

Choice of Rotary Instrument Usage among Endodontists and General Practitioners—A Questionnaire Survey

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Abstract

Objectives: The aim of this article is to evaluate attitude among dental practitioners in Erbil/Iraq toward the use of hand and rotary endodontic instruments and to evaluate whether there is any relation regarding the preference in using a specific type of instrument with the level of specialization and clinical practice when performing root canal treatments (RCTs). **Materials and Methods:** It was a cross-sectional questionnaire study conducted in Erbil, Iraq. A total of 111 dentists participated in this study; data regarding the information about demographic details of dental professionals, years of experience, and number of RCTs done per week by dental professionals were obtained. The use of rotary and hand instruments by dental professionals was inquired. Procedural problems with rotary instruments faced by dental professionals and reasons for not using the rotary instruments if any were also recorded. The data were submitted to descriptive analysis, and associations were tested with χ^2 test and Fisher's exact test using SPSS software version 23. *P*-value was set as <0.05 . **Results:** Forty-four (39.6%) of the total study samples used both rotary and hand instruments, whereas 25 (22.5%) of them used only rotary instruments for RCTs. Dentists who were using rotary instruments are facing the procedural problems of file fracture [74 (66.7%)] and those dental professionals using hand instruments are facing the procedural problems of ledge formations [55 (49.5%)]. There was no significant relationship between using a specific type of instrument and the level of specializations ($P = 0.941$). **Conclusion:** In conclusion, the results of this study showed that dentists preferred using both rotary and hand endodontic instruments for RCTs with no significant relation with the level of specialization regarding using specific types of instruments, and dentists experienced some procedure errors regarding both types of instruments while using them for RCTs.

Keywords: Hand instruments, root canal treatments, rotary endodontic devices

INTRODUCTION

Root canal therapy is the procedure for the treatment of infected pulp tissue and removal of inflamed tissue, so as to prevent future invasion by microorganism.^[1] Pulp chamber and root canals are normally present within tooth structure that contains blood vessels, nerve tissue, and other cellular structures which are responsible for national and sensory innervations.^[2] Removal of these tissue structures when inflamed by a procedure is called root canal therapy, which involves adequate shaping and cleaning of root canals using files and subsequent obturations of these canals by a material called gutta-percha.^[3]

The aim of root canal treatment (RCT) is removal of inflamed pulp tissue within root canal systems by the procedure of cleaning and shaping of canals to prevent

future recontamination of these canals.^[4] Different systems and techniques have been developed for cleaning and shaping of root canals.^[5] Improvement in endodontic systems has allowed several numbers of severely damaged teeth to be saved around mid-twentieth century. Initial systems that used old type of stainless steel instruments were found to cause many procedural errors. Therefore, the introduction of new instruments made of nickel titanium has allowed us to develop rotary instrumentation, which has more resistance to clockwise

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Submission: 02-Oct-2021 **Accepted:** 23-Oct-2021 **Published:** 17-Dec-2021

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How to cite this article: Azeez SM. Choice of rotary instrument usage among endodontists and general practitioners—A questionnaire survey. Med J Babylon 2021;18:428-34.

Access this article online

Quick Response Code:



Website:
www.medjbabylon.org

DOI:
10.4103/MJBL.MJBL_80_21

torsional stress because nickel titanium is more flexible than the stainless steel hand files; the main advantage of these instruments is that they allow canal preparation with less procedural errors.^[6]

The benefit of biomechanical preparation is to shape the canals despite cleaning, because the more round the preparation of canals the much better the adaptation of root canal filling materials.^[7] Nickel-titanium (NiTi) engine-driven instruments are widely used nowadays, but the procedural error associated with these instruments made limitations such as file fracture associated with torsional stress.^[8] These instruments performed well if used according to the manufacturer's instructions and guidelines. Procedures involve their steps (NGP), initial canal negotiation (N), glide path creation (G), and canal preparation (P).^[9]

The application of engine-driven NiTi instruments for preparation of root-curved canals has been used by undergraduated students in the recent years. Therefore, the course books of undergraduated students should include updated scientific information about these instruments and how to use it and what are the limitations.^[10-13] Numerous studies have investigated the attitude of dentists in western countries such as Germany, UK,^[14] USA,^[15] and India.^[16] However, there is lack of such studies in Erbil, Iraq. An important method for knowing the attitude of dental professionals toward use of hand and rotary instruments is through providing a good questionnaire. The present study was designed to evaluate the preference of dentists for the instruments chosen to perform RCT and the association of both clinical experience and level of specialization on dentist's preference for using hand or rotary instrument.

