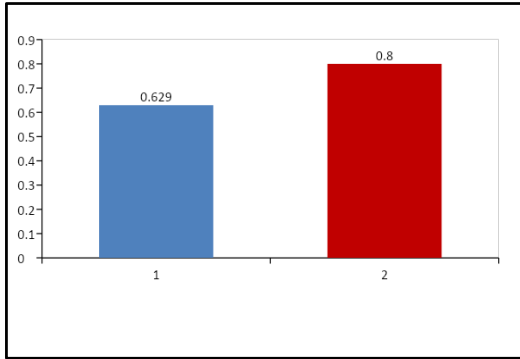


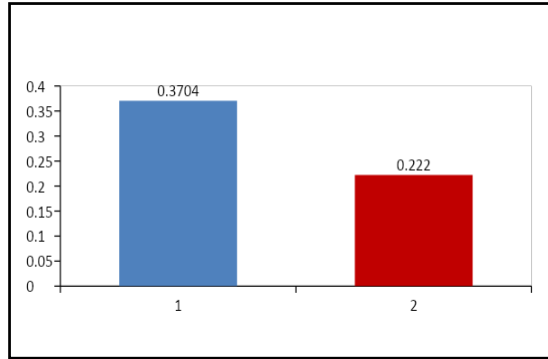
Figure 4: Post op pain between Group A and Group B on 24 hrs.



**Figure 5: Post op pain between Group A and Group B on 48 hrs.**



**Figure 6: Post op pain between Group A and Group B on 72 hrs.**



There was no statistically significant difference in pain between the groups I & II for post-operative period of 6, 12, 24, 48 and 72 hours respectively. (Table 4,5,6,7 and 8)

**Table 1: Comparison of pre op pain score between the groups**

	Groups	Mean	Std. Deviation	Mean difference	t value	p value
Pre op pain score	Group A	5.259	1.754	-.4074	-0.997	.335
	Group B	5.666	1.754			

Independent t test-

Table 1 depicts the mean pre op pain between the groups. The difference was not found to be significant statistically (p value $\geq$ 0.05).

**Table 2: Comparison of post op pain score – 6 hours between the groups**

	Groups	Mean	Std. Deviation	Mean difference	t value	p value
Post op pain score – 6 hours	Group A	3.888	1.050	-.2592	-0.809	.860
	Group B	4.148	1.292			

Independent t test

Table 2 depicts the mean post op pain at 6 hours between the groups. The difference was not found to be significant statistically (p value $\geq$ 0.05).

**Table 3: Comparison of post op pain score – 12 hours between the groups**

	Groups	Mean	Std. Deviation	Mean difference	t value	p value
Post op pain score– 12 hours	Group A	2.811	1.564	-.18519	-.463	.853
	Group B	3.000	1.358			

Independent t test

Table 3 depicts the mean post op pain at 12 hours between the groups. The difference was not found to be significant statistically (p value $\geq$ 0.05).

**Table 4: Comparison of post op pain score – 24hrs between the groups**

	Groups	Mean	Std. Deviation	Mean difference	t value	p value
Post op pain score – day 1	Group A	1.296	1.353	-.1481	-.433	.917
	Group B	1.444	1.154			

Independent t test

Table 4 depicts the mean post op pain on day 1 between the groups. The difference was not found to be significant statistically (p value $\geq$ 0.05).

**Table 5: Comparison of post op pain score – 48hrs between the groups**

	Groups	Mean	Std. Deviation	Mean difference	t value	p value
Post op pain score – day 2	Group A	.629	.883	-.1481	-.646	.775
	Group B	.778	.800			

Independent t test

Table 5 depicts the mean post op pain on day 2 between the groups. The difference was not found to be significant statistically (p value $\geq$ 0.05).

**Table 6: Comparison of post op pain score – 72hrs between the groups**

	Groups	Mean	Std. Deviation	Mean difference	t value	p value
Post op pain score – day 3	Group A	.3704	.687	.1481	.953	.072
	Group B	.222	.423			

Independent t test

Table 6 depicts the mean post op pain on day 3 between the groups. The difference was not found to be significant statistically (p value $\geq$ 0.05).

