

Evaluation of Postoperative Pain after Endodontic Treatment using XP-Endo Shaper and Oneshape (A double-blind Randomized Clinical study)

Mohamed A. Tamмам¹, Sherif A. Elkhodary², Alaa A. ElBaz³

ARTICLE INFO.

Keywords:

Rotary Files, single visit, pain

Abstract

Background: This study evaluated postoperative pain (incidence, degree and duration) after using Xp endoshaper and Oneshape in root canal treatment.

Methods: Thirty patients with irreversible pulpitis in a single canal premolar were chosen randomly according to the inclusion and exclusion criteria. Patients were divided equally into two groups; group A (n = 15) were treated with Xp endoshaper whilst those in group B (n = 15) were treated using Oneshape both in a single visit treatment. Rating of postoperative pain after treatment was recorded using NRS which is a horizontal line of 11 marks and 10 intervals each takes numbers from 0 to 10 where 0 = no pain, 1-3 = mild pain, 4-6 = moderate pain, 7-10 = severe pain after 6hrs, 12hrs, 24hrs, 48hrs.

Results: Within group A (Xp endoshaper) pain intensity showed significant reduction from the preoperative state at all the time intervals 6, 12, 24 and 48hrs ($p < 0.001$). Pain intensity showed no significant difference between the 24hrs and 48hrs interval ($p = 0.063$). Within group B (Oneshape) pain intensity showed significant reduction from the preoperative state to all the time intervals 6, 12, 24 and 48hrs. ($p < 0.001$). Pain intensity showed no significant difference between the 24hrs and 48hrs interval ($p = 0.004$). Postoperative pain was lower using Xp endoshaper file than Oneshape ($p < 0.05$)

Conclusion: XP endoshaper file showed lower postoperative pain level after 6hrs, 12hrs 24hrs 48hrs than Oneshape file, both files were found to be effective in controlling postoperative pain.

© 2023 MSA. All rights reserved.

* Corresponding author.

Email address:

Mohamed_tammam@hotmail.co.uk

¹ Master Degree in Endodontics, Faculty of Dentistry, October University for Modern Sciences and Arts (MSA), Cairo, Egypt.

² Associate Professor of Endodontics, Faculty of Dentistry, Cairo University, School of Dentistry Newgiza University, Cairo, Egypt.

³ Lecturer of Endodontics, Faculty of Dentistry, Cairo University, Egypt

1. Introduction

During chemo-mechanical preparation of the root canals, unfortunately some of the dentinal debris, pulp tissue, micro-organisms and irrigants are transported to the periradicular tissues which can create or exacerbate an inflammatory response leading to pain which ranges in incidence from 1.4%-16% according to the literature^{1,2}.

XP-endo Shaper has been introduced by FKG Dentaire as single, MaxWire nickel-titanium alloy with size 30/0.01 and activated within the root canal at body temperature to reach a final size 30/0.04 canal preparation. So far, there is no available information regarding apical extrusion of dentinal debris and/or bacteria using this instrument as well as no study evaluating its intra-canal antibacterial effects³.

Oneshape system is a continuous rotary single-file system made of conventional NiTi alloy with variable cross-section along its active region. It has variable pitch and variable helix angles along the instrument. This file has tip size 25 and a 6% taper^{4,5}.

This clinical trial is to evaluate the post-operative pain with single rotary file (XP endoshaper) and single rotary file (Oneshape) in treating premolar with acute irreversible pulpitis. There are many factors that may lead to postoperative pain which are demonstrated as acute periapical inflammation due to chemical, mechanical, and/or microbial injury of periapical tissue^{6,7,8}. Over the past few years, single-file nickel-titanium instrumentation systems have been introduced for root canal preparation. Modifying and improving instruments is to simplify the cleaning and shaping stage and to reduce the number of used instruments along with preserving the original shape of the prepared root canals^{9,10}.

FKG Dentaire manufacturers have introduced XP-endo Shaper single file system in 2015. XP-endo Shaper shapes the root canal by achieving an asymmetric rotary movement, by taking on a semicircular shape when it expands at a temperature of 35°C or higher^{11,12}.

OneShape file by Micro Méga were launched into the market in 2011 as the first rotary single-file endodontic system, One Shape system is a continuous rotary single-file system made of conventional nickel-titanium with a tip size 25/.06 taper⁴.

The aim of the study was to evaluate the postoperative pain (incidence, degree and duration) after using XP-endo shaper and one shape in root canal treatment. The hypothesis of the current study was that there will be no significant difference between XP endoshaper compared with Oneshape file post-operative pain after single visit endodontic treatment.