Aims

The aim of this article is to evaluate the attitude among dental practitioners in Erbil/Iraq toward the use of hand and rotary endodontic instruments and whether there is any relation regarding the preference in using specific type of instrument with the level of specialization and clinical practice for performing RCTs.

Objectives

1. To assess the attitude of dental professionals toward the use of rotary instruments or hand instruments in RCTs;
2. To find out the most procedural problems when using both hand and rotary instruments faced by dental professionals;
3. Explain reasons for not using the rotary instrument;
4. To determine whether there is any relation between years of provisional experience and clinical practice time with the type of instrument used for RCT.

MATERIALS AND METHODS

It was a cross-sectional questionnaire study conducted in Erbil, Iraq. On 111 dentists in which, (N. 58) were general practitioners and (N. 53) were endodontics. The study was conducted in two months. Data was obtained through self-administered questioner among dental professionals in their private clinics. Every dental professional including bachelors and specialty in endodontic field were included. The following information was gathered: sociodemographic details of dental professionals and post-graduate training (none, specialization level, Master's, or PhD degree) dichotomized into none and specialist. Information regarding clinical experience (time since graduation) in years and categorized as less than 5 years (>5 years), 5–10 years, and more than 10 years (>10) were obtained; the number of RCTs done per week by dental professionals was also included. Use of rotary and hand instruments by dental professionals was inquired, and questions about the type of most procedure errors faced when using both hand and rotary instruments also included the following: ledge formation, file fracture, and transportations; the reason for not using rotary instruments by most dental professionals has been asked. The collected data did not allow any information to be included that could identify the dentists. An assisted self-administered questionnaire was conducted with each dentist working at the College of Dentistry. Information about the study and its importance were explained; the undergraduated students were excluded from this study. Data were submitted to descriptive analyses, and the existing association between levels of specialization and clinical experience time with the type of instrument used were assessed using the χ^2 and Fisher's exact tests. The analysis was carried out with SPSS software version 23. The level of significance was set as $P < 0.05$. The results were then calculated as absolute frequencies and valid percentages.

RESULTS

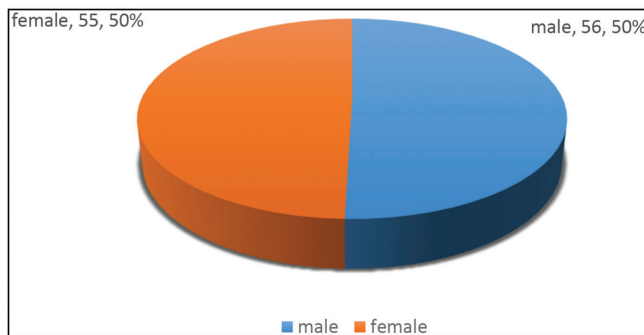
Table 1 shows that the mean age for the majority of dental practitioners who respond to the questionnaire was 32.8108 ± 6.75 .

The study samples had both male and female participants in close number. Out of the total 111 participants, 56 (50.5%) were males and 55 (49.5%) were females as shown by Chart 1. Most of the dental professionals who were included in the study were having only a bachelor degree in dental surgery [58 (52.3%)], whereas those who had either MSc or PhD were 53 (47.7%); the majority of them 64 (57.7%) having professional experience for about 5–10 years, as shown in Table 2.

In relation to Table 3, out of the 111 participants, only 4 (3.6%) of the dental professionals did not practice RCT in their private clinics in the recent years. While 107 (96.4%)

Table 1: Mean age of dental participants

Age	
Mean	32.8108
Median	31.0000
Std. deviation	6.75751


Chart 1: Pie chart showing the percentage of male and female dentists who participated in the study

of them were performing RCT, 78 (70.3%) of them do less than five (<5) RCTs per week. Table 4 shows that only 25 (22.5%) of the total study samples were using rotary instruments for RCT and 44 (39.6%) were using both rotary and hand instruments for RCT. Majority of the dentists who are using rotary instruments face the procedural problem of file fracture [74 (66.7%)], and those dental professionals who are using hand instruments are facing the problem of ledge formation [55 (49.5%)], as shown in Table 5. Table 6 shows that 47 (42.3%) of the dentists lack experience, which is a major factor for not using rotary instruments.

