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The use of rotary nickel–titanium endodontic instruments by Dental practitioner in Saudi Arabia - A cross sectional study

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ABSTRACT

The objective of the study was to determine the use of rotary nickel-titanium endodontic instruments by Dental practitioners in Saudi Arabia. A cross-sectional study conducted 650 dental practitioners. The result of the study revealed that a total of 180 (60%) of the respondents used rotary endodontic systems, while 90 (40%) did not. The male respondents (66.7%) were more likely to use rotary endodontics than females (55.3%). *Aim:* To evaluate the use of rotary nickel–titanium endodontic instruments by Dental practitioner in Saudi Arabia. *Material and Method:* A questionnaire contains 12 multiple-choice questions conducted online by SurveyMonkey.com. the target samples are undergrad students, dental interns, general practitioners, post grad and Endodontists. The study was done in central, northern, eastern, western and southern regions of Saudi Arabia. The survey was distributed in multiple universities, governmental hospitals, privet clinics and social media. *Result:* A total of 180 (60%) of the respondents used rotary endodontic systems while 90 (40%) did not. The male respondents (66.7%) were more likely to use rotary endodontics than females (55.3%). *Conclusion:* The majority of dentist at Saudi Arabia use rotary NiTi systems forendodontic procedures in their clinical practice.

Keywords: Rotary, nickel–titanium, endodontic, Saudi Arabia

1. INTRODUCTION

One of the most technically challenging procedures in dentistry is root canal treatment and the success depends on the correct diagnosis, instruments used and the technique used Endodontic treatment designed to maintain pulp healthy and intact (Patil, 2017). The treatment is aimed at preserving normal periradicular tissues When the pulp is diseased or injured. When pulpal diseases have spread to the periradicular tissues treatment is aimed at restoring them to health. This is usually achieved by root canal treatment (Jenkins, Hayes and Dummer, 2001). the main goals in endodontics are cleaning and shaping of the root canal system which can be using different systems and techniques (Parashos and Messer, 2004).Usually, stainless steel used in the manufacturing of thehand instruments for root canal shaping and it has lack flexibility with increasing sizes and can lead to procedural errors (Serene, Serene, Adams and Saxena, 1995). which lead to a decrease success rate for endodontic treatment (Torabinejad and Walton, n.d.) learning and comprehension of strategies and instruments utilized for cleaning and molding are fundamental. While root-canal instruments had been first made of carbon steel, tempered stainless steel instruments

(SSIs) were overwhelming for couple of decades because of their more prominent flexibility, which enabled more noteworthy protection from crack (Madarati and Habib, 2018). The application of new technologies continues to change the dynamics of endodontic practices. The rotary nickel–titanium endodontic instrument has increased two folds in the last two decades (PATIL, 2017). The preference and usage of nickel titanium rotary instruments are different from dentist to dentist based on their technique, experience and the clinical situation. Nickel titanium instruments have more advantage than other instrumentation technique which can reduce procedural errors. As compared to stainless steel, they are more flexible and have superior resistance to torsional fracture (Walia, Brantley and Gerstein, 1988; Iqbal, Kohli and Kim, 2006). As a super-flexible alloy, disfigurements of as much as 8% strain can be completely recoverable contrasted with under 1% with hardened steel (Thompson, 2000). Also, and unlike SSIs, which are manufactured by twisting, NiTi instruments are machined, which allows producing various instruments designs (Thompson, 2000). This with the super- versatility property are nearly the primary explanations behind utilizing the NiTi alloy generally in assembling endodontic instruments; particularly rotational instruments (RIs). Numerous investigations have detailed better execution of NiTi-RIs, in cleaning and molding of the root-canal framework, contrasted with SSIs (Thompson, 2000; Pettiette, Olutayodelano and Trope, 2001; Abu-Tahun, Al-Rababːah, Hammad and Khraisat, 2014). Anyway there are sure impediments worried about rotary instruments, for example, cost and instrument crack (Patturaja, Leelavathi and S., 2020). Various brands of turning instruments are accessible in market and as of now utilized by endodontists which incorporates k3, Mtwo, heroshaper, protaper, endostar, HyFlex, and so on (Patturaja, Leelavathi and S., 2020).