2. Material & Methods:

Thirty patients with irreversible pulpitis in a single canal premolar were chosen randomly from the outpatient clinic at dental school of the Modern Sciences and Arts University under the rules described by the ethical committee, Faculty of Dentistry, Modern Science and Arts University (MSA).

Inclusion Criteria were healthy patients, age range from 20 to 50 year, no medical problem (ASA class 1*), males and females, symptomatic irreversible pulpitis in single canal lower first, second and upper second premolar teeth without apical lesion, teeth with mature roots, restorable teeth, patients who can understand numerical rating scale. Exclusion criteria were patients with previous endodontic treatment, patients with history of medicine intake including corticosteroids,

opioids, non-steroidal anti-inflammatory (NSAIDS) drugs in the past 12 hrs. Pregnant females, complicated anatomy, calcified, open apices or external and internal resorption, patients with periodontal diseases, swelling or abscess or any periapical lesion, Patients having bruxism or clenching.

After selection of the Lower/upper premolar that fits the inclusion criteria, patients were asked to rate their pain level on numerical rating scale before the anesthesia injection and the beginning of the preparation to get the baseline record for the pain preoperatively. The patient was handed two enclosed envelopes and chose one in order to be allocated in one of the treatment groups.

After the selection of the file group the patient received an inferior alveolar nerve block injection for lower premolars (1.8 ml mepivacaine hydrochloride 2% 1: 100,000 epinephrine), for upper premolars patients received a buccal infiltration injection (1.8 ml mepivacaine hydrochloride 2% 1: 100,000 epinephrine). After 15-minutes, access cavity was performed, presence of blood from the canal confirmed proper diagnosis of irreversible pulpitis. Isolation was then performed, patency of the canal was checked with K- file size 10 taper 0.02, extirpation of pulp with K- file sizes 15 and 20 taper 0.02. An electronic apex locator was used to determine working length, and then working length was confirmed radiographically to be adjusted 1mm shorter than the radiographic apex. Irrigation was done using 2.5% sodium hypochlorite. For group A Xp endoshaper (Table 1) was set at speed 1000 rpm and a torque 1 Ncm. Long gentle strokes were used to progress down to working length, if working length was not reached in five strokes, file was taken out, then irrigation was applied, apical patency

checked using K-file size 15 and this step was repeated till WL was reached. After WL was reached, irrigation was done, then 15 additional long gentle strokes were done till WL to adequately shape the canal.

For group B Oneshape (Table 1) was used at a speed 400 rpm and a torque 2.5 Ncm, file was advanced down to two thirds of the working length using an in-and-out movement without pressure while performing an upward circumferential filing movement in order to pre-enlarge the canal. The file was withdrawn and canal was irrigated and patency was checked. The same procedure was repeated till 3mm away from WL, then file was withdrawn and canal was irrigated and patency was checked. Then the file was advanced to the full working length performing the in-and-out movement without pressure and then irrigation of the canal was done.

X-ray was done to confirm proper adaptation of master cone size 25 taper 4% for the Oneshape group and size 30 taper 4% for the Xp endoshaper group.

Activation of irrigation was done using manual agitation for one minute using master cone 1 mm shorter than the working length, the canals were then dried with paper points size 25 for the Oneshape Group and size 30 for the Xp endoshaper group. Obturation was done with the selected master cone and resin sealer, using modified lateral compaction technique a spreader size 25 was selected to provide auxiliary cones size 25 A cotton pellet was then soaked in alcohol and used to clean the access cavity of the tooth, access cavity was then sealed with composite restoration. Postoperative x-ray was taken to record the case.

Rating of postoperative pain after the treatment was recorded by numerical rating scale (NRS) in a sheet given to the patient to record the degree of pain after 6 hrs, 12 hrs, 24 hrs, 48 hrs together with recalling the patient to check the record. No anti-inflammatory drugs were prescribed.