There was no significant association between level of specialization and type of instrument used ($P = 0.941$), which is more than 0.005. However, most of the general dentists who have only bachelor degree seem to use hand instruments, whereas 23 (54.8%) use rotary instruments for RCTs [13 (52.0%)]. Those who were specialists seem to use both hand [19 (45.2%)] and rotary [12 (48.0%)] instruments in close quantity to each other. Regarding the association between years of professional experiences and the type of instrument use, there was no significant relation between them ($P = 0.05$). Most of the dentists who have experience about 5–10 years seem to use hand instruments [31 (73.8%)] more than rotary instruments [11 (44.0%)], whereas those who had experience >10 years tend to use both types of instruments [hand 8 (19.0%) and rotary 6 (24.0%)] in close quantity to each other, as shown in Table 7.

DISCUSSION

For the success of endodontic treatment, appropriate cleaning and shaping of root canal system is mandatory

to eliminate microorganisms from root canal systems and adequate sealing is also necessary.^[17] The present severe fine-curved canals in root canal systems help achieve highest cleaning and shaping efficacy during preparation. Endodontic instruments and techniques undergo numerous modifications, which led to the development of NiTi engine-derived files that become popular in recent years due to their high flexibility and elasticity, which makes it efficient and safe for these canals.^[18,19]

The present study is undertaken to assess the attitude of dentists working in the Hawler Medical University/ College of Dentistry of Erbil, Iraq, toward the use of rotary and hand endodontic instruments for RCT. In the present study, 96.4% of the general dental practitioners (GDPs) practice RCT procedures. This findings were higher than a study in 2006 conducted by Che Ab Aziz *et al.*^[20] The reason behind this could be that the present study has been conducted in 2017 as new advancements had come in the endodontics and more number of dentists attend CDE (continue dental education) programs in endodontics.^[21] Also the present study shows that most of the dental professionals (57.7%) had professional experience between 5 and 10 years; this may be related to that our study sample mean age was 32.8 which is around middle age so it is in close relation with the year of professional experience.

A study was carried out by Raoof *et al.*^[22] in 2015 which gathered information on materials and methods employed in RCT by GDPs in Iran, in which most of the sample dental professionals (29.0%) had professional experience of more than 20 years. Another study by Malik *et al.*^[16] in 2016 assessed the attitude of GDPs toward use rotary instruments and hand instruments for RCT in India, where most of the dental professionals (51%) have experience in dental surgery of about 1–5 years. Most of dental professionals (39.6%) were using both hand and rotary endodontic instruments, and 37.8 of them using hand instruments, whereas the remaining 22.5% only using rotary instruments for RCTs.

From these results, we can understand that in recent years the attitude for using rotary instruments among dentists in Hawler Medical University/College of Dentistry of Erbil, Iraq becomes increased. The reason behind it may be related to the present study, which has been conducted in 2017 as new advancement had come in the endodontics and a greater number of dentists attend CDE, which made more attention on advanced technology.^[21] In addition, the development of NiTi engine-driven files is highly popular because they are efficient and safe, especially for preparation of fine-curved canals due to their high flexibility and elasticity.^[23,24]

However, from the present study, despite development of new advanced technologies and materials for RCT like engine-derived NiTi instruments and still dental

Table 2: Level of specialization and years of professional experience

		Number (N)	Percentage (%)
Level of specialization	General dentist	58	52.3
	Specialist	53	47.7
	Total	111	100.0
Years of professional experience	<5 years	21	18.9
	5–10 years	54	57.7
	>10 years	26	23.4
	Total	111	100.0

Table 3: Performing RCT and number of RCTs/week

		Number (N)	Percentage (%)
Performing RCT in your private clinic	Yes	107	96.4
	No	4	3.6
	Total	111	100.0
Number of RCTs done per week	<5	78	70.3