2. MATERIALS AND METHODS

A cross-sectional study was collected by using an electronic copy, and a consent form was provided on the first page of the questionnaire by SurveyMonkey.com. Ethical approval was obtained from the institutional review board committee at Riyadh Elm University, (RC/IRB/ 2019/140) priorto the study. The duration of this study lasted for three months from June to August 2019. The sample size was 650(270 male, 380 females), the questionnaire consists of 12 multiple-choices using a self-administered close-ended

questionnaire. The questionnaire consisted of the following sections: First, demographic data including gender, professional status, place of work, year of graduation, and the region. Second, the incidence of file fracture and time-consuming; Third, the prevalence of using Nickle-titanium rotary instruments, obstruction/barriers to the use of rotary endodontic instruments, Procedural problems experienced, methods of increasing the safety of the rotary instruments. The online-based surveys were distributed thorough Saudi endodontic society members, Saudi commission for health specialties, governmental hospitals, privet clinics, faculty members of the restorative department, and postgrad and undergrad students in Governmental and private universities by their official emails, and social media platforms. Target subjects based on the inclusion criteria were undergrad students, dental interns, general practitioners, postgrads, and Endodontists in Saudi Arabia. Finally, the data received were transferred in an Excel sheetthen analyzed by using IBM statistical package for the social sciences software, version 22.0 (SPSS). Chi-square test was used to assess the relationship between using NiTi rotary system with gender, professional status, region, place of work, and year of graduation.

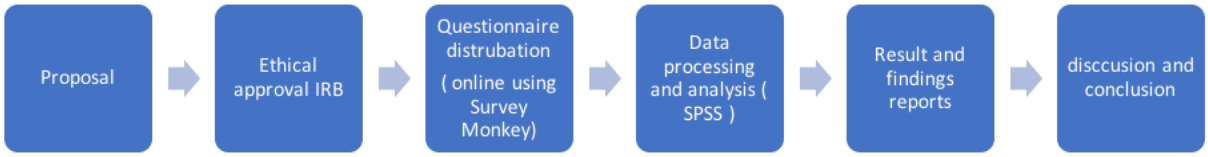

Figure 1: Flow chat for methodology of the study

3. RESULTS

The sample comprised of 650 respondents (270 male, 380 females). A total of 180 (60%) of the respondents used rotary endodontic systems while 90 (40%) did not. The male respondents (66.7%) were more likely to use rotary endodontics than females (55.3%). The Chi Square test found the difference to be statistically significant (Chi Square = 8.553, p=0.003). When the reasons for not using rotary endodontics were measured it was observed that lack of availability was the most commonly cited reason for not using rotary endodontics followed by a lack of education on the topic. Only 11 respondents felt that there was no perceived advantage to using rotary endodontic instruments.

A binary logistic regression model with the use of rotary endodontics as the dependent variable was created. The age, year of graduation, clinical rank, region and place of work were used as the cofactors for the model. The model showed that academic rank and place of work had a significant impact on whether the respondents used rotary endodontics or not. The gender, year of graduation and region where they practiced had no significant association with the use of rotary endodontic instruments (table 3).

Table 1: Demographic Profile of the population

		Gender						Chi Square	Sig
		Male		Female		Total			
		Count	%	Count	%	Count	%		
Category	Student	71	26.3%	149	39.2%	220	33.8%	37.774	<0.001
	Intern	47	17.4%	103	27.1%	150	23.1%		
	GP	59	21.9%	62	16.3%	121	18.6%		
	Post Grad	37	13.7%	34	8.9%	71	10.9%		
	Endodontist	56	20.7%	32	8.4%	88	13.5%		
Region	Eastern Region	15	5.6%	40	10.5%	55	8.5%	8.082	0.089
	Northern Region	13	4.8%	23	6.1%	36	5.5%		
	Western Region	29	10.7%	39	10.3%	68	10.5%		
	Central Region	198	73.3%	267	70.3%	465	71.5%		
	Southern Region	15	5.6%	11	2.9%	26	4.0%		
Year of Graduation	1960-1980	3	1.1%	3	0.8%	6	0.9%	12.363	0.015
	1981-1991	8	3.0%	13	3.4%	21	3.2%		

