Adoption of Endodontic Rotary Nickel-Titanium Instrumentation by Nigerian Dental Practitioners.

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ABSTRACT

Objectives: The aim of this study was to assess the knowledge Nigerian Dental Practitioners (across different cadres) have of rotary endodontics, to investigate the adoption of Nickel-Titanium (NiTi) rotary instrumentation among specialists and other dental practitioners and to determine the factors associated with avoidance of this adoption.

Methods: This study was conducted through the distribution of structured self-administered questionnaires to randomly selected dental surgeons and endodontists in Nigerian government institutions and private practices. Chi-square, Fisher's exact tests and Logistic regression analysis were used to examine differences between groups. Statistical significance level was set at $p \leq 0.05$.

Results: A total of 240 dental practitioners were surveyed in this study. Only 55 (28.6%) of the respondents had previously used a rotary endodontic system. The most cited reason for not using NiTi rotary instrumentation for root canal preparation among the respondents was unavailability of endomotor and NiTi rotary files 9(96;70.1%) followed by inadequate knowledge about the rotary endodontic practice (37;27.0%). Consultants (OR =5.051; CI =1.431-45.811) and those that had practiced dentistry for >10 years (OR =4.255; CI= 0.849-21.323) were significantly more likely to use and to have good knowledge about rotary endodontics than other respondents. (p< 0.05)

Conclusion: Our study revealed a low rate of adoption of NiTi rotary endodontic technology among dental surgeons in Nigeria and the most commonly cited reason for this was cost of armamentarium as well as inadequate exposure to hands-on-training. A concerted effort is required to improve the uptake and utilization of this technology in our environment.

Key Words: Knowledge; Adoption; Dental practitioners; NiTi; Rotary-Endodontics

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INTRODUCTION

Endodontics is one of the leading specialties in Dental Surgery and it is steadily evolving with the introduction of several instruments, materials and techniques.[1,2] The development of nickel-titanium (NiTi) rotary instruments has undeniably led to a progressive advancement in the endodontic field ranging from the metallurgical properties of NiTi alloy to the introduction of M-wire technology. There has also been a steady evolution of the NiTi rotary file system (as regards the file design and advancing from multiple rotary file system to single file system), instrumentation kinematics, the different motor system and incorporation of apex locator.[3]

Root canal treatment is one of the most complex, methodological, technical and demanding dental

procedures.[1,4-7] It's success largely depends on the accurate pre-operative evaluation (e.g. root canal morphology, size of periapical radiolucency), appropriate diagnosis, the severity of the pulpal or dento-alveolar infection (acute or chronic, microbial pathogens and toxins), proper case selection, type of instruments and the technologies adopted as well as time frame of the treatment.[1,4,5] It is worth noting that success of root canal treatment is also largely dependent on operator skill, experience and attitude just as much as the other prognostic factors or variables stated above.[1] These operator factors may be more crucial causes of endodontic failure than the directly related microbial causes.[1]

Adequate elimination of the infected or necrotic pulp tissue, the causative bacteria and its toxins from the complex root canal system during the canal preparation stage is the most essential step and the main goal for a successful root canal treatment.[4,8] Root canal preparation can be performed using different systems (different hand-held files or rotary files driven by motor system) and different techniques- varying from manual step-back, manual crown-down to rotary crown-down techniques in accordance to the treatment protocol and instructions by the manufacturer.[3,9,10]

In order to achieve satisfactory elimination of the infected pulp contents from the root canal, stainless steel hand files were traditionally used. However, these hand-held canal shaping instruments lack flexibility with increasing sizes and their use often lead to procedural errors resulting in increased cases of endodontic treatment failure.[11,12] The introduction of NiTi alloys in 1988 into endodontics has helped overcome the setback of stainless steel due to its superelastic properties.[13] Since the application of these NiTi rotary files in canal instrumentation, there has been continuous improvement and the steady advancement of the file design and mechanics which has led to improved cutting efficiency with reduced procedural errors. The excellent superelasticity property of NiTi rotary files has facilitated more efficient negotiation and instrumentation of narrow and curved canals with the use of torque motor-driven handpieces at a controlled speed. These developments have led to rotary instrumentation progressively and rapidly gaining popularity among clinicians in endodontic practice.[10,11]

The several reported advantages of NiTi rotary instrumentation over manual instrumentation in literature are: reduced debris extrusion, reduced incidence of procedural errors, superior shaping ability, easier obturation, time efficacy, reduced flare-up rate, easier performance and improved outcome of re-treatment cases, and a better treatment outcome/ higher success rate.[14-22] However, there have been a few reported disadvantages of the use of rotary instrument such as the high cost and fracture susceptibility.[10,23,24] Some studies have reported that factors such as practitioner's experience, preparation technique, and overuse have been related to file fracture.[25-27]

Since this modern approach to canal instrumentation has proven to be time saving and have better cleaning ability with reduced debris extrusion resulting in better clinical outcomes, it is important that clinicians adopt this constantly evolving endodontic treatment approach to ensure an increased chance of success following treatment and better productivity in clinical practice.