Table 4: Use of hand and rotary endodontic instruments in RCT by dental professionals

Type of instrument	Number (N)	Percentage (%)
Hand instruments	42	37.8
Rotary instruments	25	22.5
Both rotary and hand instruments	44	39.6
Total	111	100.0

professionals using hand instrument in relation to the rotary endodontic instruments, this may be due to that no single instrument system is capable of providing the ideal quality of canal preparation with respect to canal cleanliness, canal transportation, and canal shape.^[25]

Compared to Malik *et al.*,^[16] in 2016 study, 33% of dental professionals use rotary instruments and 35% of them use hand instruments and 32% of the respondents are using both types of instruments for RCTs. Meel *et al.*^[26] in 2016 carried out a study in India among GDPs, in which 75% of the respondents of general dentists used NiTi rotary instruments. Also our findings were consistent with some previous studies which showed 22% of general dentists and 64% of endodontics in an Australian study.^[5] In addition, approximately 70% of general dentists and almost 83% of endodontists in a study performed in UK.^[23,27] In addition, 77% of the Swedish general dentists who participated in an endodontic educational program have mentioned that they used NiTi rotary instruments.^[24]

In contrast to our findings, a study by Gaikwad *et al.*^[21] in 2013 showed that (71.2%) dentists in this survey tended to use hand instruments and were not inclined to use more advanced engine-driven techniques for shaping the root canal system, whereas only 12.6% were using rotary instruments. Also the Danish study showed that only 18% of the Copenhagen dentists often negotiated root canals

with hand NiTi instruments and 10% often used rotary NiTi instrumentation.^[28]

This may be attributed to the fact that most of the study samples were GDPs. Regrettably, dental practitioners despite various advantages offered by rotary endodontics select to use conventional hand files,^[29] due to lack of skill and specialization training and therefore less use of rotary instruments in these developing countries. So, there should be continuing dental education programs in endodontics with new advanced techniques.^[21]

The main procedural problems that dental professionals faced in this study were ledging of the canal by hand instruments and file fracture for the rotary instruments; this may relate to those main problems occurring during preparation of severely curved canals. Early systems using traditional stainless-steel instruments were found to produce technical errors; when stainless-steel files are used, there is increased affinity for each preparation procedure to make the prepared canal faraway from its original axis. Deviation from the original curvature can direct to practical errors such as zipping, stripping or perforations, ledge formation.^[30]

The introduction of instruments prepared of nickel-titanium has allowed the development of rotary instrumentation because nickel-titanium is two to three times more flexible than stainless steel and significantly more resistant to clockwise torsional stress. The main benefit to nickel-titanium instruments is that they allow canal preparation with less transportation and ledging. Literature review displays that engine-driven Ni-Ti instruments need less chair time to prepare the canal when compared with stainless steel files.^[6] But, despite advancement in the metal alloys and file designs, still parting of rotary instruments during endodontic treatment is a challenging, surplus, and boring complication. Mostly, fracture of endodontic

Table 5: Most procedural problems faced by dental practitioners by using hand and rotary dental instruments

	Hand instruments		Rotary instruments	
	No.	%	No.	%
Ledging of the canal	55	49.5	11	9.9
File fracture	20	18.0	74	66.7
Transportation of the canal terminus	22	19.8	18	16.2
None	14	12.6	8	7.2
Total	111	100.0	111	100.0

Table 6: Reasons for not using the rotary instruments by most of dental professionals

Reasons	Number (N)	Percentage (%)
Lack of experience with rotary instrument	47	42.3
Cannot offer to the purchase of the rotary instrument	40	36.0
Failure of cases in the past with rotary instruments	24	21.6
Total	111	100.0

Table 7: Association between levels of specialization and clinical practice time with the type of instrument use