## DISCUSSION

The effectiveness of cleaning, shaping, and obturation as well as the level of discomfort experienced after surgery all contribute to the success of endodontic therapy. The subjective aspect of this evaluation and the inherent difficulty in quantifying pain are two of the key flaws encountered while evaluating post-operative pain. Extrusion of debris from the root canal caused by instrumentation results in discomfort. This randomized controlled clinical trial's goal was to assess the variations in post-operative discomfort brought on by single file reciprocating and rotary file systems. According to age, the patients were distributed at random (18-75 years). 54 patients in total received treatment at the baseline evaluation for post-operative pain at 6, 12, 24, 48, and 72 hours. Each group's post-operative pain was recorded and evaluated using a VAS scale.

The dental pulp is removed during endodontic therapy or root canal therapy, and the tooth's root canals are then shaped, cleaned, and sealed. The total alleviation of pain is one of the key goals of root canal therapy. The precise reasons for discomfort after root canal therapy have not been well reported. Root canal therapy can be completed in a single visit or across many. To ensure a straightforward, consistent treatment strategy and rule out the potential influence of intracanal medication, single-visit endodontic treatment was adopted. According to Su et al.<sup>6</sup>, the incidence of discomfort following a single endodontic visit was lower than that reported following a multi-visit endodontic procedure. Single visit for endodontic treatment has been linked to an increase in post-operative discomfort and flare-up rates, although other research have shown no correlation between these two factors.

Extrusion of microorganisms, materials, or dentin debris into the periradicular area has been shown to cause inflammation and may be related to post-operative pain and flare-ups. As a result, forcing these irritants into the area causes inflammation, the severity of which depends on the quantity and quality of the extruded debris. The intensity of the response will increase with the amount of extruded debris<sup>7</sup>. Patients may suffer post-operative discomfort differently depending on the instrumentation approach used because of changes in the amount of debris extrusion and neuropeptides produced by C-type nerve fibres found in the periodontal ligament<sup>8</sup>. The difference shown, according to some authors<sup>9</sup>, may be caused by variations in the cross section, cutting-edge design, taper, tip type, configuration, usage concept, flexibility, alloy type, quantity of files utilized, kinematics, or cutting efficacy.

To remove or reduce interpersonal variability in the treatment processes, just one clinician carried out all the treatments. In each of these groups, the post-operative pain score at 6 and 12 hours was considerably greater than at 24, 48, and 72 hours. Pak and White<sup>9</sup> conducted a systematic review in 2011 and found that the early stages following root canal therapy were when post-operative discomfort was at its highest level. According to many authors reports, the incidence of post-operative discomfort was 40% in the first 24 hours, dramatically decreased in the first 48 hours, and was found to be 11% or less on the seventh day.<sup>10</sup> According to Burklein and Schafer<sup>11</sup>, reciprocating instruments extruded more debris than rotary ones do. However, some authors<sup>12,13</sup> have discovered that using reciprocating systems does not result in a larger extrusion of apical debris.

When compared to root canal preparations carried out by convention full-sequence rotary systems, post-operative discomfort following root canal therapy using reciprocating tools is not related with greater pain. Cruz Junior et al<sup>14</sup> demonstrated that the Reciproc system's apical extrusion was not clinically significant. Other research<sup>15</sup> demonstrates that, when compared to a rotary nickel-titanium crown down instrumentation approach employing Twisted Files, the reciprocating single-file technique results in a more substantial inflammatory reaction and discomfort. A greater cutting angle and a lower releasing angle combine to create the reciprocation movement. When the releasing angle is used, the file moves apically. Debris is thereby pushed apically rather than being removed at the releasing angle. The WaveOne file thereby functions as a piston to moves material further than the apical foramen.