Table 1: Materials used in this study were:

Product	Manufacturer
XP endoshaper File	FKG Dentaire
Oneshape File	Micro Mega
Local anesthesia	Mepecaine-L
Round bur (size:2)	Mani Inc., Tochigikan, Japan
Endo Z bur	Prima dental
Rubber dam sheets	Sanctuary
K files (sizes:10, 15,20)	Mani Inc., Tochigikan, Japan
Apex locater	Morita Corporation, Kyoto, Japan
Endo Motor	E-connect S by Eighteeth
Sodium hypochlorite	Clorox
30 gauge Side vented needle	Medic
PSP X ray film	Fona
Paper points	Metabiomed. CO., LTD, Korea
Gutta Percha 4% taper (size:25,30)	Metabiomed. CO., LTD, Korea
Gutta Percha 2% taper (size:25)	Metabiomed. CO., LTD, Korea
Adseal resin sealer	Metabiomed. CO., LTD, Korea
Spreader (size:25)	Mani Inc., Tochigikan, Japan
Core build up composite	Charmcore-DentKist

3. Results

3.1 Changes in pain intensity with time within each group as in table 10:

a. Within group A (Xp Endoshaper):

Pain intensity showed significant reduction from the preoperative state at all time intervals 6, 12, 24 and 48hrs. ($p < 0.001$). A significant reduction of pain

intensity was found from the 6hrs interval to the 12hrs ($p = 0.009$), 24hrs ($p = 0.001$) and 48hrs ($p = 0.001$). A significant reduction of pain intensity was found from the 12hrs interval to the 24hrs ($p = 0.017$) and 48hrs ($p = 0.01$) intervals. Pain intensity showed no significant difference between the 24hrs and 48hrs interval ($p = 0.063$).

b. Within group B (Oneshape):

Pain intensity showed significant reduction from the preoperative state at all time intervals 6, 12, 24 and 48hrs. ($p < 0.001$). A significant reduction of pain intensity was found from the 6hrs interval to the 12hrs ($p = 0.002$), 24hrs ($p = 0.001$) and 48hrs ($p = 0.001$). A significant reduction of pain intensity was found from the 12hrs interval to the 24hrs ($p = 0.015$) and 48hrs ($p = 0.001$) intervals. Pain intensity showed no significant difference between the 24hrs and 48hrs interval ($p = 0.004$).

Table (10): results of Wilcoxon signed rank test for comparison of change in pain intensity at different time intervals within each group:

	Group A (XPS)	Group B (OS)
Preoperative - 6 hours	0.001*	0.001*
Preoperative - 12 hours	0.001*	0.001*
Preoperative - 24 hours	0.001*	0.001*
Preoperative - 48 hours	0.001*	0.001*
6 hours - 12 hours	0.009*	0.002*
6 hours - 24 hours	0.001*	0.001*
6 hours - 48 hours	0.001*	0.001*
12 hours - 24 hours	0.017*	0.015*
12 hours - 48 hours	0.01*	0.001*

24 hours - 48 hours	0.063	0.004*
----------------------------	-------	--------

*Significant at $p < 0.05$

3.2 Comparison between the two groups:

1. Age:

Group A (Xp endoshaper) showed significantly higher mean age value than group B (Oneshape). ($p < 0.001$) as in Table (2)

Table (2): Descriptive statistics and the results of independent *t* test for comparison of age between the two groups:

	Group A (XPS)	Group B (OS)	P - Value
<i>Mean</i>	35.00	23.00	
<i>SD</i>	6.72	4.47	<0.001*
<i>Median</i>	35.00	23.00	
<i>Min</i>	23.00	16.00	
<i>Max</i>	48.00	30.00	

*Significant at $p < 0.05$.

2. Gender distribution:

There was no significant difference in gender distribution between the two groups. ($p = 0.143$) as in Table (3)

Table (3): frequencies, percentages and the results of chi square test for comparison of gender distribution between the two groups:

	Group A (XPS)		Group B (OS)		P - Value
	Frequency	%	Frequency	%	
M	6	40.0%	10	66.7%	0.143
F	9	60.0%	5	33.3%	

3. Tooth type distribution:

There was no significant difference in tooth type distribution between the two groups. ($p = 0.475$) as in Table (4)

Table (4): frequencies, percentages and the results of chi square test for comparison of tooth type distribution between the two groups:

	Group A (XPS)		Group B (OS)		P - Value
	Frequency	%	Frequency	%	
Lower					
1st premolar	2	13.3%	1	6.7%	
Upper					
2nd premolar	1	6.7%	0	0.0%	0.475
lower					
2nd premolar	12	80.0%	14	93.3%	

4. Preoperative pain:

There was no significant difference in preoperative pain between the two groups. ($p = 0.512$) as in Table (5)

Table (5): Descriptive statistics and the results of Mann-Whitney U test for comparison of preoperative pain between the two groups:

	Group A (XPS)	Group B (OS)	P - Value
<i>Mean</i>	6.87	7.20	
<i>SD</i>	1.13	0.68	0.512
<i>Median</i>	7.00	7.00	
<i>Min</i>	4.00	6.00	
<i>Max</i>	8.00	8.00	

5. Postoperative pain after 6 hours:

Group A (XP endoshaper) showed significantly lower postoperative pain level after 6 hours than group B (Oneshape). ($p = 0.003$) as in Table (6)

Table (6): Descriptive statistics and the results of Mann-Whitney U test for comparison of postoperative pain after 6 hours between the two groups:

	Group A (XPS)	Group B (OS)	P Value
Mean	3.40	4.87	
SD	1.99	0.83	0.003*
Median	3.00	5.00	
Min	0.00	3.00	
Max	8.00	6.00	

*Significant at $p < 0.05$.

6. Postoperative pain after 12 hours:

Group A (Xp endoshaper) showed significantly lower postoperative pain level after 12 hours than group B (Oneshape). ($p < 0.001$) as in Table (7)

Table (7): Descriptive statistics and the results of Mann-Whitney U test for comparison of postoperative pain after 12 hours between the two groups:

	Group A (XPS)	Group B (OS)	P Value
Mean	1.27	3.67	
SD	1.33	0.90	0.000
Median	1.00	3.00	
Min	0.00	3.00	
Max	3.00	6.00	

*Significant at $p < 0.05$.

7. Postoperative pain after 24 hours:

Group A (Xp endoshaper) showed significantly lower postoperative pain level after 24 hours than group B (Oneshape). ($p < 0.001$) as in Table (8)

Table (8): Descriptive statistics and the results of Mann-Whitney U test for comparison of postoperative pain after 24 hours between the two groups:

	Group A (XPS)	Group B (OS)	P Value
Mean	0.40	2.47	
SD	0.74	1.19	<0.001*
Median	0.00	3.00	
Min	0.00	0.00	
Max	2.00	4.00	

*Significant at $p < 0.05$.

8. Postoperative pain after 48 hours:

Group A (Xp endoshaper) showed significantly lower postoperative pain level after 48 hours than group B (Oneshape). ($p < 0.001$) as in Table (9)

Table (9): Descriptive statistics and the results of Mann-Whitney U test for comparison of postoperative pain after 48 hours between the two groups:

	Group A (XPS)	Group B (OS)	P Value
Mean	0.40	2.47	
SD	0.74	1.19	<0.001*
Median	0.00	3.00	
Min	0.00	0.00	
Max	2.00	4.00	

*Significant at $p < 0.05$.

4. Discussion

Postoperative pain is a common finding after root canal treatment that has been attributed to many factors, one of the factors that is considered to have an effect on postoperative pain occurrence is the file being used to shape the canal. This study evaluated postoperative pain (incidence, degree and duration) after using two different file systems XP endoshaper

and Oneshape in root canal treatment. The null hypothesis was rejected as XP endoshaper file showed lower postoperative pain level after 6hrs, 12hrs 24hrs 48hrs than Oneshape file.

Alamassi et al.⁶ studied postoperative pain and stated that it is complicated and unclear in regards to incidence and varies from study to another. The probable causes that lead to this complication are chemical, mechanical or microbial injury to the periradicular tissues. The most commonly stated causes are instrumentation beyond the apical foramen and apical extrusion of infected debris which causes an acute immune response in the periapical area. The reported incidence of this phenomenon varied from 1.7 to 70. Bassam et al.,¹³ stated that any of the procedural steps could be the cause or even all of them as this phenomenon is multifactorial. In this study the instrumentation factor was the one tackled.

Premolars were chosen to be the teeth of choice in this study as they mostly have single straight canals with low variations to keep the tooth variant static as much as possible.

Pain perception is a highly subjective and variable experience which is affected by multiple physical and psychological factors. It is difficult to objectively measure a patient's level of discomfort as data for this variable depend on subjective information provided by the patients themselves and are subject to error⁷. NRS was chosen for this study as stated by Jensen et al.,¹⁴ it is simple for the patient to use and reliable for the operator to compare results. The Numerical Pain Rating Scale (NPRS) is used to rate participant's pain on an eleven-point numerical scale.

The scale is composed of 0 (no pain at all) to 10 (worst imaginable pain).