		Type of instrument use						P-value
		Hand		Rotary		Both		
		No.	%	No.	%	No.	%	
Level of specialization	General dentists	23	54.8	13	52.0	22	50.0	0.941
	Specialist	19	95.2	12	48.0	22	50.0	
	Total	42	100.0	25	100.0	44	100.0	
Years of professional experience	<5 years	3	7.1	8	32.0	10	22.7	0.50
	5–10 years	31	73.8	11	44.0	22	50.0	
	>10 years	8	19.0	6	24.0	12	27.3	
Total		42	100.0	25	100.0	44	100.0	

file results from inaccurate use or overuse.^[31] Same results were obtained in a study performed by Khawaja *et al.*,^[29] in 2016 in which they evaluated that the incidence of instrument separation was greater in rotary systems when compared with conventional file systems in the sample. Even after the arrival of rotary Ni-Ti files, unfortunate increase in the departure of these instruments has been informed.^[32] According to the survey studies, operators identify file fracture as one of the most noticeable problems with Ni-Ti rotary instruments.^[33]

This finding indicated that rotary systems are more disposed to this type of procedural error. This can be related to cyclic fatigue practiced by rotary instruments, which is a problem not readily apparent upon repeated use of NiTi systems. In contrast, stainless steel files are more resilient to fracture and provide easily distinguishable signs (e.g., visible unwinding of flutes, tip distortion, roll-up of flutes, corrosion) prior to separation.^[34] Another study by Karunakar *et al.*,^[35] in 2015 investigated the opinions and attitudes of endodontists toward the intracanal separation of endodontic instruments, who attended a national conference in India. The majority of

respondents of this survey had experienced instrument separation when using Ni-Ti files (64.4%), whereas stainless steel files were 35.6%. Although Ni-Ti files were identified to show higher resistance to fracture than stainless steel files, with the results of the present study, it was considered that over practice, excessive pressure on file, difficult root canal anatomy, and incorrect insertion angle as the most common factors related to file fracture.^[5]

In addition, another study was concomitant with our findings carried out by Malik *et al.*,^[16] in 2016 in which they evaluated that the main procedural problem that a dentist faced with rotary instruments was breakage of file [70 (36%)] whereas with hand instruments it is ledge formation [82 (40%)]. Same results were seen in study by Mozayeni *et al.*, in 2011 in which file fracture was faced by 88.5% of dental professionals using rotary instruments and ledge formation with hand instruments.^[36]

We cannot decide the use of rotary file systems over their conventional corresponding item on the basis of procedural errors created, but it is undeniable that rotary systems are faster, more fitting, and relaxed

for the patient as well as the clinician. It is infrequent for conventional RCT to be completed in less than 3 visits, whereas if the conditions are satisfactory, rotary RCT can be completed within a single appointment. Therefore, our recommendation is that dentists should develop necessary skills to handle these systems more effectively to minimize the procedural errors.^[29] Also the present study showed that most of the causes (42.3%) for not using rotary endodontic instruments by dental practitioners was lack of experience regarding manipulation of rotary endodontic instruments for RCTs. The reason behind this hesitation might be attributed to lack of continuing training courses and the subsequent unfamiliarity of the GDPs with the tools, device accuracy, and high equipment prices. Most GDPs were using hand instrumentation and were not tending to use more advanced engine-driven techniques for shaping the root canals.^[22]

Similarly, practitioners in Jordan and Denmark tend to use hand instruments and are not motivated to use more advanced engine-driven techniques for shaping of the root canal system.^[36,37] In the present study, there was no significant association between using specific type of instrument for RCT and the level of specialization ($P = 0.941$), and there was no significant relation between years of professional experience and the type of endodontic instrument use ($P = 0.005$), in which most of the dental professionals who had experience about 5–10 years tend to use conventional hand instrument files (73.8%) more than using advance rotary endodontic files (44.0%), whereas those who had experience level less than 5 years tend to use rotary endodontic files (32.0%) more than conventional hand files (7.1%) for RCTs.

In general, according to the results of this study, we can say that the attitude of dental professionals toward use of both hand and rotary instruments is linked to the difficulty of each case and to the practitioner's skill and experience in which every type of instrument poses a challenge to every dentist.

This study had some limitations, as it was based on a self-applied questionnaire which did not allow for open-mind questions and also due to small study sample.

CONCLUSION

From the results of this study, we concluded that dental professionals in Erbil/Iraq are using rotary instruments and combination of hand and rotary instruments. The main procedural failure of the rotary instruments in RCT faced by dental professionals was file breakage and that of the hand instrument is ledge formation. Lack of expertise is the main reason which restricts dental professionals from using rotary instruments. This shows that more and

more program should be organized for them to improve their compliance.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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