In addition, the WaveOne method uses a single-file system with a greater taper (usually 0.08 taper, size 25). Without first enlarging the coronal, these instruments are used. The length of the file comes into touch with the canal wall as a result, increasing the quantity of debris that is produced. Additionally, the reciprocating file's cutting ability is significantly lower than continuous rotation, and it also removes less debris. As a result of the debris becoming caught in the flutes, frictional stress and torque demand increased<sup>16</sup>. In comparison to a file with a centred mass and axis of rotation, a file with an offset design provides additional cross-sectional area for improved cutting, loading, and pushing debris out of a canal. Because of the abundance of intra-blade debris that is stuck between the cutting flutes over the active area of a file, many instruments frequently breaks. The likelihood of lateral compacting debris and obstructing the root canal system anatomy is often reduced by offset file designs.

Varying extruded debris and neuropeptide amounts might be produced by different instrumentation approaches, which would account for the reported variations in postoperative pain intensity. Although several canal instrument systems have been created, despite variations in design, cross-sectional structure, and application techniques, all show some degree of debris extrusion. Even with careful working length management, material extrusion via the apical foramen cannot be totally avoided.<sup>17</sup>

The rotary instruments are developed with both symmetrical and asymmetrical rotary motions. Asymmetrical rotary instruments have their centres off-centre from the main axis of rotation of the instrument. The length of the working portion of the instrument tends to move in a wavelike pattern during rotation, reducing contact between the file and dentin. In this scenario, rotary instruments may be able to generate cleaner canals with less debris build up than reciprocating instruments. Basically, the reciprocating action is linked to an initial counterclockwise rotation, allowing the device to penetrate, and cut the dentin. The instrument can then be disengaged with a further rotation in the reverse direction<sup>18</sup>. Furthermore, the utilization of the irrigation procedure as well as the kinematics are both factors in the fact that reciprocating instruments produced more debris.<sup>19</sup>

Studies conducted in vitro have shown that reciprocating systems can lead to higher debris extrusion or accumulation in the root canal<sup>20</sup> than rotary systems, most likely because of the reciprocating instrument's reversing motion. However, another in vitro investigation found that employing the reciprocating system resulted in reduced apical extrusion of bacteria. However, in vitro results might not generalize to clinical situations.

Nickel-titanium (NiTi) Rotary files have been shown to extrude less debris than hand files made of stainless steel. There have been more rotational and reciprocal NiTi devices introduced recently. According to reports, both continuous rotary systems (i.e., ProTaper and M two instruments) and single-file reciprocating systems (i.e., Wave One and Reciproc instruments) were equally successful at removing cultivable bacteria and endotoxins from mostly infected root canals.<sup>21</sup> In contrast to reciprocal instrumentation, continuous rotary instrumentation creates a channel for the clearance of debris from the root canal, hence lowering apical extrusion of debris and the intensity of post-operative discomfort. The use of reciprocal instrumentation was associated with reduced post-operative discomfort than rotational instrumentation in a clinical randomised study with 624 patients<sup>22</sup>. This study found inconsistent results when rotary and reciprocating systems were compared for post-operative pain, however numerous studies found reciprocation to result in severe post-operative pain.

A recent systematic review revealed contradictory findings, but it also indicated that reciprocating instruments tended to extrude more dentine debris than rotary instruments. Using rotary vs. reciprocating instruments for single-visit root canal preparation, a recent meta-analysis of a few studies examined the post-operative pain, and it revealed no differences in the methods' pain incidence.<sup>23</sup>

The mechanical movement wave propagates down the length of the instrument's working component while it rotates, limiting contact between the file and dentin. In such instances, rotary files produce cleaner canals by assuring lower levels of debris accumulation than reciprocating devices do. Comparing the quantity of files

needed for root canal preparation is another aspect to consider. In the apical area, it is shown that the number of files increases the production of debris and the level of manipulation. Using more tools to get to the working length might result in increased extrusion and post-operative discomfort.