Sodium hypochlorite is the most used irrigant in endodontics due to its antimicrobial activity and ability to dissolve tissue. It was used at a concentration of 2.5% in this study. The 2.5% sodium hypochlorite rinsing solution is considered the first choice for use in root canal systems, because it promotes complete removal of pulp debris and cleans areas that are difficult to reach with instruments giving the same effect as 5.25%¹⁵, it was found to have no effect on postoperative pain¹⁶. Sodium hypochlorite 2.5% was used rather than 5.25% as the lower the concentration, the lower the chlorine loss, so it is naturally more stable¹⁷. Currently, there is no consensus on the concentration of NaOCl that should be used for root canal irrigation, but there appears to be a tendency towards using higher concentrations for more effective disinfection and soft tissue, but not overly high as high concentrations increase chances of root fracture¹⁸.

Single visit treatment was done rather than multiple visits in this study firstly because the cases or subjects being tested are with irreversible pulpitis which does not require the need of intracanal medicaments or severe precautions to eliminate bacteria or bacterial toxins¹⁹. Riaz et al.,²⁰ stated that single-visit treatment has many advantages such as saving time, saves cost, better patient acceptance and less stress induction for anxious patients. Therefore single visit treatment has become a better option.

In the current study postoperative pain was measured for the first 48hrs as it is adequate for postoperative

pain evaluation since prevalence and severity of postoperative pain decrease within two days^{8,21}.

Xp endoshaper single file system was chosen in this study as it is a recent single file system that has low incidence and intensity for postoperative pain, with unique characteristics and features that allow this file to be superior to other files in the way it shapes the canal safely for the clinician and the patient¹¹.

Oneshape file system file (Micro Mega, Besancon, France) was chosen in this study as it is one of few rotary single file instruments used by many clinicians, for quick and safe root canal preparation^{4,22}. Many studies used Oneshape in comparison to different file systems regarding postoperative pain and the results varied some proved that it caused more postoperative pain and others stated the contrary^{7,21,23}.

Age has no effect on postoperative pain as discussed by many studies. Shabbir et al.,²⁴ found that there was no difference in postoperative endodontic pain intensity between different age groups. Gomes et al.,²⁵ also found that age wasn't a significant postoperative pain predictor. In the current study age in Xp endoshaper group showed significantly higher mean age value than Oneshape group.

Regarding gender there is no agreement in the literature about its role on postoperative pain incidence following endodontic treatment, with certain observations concluding that gender has no influence, the subjective component of the pain experience is probably the reason why gender varies among the different studies²⁶. It is controversial between many studies that tested the influence of gender on postoperative pain as there were always variations some proved that males had significantly higher pain

scores compared to females²⁴, others referred to females having higher postoperative pain levels²⁷. In the current study there was no significant difference between the two groups in regards to gender.

The tooth, curve and number of root canals, have not proved to have noteworthy contrasts in the flare-up rates as found by Alshehri et al²⁸. There is no significant correlation between the tooth type and the incidence of postoperative pain after endodontic treatment^{29,30}. Yadav et al.,⁵ found that there was no significant difference in the incidence of pain based on maxillary or mandibular teeth. It could be said that the influence of patient age, gender or tooth/arch group on flare-up occurrence to be of no significance⁶. In the current study there was no significant difference in tooth type distribution between the two groups.

There is a strong correlation found between preoperative pain and the incidence of postoperative pain²⁷, and the presence and severity of preoperative pain has a strong effect on the development of pain after endodontic intervention⁶. Patients with increased preoperative pain have a higher risk of experiencing postoperative pain²⁶. The core endodontic literature agreed that endodontic treatment significantly reduces preoperative pain proving that the approach used is effective in treating pain²⁵. Preoperative pain was high for both groups with no significant difference between the groups, both groups were comparable from the starting point to prevent preoperative pain being an unknown variable as in the current study the mean for the Xp endo shaper dropped from 6.87 preoperatively to 0.4 within the first 24hrs and for Oneshape the mean was 7.2 preoperatively and dropped to 2.47 within the first 24hrs, Pak et al.,³¹ stated that preoperative root canal pain prevalence started high and dropped moderately within 24hrs and considerably to minimal

levels within seven days, which is in agreement with the results of this study.

In the current study Xp endoshaper resulted in less postoperative pain than the Oneshape file. Some studies^{11,12,32} stated that XP endoshaper caused less postoperative pain when compared to other files, which is in agreement with the results of this study. Other study proved that Xp endoshaper caused higher postoperative pain intensity, Elsadat et al.,³³ found that Xp endoshaper had no statistically significant difference in pain scores when compared to another file except at 48hrs where Xp endoshaper resulted in higher postoperative pain, this is in disagreement with the results of the current study which could be due to the difference in selection of the tooth or the use of higher sodium hypochlorite concentration.