	1992-2001	22	8.1%	28	7.4%	50	7.7%		
	2002-2019	178	65.9%	206	54.2%	384	59.1%		
	Not yet graduated	59	21.9%	130	34.2%	189	29.1%		
Place of Work	Government Clinic	94	34.8%	69	18.2%	163	25.1%	36.254	<0.001
	Private Clinic	46	17.0%	40	10.5%	86	13.2%		
	University (College)	130	48.1%	271	71.3%	401	61.7%		

Table 2: Perceptions of File Fracture and Time Consumption using Rotary Endodontics

		Count	N %
Incidence of file fracture NiTi rotary instrumentation over the hand instruments?	Ni-Ti less prone	173	44.2%
	Ni-Ti more prone	133	34.0%
	There is no difference	39	10.0%
	Don't Know	46	11.8%
Time Consumption	Rotary is more time consuming'	63	15.8%
	Rotary is less time consuming	322	80.7%
	There is no difference	14	3.5%

Table 3: Binary Logistic Regression model showing the association of different variables on the use of rotary endodontic instruments

Variables in the Equation							
		B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Step 1[a]	Gender	-.178	.189	.884	1	.347	.837
	Clinical Rank	1.020	.124	67.615	1	.000	2.772
	Region	.017	.090	.034	1	.854	1.017
	Year of Graduation	.235	.127	3.411	1	.065	1.265
	Place of Work	.496	.156	10.107	1	.001	1.642
	Constant	-3.406	.848	16.125	1	.000	.033
a. Variable(s) entered on step 1: Gender, Category, Region, year, Place of work.							

Table 4: Procedural Problems Experienced

Valid	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Instrument fracture	173	26.6	44.5	44.5
Ledging of the Canal	93	14.3	23.9	68.4
Perforation	32	4.9	8.2	76.6
Others	91	14.0	23.4	100.0
Total	389	59.8	100.0	
Missing System	261	40.2		
Total	650	100.0		