According to previous studies, reciprocal files produce more debris extrusion than rotary files. Reciprocal instruments produced more debris extrusion during retreatment processes than Mtwo R instruments, according to Lu et al<sup>24</sup>. In mandibular molar teeth with necrotic pulps, Shokraneh et al.<sup>25</sup> examined the degrees of post-operative discomfort following the use of three different instrumentation techniques. When compared to root canal procedures utilizing the ProTaper Universal rotary system and hand files, they found that the WaveOne technique produced considerably lower levels of post-operative discomfort. They attributed this to the quantity of contaminated material extruded from the apex.

More research with larger sample sizes are necessary to further evaluate the limitations and benefits of these two methods with relation to pain following endodontic treatment, since it should be emphasized that the findings of a single clinical study cannot be applied to all clinical instances.

However, in terms of retreatment time, the NiTi rotary files proved faster than the hand files.

## **CONCLUSION**

In this investigation, there was no discernible difference in post-operative outcomes across the groups. New endo files are continuously added, and older systems are upgraded. Since then, attention has been directed to novel manufacturing techniques and various distinctive characteristics, such as varying cross-section over the length of the active area of the file. The amount of pressure placed on a tooth during cleaning and shaping with a single file is greater than with a multiple file system, which will lead to post-operative discomfort. As the number of files decreases debris ejection decreases. Future studies should compare the pain symptomatic patients feel during root canal preparation using single file reciprocating and rotating devices.

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**Conflicts of interest** - Nil

## **REFERENCES**

1. Rotstein, Ilan, Ingle John I. *Ingle's Endodontics* 7th ed. United States: People's Medical Publishing House; 2019.
2. Sabeti MA, Nekofar M, Motahary P, Ghandi M, Simon JH. Healing of apical periodontitis after endodontic treatment with and without obturation in dogs. *Journal of endodontics*. 2006 Jul 1;32(7):628-33.
3. Gondim Jr E, Setzer FC, Dos Carmo CB, Kim S. Postoperative pain after the application of two different irrigation devices in a prospective randomized clinical trial. *Journal of Endodontics*. 2010 Aug 1;36(8):1295-301.
4. Garred P, Brygge K, Sørensen CH, Madsen HO, Thiel S, Svejgaard A. Mannan-binding protein—levels in plasma and upper-airways secretions and frequency of genotypes in children with recurrence of otitis media. *Clinical & Experimental Immunology*. 1993 Oct;94(1):99-104.
5. Arias A, José C, Azabal M, Hidalgo JJ, Peters OA. Prospective case controlled clinical study of post-endodontic pain after rotary root canal preparation performed by a single operator. *Journal of dentistry*.