Neelakantan et al.,²¹ and Jain et al.,³⁴ found that Oneshape caused higher postoperative pain intensity which is in agreement with the results of this study. Other studies proved that Oneshape file can result in significantly lower postoperative pain levels, Eyuboglu et al.,²³ found that Oneshape caused significantly lower post endodontic pain which is in disagreement with the results of this study and could be due to using the file for retreatment of a previously treated tooth. Anous et al.,⁷ found that Oneshape file in the first 24hrs had lower pain scores, this is in disagreement with the study results and could be because Oneshape file was compared to a file with higher taper (8%) and another multiple file system which took a longer preparation time which could affect postoperative pain.

In the current study there was a significant reduction of pain intensity within the Xp endoshaper group and Oneshape group from 6hrs up to 24hrs then

from 24hrs to 48hrs there was no significant difference. Postoperative pain intensity showed a steady decrease over time in postoperative pain prevalence³¹. Severe postoperative pain was usually reduced to tolerable levels within 3 days³⁵ this agrees with the results of this study. Mean pain intensity in the Xp endoshaper group dropped to more than half from 6hrs interval (3.40) to 12hrs (1.27) and at 24hrs (0.4) it was at very mild level then remained constant to 48hrs (0.4). The mean pain intensity in the Oneshape group showed a steady decrease but slow which was (4.87) at 6hrs then reached almost half after 24hrs (2.47) then remained constant to 48hrs (2.47).

There was a difference in the apical size preparation by both files as Xp endoshaper reaches an apical size 30 while Oneshape reaches size 25, no clear evidence was available in the literature regarding the influence of apical size enlargement and postoperative pain, however Bamini et al.,²⁶ found in their study that larger preparations may influence postoperative pain incidence or duration. Adiguzel et al.,¹² reported that differences in sizes might affect the results of the study by causing different amounts of debris extrusion. Xp endoshaper has a taper of 4% and Oneshape has a taper of 6% which might have affected the results of the study. Several studies found that higher taper caused more aggressive cutting which led to larger amounts of debris extrusion which could result in higher postoperative pain levels^{22,34}. It was proved by Savadkouhi et al.,³⁶ that Xp endoshaper rotary system resulted in less debris extrusion than Oneshape system. Hazar et al.,³⁷ also found that debris extrusion was less when Xp endoshaper file was compared with files with higher taper.

5. Conclusion

Within the limitation of this study the following could be concluded:

- Group A (XP endoshaper) showed significantly lower postoperative pain level after 6hrs ($p = 0.003$), 12hrs ($p < 0.001$) 24hrs ($p < 0.001$) 48hrs ($p < 0.001$) than group B (Oneshape).
- Pain intensity in both groups showed a significant reduction from preoperative state at all-time intervals and a significant reduction of postoperative pain from 6hrs up to 24hrs then from 24hrs to 48hrs there was no significant difference but was slower in group B (Oneshape).
- Both systems were found to be effective in controlling postoperative pain. However, Xp endoshaper file system had less pain as compared to Oneshape system.
- Postoperative pain decreases to mild levels within 48hrs.

Clinical relevance

The results may help in reducing the postoperative pain after endodontic treatment.

Recommendation:

- Clinical trials with larger sample size could be used to confirm findings
- Further clinical trials are needed to compare the postoperative pain in vital against non-vital teeth, single-rooted versus multi-rooted teeth, incorporating all variables like age, sex, occlusal reduction, presence of

radiolucency, irrigation protocol and duration of time spent on root canal instrumentation.

Author's contribution:

Mohamed Abdelrahman Tammam managed the conceptualization, Methodology, Writing – Original draft, resources.

Alaa Elbaz managed the writing – reviewing, editing and main supervision.

Sherif El Khodary managed the writing – reviewing, editing and co-supervision.

Informed consent

Participants accepted an informed online consent to this survey contribution.

Conflict of interest:

The authors have declared no conflict of interest.

Funding

The research study was self funded by the authors.

Acknowledgement

The authors would like to thank Dr Mohammed Fawzy Habib , assistant lecturer department of endodontics, faculty of dentistry, October University for Modern Sciences and Arts

6. References

1. Saryılmaz E, Keskin C. Apical extrusion of debris and irrigant using XP-endo finisher, endoactivator, passive ultrasonic irrigation or syringe irrigation. *Meandros Medical and Dental Journal*. 2018;19(2):127–31.
2. Torabinejad M, Kettering JD, McGraw JC, Cummings RR, Dwyer TG, Tobias TS. Factors associated with endodontic interappointment emergencies of teeth with necrotic pulps. *Journal of endodontics*. 1988 Jan 1;14(5):261-6.