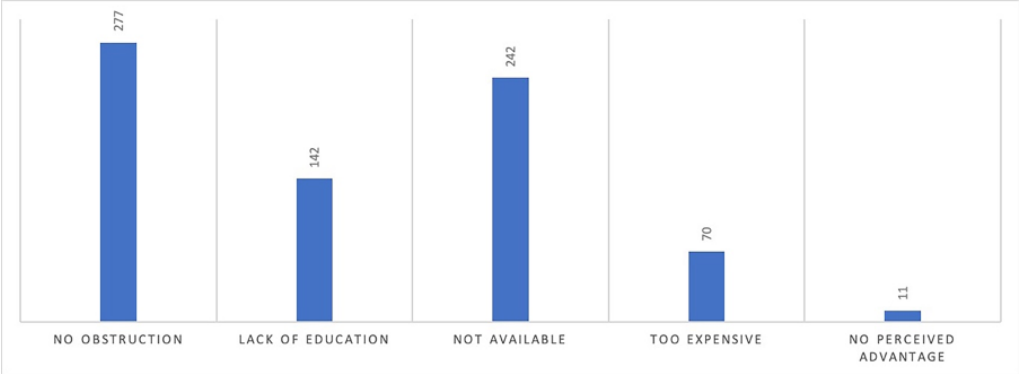

Figure 2: Obstruction/barriers to the use of rotary endodontic instruments

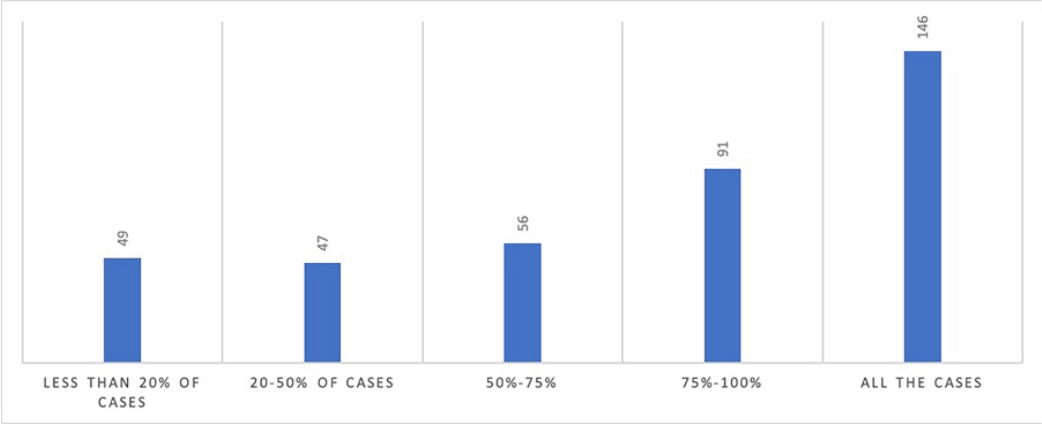

Figure 3: Use of Rotary endodontics (n=389) (those who do not use rotary are excluded from the graph)

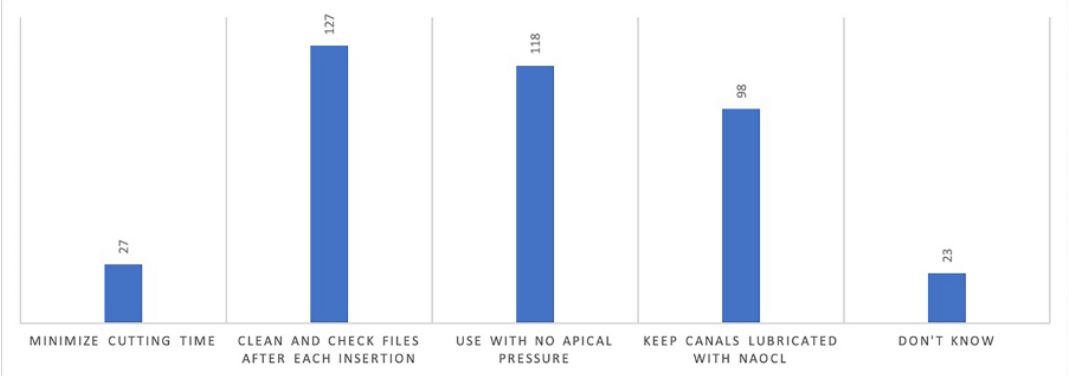

Figure 4: Methods of increasing the safety of the rotary instruments.

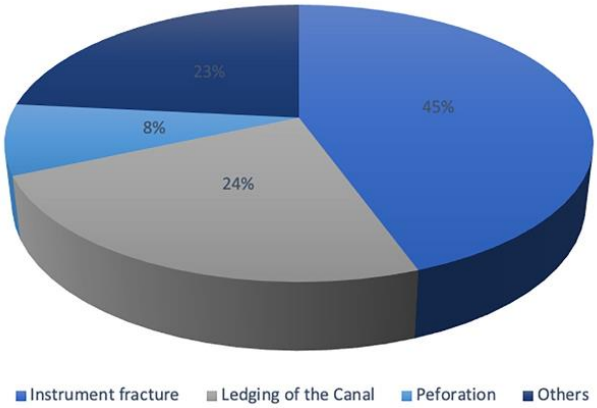

Figure 5: Type of problems encountered with rotary endodontic instrument

4. DISCUSSION

This survey was conducted with an intention to collect data from dental practitioner in Saudi Arabia regarding the usage of rotary NiTi endodontic instruments. Although such survey data are available from other countries.

The results of this study showed that 650 sample respondents consist of 13.5% Endodontist, 10.9% Post graduate, 18.6% General practitioner, 23.1% intern and most of them student that represent 33.8%, most of them from central region (71.5%), in comparing with previous study in Tehran their respondents sample was 147 consist of 42.2% of Endodontists and 57.8% of General Dentists (Mozayeni, Golshah and Kerdar, 2011). While at College of Dentistry, Taibah University, the respondents sample was 395, 66.8% General Dentists, 24.6% Endodontists, 3% were students or residents in endodontic postgraduate programs, and 5.6% were others (Madarati and Habib, 2018).