- 2015 Mar 1;43(3):389-95.
6. Su Y, Wang C, Ye L. Healing rate and post-obturation pain of single-versus multiple-visit endodontic treatment for infected root canals: a systematic review. *Journal of endodontics*. 2011 Feb 1;37(2):125-32.
  7. Kirchoff AL, Fariniuk LF, Mello I. Apical extrusion of debris in flat-oval root canals after using different instrumentation systems. *Journal of endodontics*. 2015 Feb 1;41(2):237-41.
  8. Gambarini, G., Gergi, R., Naaman, A., Osta, N., & Al Sudani, D. Cyclic fatigue analysis of twisted file rotary NiTi instruments used in reciprocating motion. *International Endodontic Journal*. 2012 Sep; 45(9): 802–06.
  9. Pak JG, White SN. Pain prevalence and severity before, during, and after root canal treatment: a systematic review. *Journal of endodontics*. 2011 Apr 1;37(4):429-38.
  10. Alí A, Olivieri JG, Duran-Sindreu F, Abella F, Roig M, García-Font M. Influence of preoperative pain intensity on postoperative pain after root canal treatment: A prospective clinical study. *Journal of dentistry*. 2016 Feb 1;45:39-42.
  11. Bürklein S, Hinschitzka K, Dammaschke T, Schäfer E. Shaping ability and cleaning effectiveness of two single-file systems in severely curved root canals of extracted teeth: Reciproc and WaveOne versus Mtwo and ProTaper. *International endodontic journal*. 2012 May;45(5):449-61.
  12. Koçak S, Koçak MM, Sağlam BC, Türker SA, Sağsen B, Er Ö. Apical extrusion of debris using self-adjusting file, reciprocating single-file, and 2 rotary instrumentation systems. *Journal of endodontics*. 2013 Oct 1;39(10):1278-80.
  13. Tinoco JM, De-Deus G, Tinoco EM, Saavedra F, Fidel RA, Sassone LM. Apical extrusion of bacteria when using reciprocating single-file and rotary multifile instrumentation systems. *International Endodontic Journal*. 2014 Jun;47(6):560-6.
  14. Junior JA, Coelho MS, Kato AS, Vivacqua-Gomes N, Fontana CE, Rocha DG, da Silveira Bueno CE. The effect of foraminal enlargement of necrotic teeth with the reciproc system on postoperative pain: a prospective and randomized clinical trial. *Journal of endodontics*. 2016 Jan 1;42(1):8-11.
  15. Gambarini G, Al Sudani D, Di Carlo S, Pompa G, Pacifici A, Pacifici L, Testarelli L. Incidence and intensity of postoperative pain and periapical inflammation after endodontic treatment with two different instrumentation techniques. *European Journal of Inflammation*. 2012 Jan;10(1):99-103.
  16. De-Deus G, Barino B, Zamolyi RQ, Souza E, Júnior AF, Fidel S, Fidel RA. Suboptimal debridement quality produced by the single-file F2 ProTaper technique in oval-shaped canals. *Journal of Endodontics*. 2010 Nov 1;36(11):1897-900.
  17. Bier CA, Shemesh H, Tanomaru-Filho M, Wesselink PR, Wu MK. The ability of different nickel-titanium rotary instruments to induce dentinal damage during canal preparation. *Journal of Endodontics*. 2009 Feb 1;35(2):236-8.
  18. Gergi R, Arbab-Chirani R, Osta N, Naaman A. Micro-computed tomographic evaluation of canal transportation instrumented by different kinematics rotary nickel-titanium instruments. *Journal of endodontics*. 2014 Aug 1;40(8):1223-7.
  19. Kuhn G, Jordan L. Fatigue and mechanical properties of nickel-titanium endodontic instruments. *Journal of endodontics*. 2002 Oct 1;28(10):716-20.
  20. Ashwinkumar V, Krithikadatta J, Surendran S, Velmurugan N. Effect of reciprocating file motion on microcrack formation in root canals: an SEM study. *International endodontic journal*. 2014 Jul;47(7):622-7.
  21. Martinho FC, Gomes AP, Fernandes AM, Ferreira NS, Endo MS, Freitas LF, Camões IC. Clinical comparison of the effectiveness of single-file reciprocating systems and rotary systems for removal of endotoxins and cultivable bacteria from primarily infected root canals. *Journal of endodontics*. 2014 May 1;40(5):625-9.

22. Neelakantan P, Sharma S. Pain after single-visit root canal treatment with two single-file systems based on different kinematics—a prospective randomized multicenter clinical study. *Clinical oral investigations*. 2015 Dec;19(9):2211-7.
23. Ahn SY, Kim HC, Kim E. Kinematic effects of nickel-titanium instruments with reciprocating or continuous rotation motion: a systematic review of in vitro studies. *Journal of endodontics*. 2016 Jul 1;42(7):1009-17.
24. Lu Y, Wang R, Zhang L, Li HL, Zheng QH, Zhou XD, Huang DM. Apically extruded debris and irrigant with two Ni-Ti systems and hand files when removing root fillings: a laboratory study. *International endodontic journal*. 2013 Dec;46(12):1125-30
25. Shokraneh A, Ajami M, Farhadi N, Hosseini M, Rohani B. Postoperative endodontic pain of three different instrumentation techniques in asymptomatic necrotic mandibular molars with periapical lesion: a prospective, randomized, double-blind clinical trial. *Clinical oral investigations*. 2017 Jan;21(1):413-18.



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