3. Alves FR, Paiva PL, Marceliano-Alves MF, Cabreira LJ, Lima KC, Siqueira Jr JF, Rôças IN, Provenzano JC. Bacteria and hard tissue debris extrusion and intracanal bacterial reduction promoted by XP-endo Shaper and Reciproc instruments. *Journal of Endodontics*. 2018 Jul 1;44(7):1173-8.
4. Gernhardt CR. One Shape—a single file NiTi system for root canal instrumentation used in continuous rotation. *Endodontic practice Today*. 2013 Sep 1;7(3).
5. Yadav B, Sharma D, Yadav A, Shekhawat VS, Sancheti P, Mathur R. Comparative evaluation of apical extrusion of debris using K-Files, Protaper Next, Oneshape, Waveone and Revos: an in vitro study. *Nat Res Dent*. 2021;2:28-35
6. Alamassi BY. Endodontic postoperative pain: etiology and related factors—an update. *International Journal of Dental Sciences and Research*. 2017 Mar 22;5(2):13-21.
7. Anous W, Al-Ashry S, Ali MM, Kataia MM. Incidence of postoperative pain after using different kinematic cutting motion in multiple versus single file concept. *Egyptian Dental Journal*. 2019 Jul 1;65(3-July (Fixed Prosthodontics, Dental Materials, Conservative Dentistry & Endodontics)):2769-77.
8. Cicek E, Koçak MM, Koçak S, Sağlam BC, Türker SA. Postoperative pain intensity after using different instrumentation techniques: a randomized clinical study. *Journal of Applied Oral Science*. 2017 Jan;25:20-6.
9. Gambarini G, Testarelli L, De Luca M, Milana V, Plotino G, Grande NM, Rubini AG, Al Sudani D, Sannino G. The influence of three different instrumentation techniques on the incidence of postoperative pain after endodontic treatment. *Annali di stomatologia*. 2013 Jan;4(1):152.
10. Kherlakian D, Cunha RS, Ehrhardt IC, Zuolo ML, Kishen A, da Silveira Bueno CE. Comparison of the incidence of postoperative pain after using 2 reciprocating systems and a continuous rotary system: a prospective randomized clinical trial. *Journal of Endodontics*. 2016 Feb 1;42(2):171-6.
11. Emara RS, Gawdat SI, El-Far HM. Effect of XP-endo Shaper versus conventional rotary files on postoperative pain and bacterial reduction in oval canals with necrotic pulps: a randomized clinical study. *International Endodontic Journal*. 2021 Jul;54(7):1026-36.
12. Adiguzel M, Tufenkci P. Comparison of postoperative pain intensity following the use of three different instrumentation techniques: A randomized clinical trial. *Journal of Dental Research, Dental Clinics, Dental Prospects*. 2019;13(2):133.
13. Bassam S, El-Ahmar R, Salloum S, Ayoub S. Endodontic postoperative flare-up: An update. *The Saudi dental journal*. 2021 Nov 1;33(7):386-94.
14. Jensen MP, Chen C, Brugger AM. Postsurgical pain outcome assessment. *Pain*. 2002 Sep 1;99(1-2):101-9.
15. Baumgartner JC, Cuenin PR. Efficacy of several concentrations of sodium hypochlorite for root canal irrigation. *Journal of endodontics*. 1992 Dec 1;18(12):605-12.
16. Rodrigues GS, da Silveira Bueno CE, De Martin AS, Fontana CE, Pinheiro SL, Pelegrine RA, Rocha DG. Evaluation of postoperative pain after endodontic treatment under irrigation with 2.5% or 5.25% Sodium Hypochlorite. *Research, Society and Development*. 2022 May 19;11(7):e16011729788-.
17. Camões IC, Freitas LF, Santiago CN, Gomes CC, de Menezes FV. Análise da concentração e do ph de diferentes marcas comerciais de hipoclorito de sódio. *Revista de Odontologia da Universidade Cidade de São Paulo*. 2012;24(1):15-8.
18. Xu H, Ye Z, Zhang A, Lin F, Fu J, Fok AS. Effects of concentration of sodium hypochlorite as an endodontic irrigant on the mechanical and structural properties of root dentine: A laboratory study. *International Endodontic Journal*. 2022 Oct;55(10):1091-102.
19. Mohammadi Z, Farhad A, Tabrizzadeh M. One-visit versus multiple-visit endodontic therapy—a review. *International dental journal*. 2006 Oct;56(5):289-93.
20. Riaz A, Maxood A, Abdullah S, Saba K, Din SU, Zahid S. Comparison of frequency of post-obturation pain of single versus multiple visit root canal treatment of necrotic teeth with infected root canals. A Randomized Controlled Trial. *JPM. The Journal of the Pakistan Medical Association*. 2018 Oct 1;68(10):1429-33.
21. 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;19:2211-7.
22. Arora N, Joshi SB. Comparative evaluation of postoperative pain after single visit endodontic treatment using ProTaper Universal and ProTaper Next rotary file systems: A randomized clinical trial. *Indian Journal of Health Sciences and Biomedical Research KLEU*. 2017 May 1;10(2):124-30.
23. Eyüboğlu TF, Özcan M. Postoperative pain intensity associated with the use of different nickel-titanium shaping systems during single-appointment endodontic retreatment: a randomized clinical trial. *Quintessence International*. 2019.
24. Shabbir J, Khurshid Z, Qazi F, Sarwar H, Afaq H, Salman S, Adanir N. Effect of different host-related factors on postoperative endodontic pain in necrotic teeth dressed with