Total of (60%) of the respondents used rotary endodontic systems while (40%) did not. The male respondents (66.7%) were more likely to use rotary endodontics Than females (55.3%), in Tehran the overall response rate of73.5%, 95 (64.6%) were male and 52 (35.4%)were female (Mozayeni, Golshah and Kerdar, 2011).

The reasons for not using rotary endodontics were measured; it was observed that lack of availability was the most commonly cited reason 37.3%, followed by a lack of education 21.8%. Only 1.6% respondents felt that there was no perceived advantage to using rotary endodontic instruments, while in Australia study the main reason was lack of education and training 12%, also on Tehran the most important reason for not using NiTi instruments seems to be lack of education (Parashos and Messer, 2004).

We asked about the use of rotary files in their endodontic cases (those who do not use it are excluded from the study) 22.5% of dentists are using the rotary NiTi systems in all of their cases, 14.0% use it in 75 – 100% of cases and 7.5% use it in less than 20% of cases.

According to the methods of increasing the safety of rotary instruments, majority of dentists 19.5% clean and check files after each insertion, 18.2% use it with no apical pressure and 15.5% are keeping the canals lubricated with NaOCl, only 4.2% are minimizing the cutting time, regarding the Indian study it is recommended that NiTi rotary instruments be discarded after a single use and the use of adequate irrigant and lubrication with the file system (Patil, 2017).

In accordance with previous reports that demonstrate as type of problem encountered with rotary instrument in Tehran the file fracture 88.5% and in our study 44.5%, Ledging formation demonstrate 68.4% similar in Tehran and Saudi Arabia, according to our result the most common producer accident is perforation 77.6% (Mozayeni, Golshah and Kerdar, 2011).

According to Incidence of file fracture NiTi rotary instrumentation over the hand instruments, majority of dentists 44.2% Ni-Ti is less prone to fracture, 34.0% Ni-Ti is more prone, 10.0% There is no difference and 11.8% Of them, they don't know. The results of our study showed that the time consuming of NiTi rotary instrumentation over the hand instruments, majority of dentists Rotary 80.7% has less time consuming, 15.8% of dentists has more time consuming in NiTi rotary instrumentation, and only 3.5% has no difference

The results of this study showed that 650 sample respondents consist of 5.5% Northern Region, 4.0% Southern Region ,10.5% Western Region, 8.5% Eastern Region, and most of them from central region (71.5%).

The results of our study showed that Year of Graduation consist of 29.1% Not yet graduated, (0.9%) 1960-1980, (3.2%) 1981-1991, (7.7%) 1992-2001, and most of them from 2002-2019 (59.1%). The previous study in Australia showed that Year of Graduation consist of (0.05%) 1946-1950, (2.5%) 1951-1960, (13%) 1961-1970, (32%) 1981--1990, (19%) 1991- 2000 and most of them from 1971-1980 (32%). According to place of work, majority of dentists are 61.7% in University (College), 25.1% in Government Clinic, and 13.2% of them in Private Clinic. The previous study in Taibah showed that Place of Work consists (8.1%) Academic (38.2%) Government and most of them in Private (57.6%), (Madarati and Habib, 2018).

5. CONCLUSION

It can be concluded from the study that majority of dentist use rotary NiTi systems for endodontic procedures in their clinical practice. The most common Procedural Problems experienced is Instrument fracture. Rotary NiTi systems are relatively well adopted in Saudi dental practice. However, better education, training and lower cost can increase their usage.

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Conflict of interest

Authors reveal no conflict of interest.

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Author Contributions
AA[1], AA[2], NA: conception and design, and acquisition of data.
AA[3], MA[2], SA, AA[4]: drafting the article and revising it critically for important intellectual content.MA[1] give final approval of the version to be submitted and any revised version.

Informed consent
Written informed consent was obtained from all individual participants included in the study.

Ethical approval
The research protocols used in this research were approved by the ethics committee of Riyadh Elm University IRB (RC/IRB/2019/140)

Data and materials availability
All data associated with this study are present in the paper and/or the Supplementary Materials.

Abbreviations
NiTi - Nickel–titanium
SSIs - Stainless steel instruments
(RIs)- Rotational instruments
NiTi- Nickel–titanium rotational instruments
SPSS - Statistical package for the social sciences software

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