- interappointment intracanal medicaments: a multicomparison study. *European Journal of Dentistry*. 2021 Jan 28;15(01):152-7.
25. Gomes MS, Böttcher DE, Scarparo RK, Morgental RD, Waltrick SB, Ghisi AC, Rahde NM, Borba MG, Blomberg LC, Figueiredo JA. Predicting pre-and postoperative pain of endodontic origin in a southern Brazilian subpopulation: an electronic database study. *International Endodontic Journal*. 2017 Aug;50(8):729-39.
 26. Bamini L, Sherwood A, Arias A, Subramani SK, Bhargavi P. Influence of tooth factors and procedural errors on the incidence and severity of post-endodontic pain: A prospective clinical study. *Dentistry Journal*. 2020 Jul 7;8(3):73.
 27. Shresha R, Shrestha D, Kayastha R. Post-operative pain and associated factors in patients undergoing single visit root canal treatment on teeth with vital pulp. *Kathmandu Univ Med J*. 2018;62(2):120-3.
 28. Alshehri AA, Alshraim RA, Dawood AA, Alhawsawi AS, Ibrahim MB, Almutairi AH, Alzaidy FA, Aldouweghri AA, Nur AA. Endodontic flare-ups: A study of incidence and related factors. *The Egyptian Journal of Hospital Medicine*. 2018 Jan 1;70(2):349-53.
 29. Onay EO, Ungor M, Yazici AC. The evaluation of endodontic flare-ups and their relationship to various risk factors. *BMC oral health*. 2015 Dec;15:1-5.
 30. Nair M, Rahul J, Devadathan A, Mathew J. Incidence of endodontic flare-ups and its related factors: A retrospective study. *Journal of International Society of Preventive & Community Dentistry*. 2017 Jul;7(4):175.
 31. 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.
 32. Al-Nahlawi T, Alabdullah A, Othman A, Sukkar R, Doumani M. Postendodontic pain in asymptomatic necrotic teeth prepared with different rotary instrumentation techniques. *Journal of Family Medicine and Primary Care*. 2020 Jul;9(7):3474.
 33. Elsadat M, Refai AS, Islam TM. Evaluation of postoperative pain after using XP-endo shaper and F-One blue files. *Al-Azhar Journal of Dental Science*. 2022 Apr 1;25(2):127-32.
 34. Jain N, Pawar A, Gupta A. Incidence and severity of postoperative pain after canal instrumentation with reciprocating system, continuous rotary single file system, versus SAF system. *Endod practice*. 2016 Sep 1;10:153-60.
 35. Genet JM, Wesselink PR, Van Velzen ST. The incidence of preoperative and postoperative pain in endodontic therapy. *International endodontic journal*. 1986 Sep;19(5):221-9.
 36. Savadkouhi S, Esnaashari E, SHahzaidi A, Fazlyab M, Moshari AA. Comparison of debris extrusion in XP-endo-Shaper and One-Shape rotary systems: In vitro study. *Res Dent Sci*. 2018 Jul 10;15(2):93-8.
 37. Hazar E, Özdemir O, Koçak MM, Sağlam BC, Koçak S. Apical debris extrusion of single-file systems in curved canals. *Endodontology*. 2021 Jul 1;33(3):128-32.