The use of these NiTi rotary systems demands a thorough knowledge and previous training prior to their use.[2] It is therefore important to update clinicians on the recent endodontic technologies that will improve efficiency of procedures, comfort of patients and the success rate of treatment.[2]

There is a need for African studies to contribute to the existing literature and no information is available regarding the new endodontic concepts and the adoption of nickel titanium rotary instrumentation by dental practitioners and specialists in Nigeria. There is also a general dearth of research data on knowledge, attitude, and practice regarding the use of endodontic rotary instruments amongst dental practitioners.[1,7,10] Therefore, the aim of this study was to (i) assess the knowledge different cadres of dental practitioners have of rotary endodontics, (ii) investigate the adoption of NiTi rotary instrumentation among specialists and other cadres of dental practitioners and (iii) determine the factors associated with uptake or avoidance of its adoption.

MATERIALS AND METHODS

This descriptive, cross-sectional study was reviewed by the institutional ethics committee of the Lagos University Teaching Hospital and ethical approval was obtained before commencement of the study. The study was conducted in full accordance with ethical principles including the World Medical Association Declaration of Helsinki (version 2008).

The inclusion criteria for the participants included being a house officer, dental officer/ general dental practitioner who perform root canal treatment procedure on a routine basis), junior registrar, senior registrar (Specialist in Training in Endodontics) and

Specialist Endodontist. Dental students, dentists who do not routinely perform endodontic procedures, Specialists in training and Specialists in other fields like Orthodontics, Periodontics, Oral medicine or Oral and maxillofacial surgery and also dentists who did not consent to participate in the study were excluded from the study.

A pilot study was carried out among 25 dental practitioners across the different cadres- house officers, dental officers, specialists in training (junior and senior resident doctors) and specialists in a tertiary health institution (who were not included in the final study) to test the clarity of the previously validated questionnaire used for this study.

A simple random sampling procedure was used in the selection of six tertiary hospitals representing the six geopolitical zones of the country. The well-structured self-administered questionnaires, with many multiple options and with every question indicated as mandatory, were randomly distributed to willing participants (house officers, dental officers, specialists in training and endodontists in the selected Nigerian tertiary hospitals- Lagos University Teaching Hospital, University of Benin Teaching Hospital, University of Nigeria Teaching Hospital, Aminu Kano Teaching Hospital, University of Maiduguri Teaching Hospital and National Hospital) who gave their written consent after the investigator had explained the purpose of the study. The designed questionnaire consisting of 32 questions began with an introductory explanation of the purpose of the study and emphasized the anonymity of each participant. Socio-demographic and professional characteristics of the practitioners was collected. The study participants answered questions on their knowledge of rotary instrumentation. They were also assessed on their attitude and practice of this modern approach to endodontic treatment. The barriers to adopting the practice of rotary endodontic treatment amongst these practitioners were also investigated.

Following data collation, statistical analysis was performed using the IBM SPSS Statistics 22.0 (IBM Corp., Armonk, NY: IBM Corp. USA). Frequency distribution tables and cross tabulations were generated for all inputs provided by participants. The skewed nature of quantitative variables was first ascertained using the Kolmogrov-Smirov test. Descriptive statistics was generated, thereafter, Chi-square and Fisher's exact tests were used to examine differences between groups. Logistic regression analysis was used to confirm significant effect of several variables on NiTi rotary usage differences between endodontists and general dental practitioners. Differences at 5% level was accepted as significant.

RESULTS

A total of 240 dental practitioners were surveyed in this study and 214 questionnaires were returned properly filled giving a response rate of 89.2%. The highest proportion of the respondents belonged to the 31-40 years age group, 105 (49.1%); were house officers, 71 (33.2%) and had been in dental practice for ≤5 years 81 (41.6%). Only 55 (28.6%) of the respondents had previously used a rotary endodontic system. Their major source of information about the rotary endodontic system was didactic lectures, 119 (55.6%) (Table 1).

Table 3 shows the most cited reason for not using rotary endodontics among the respondents was unavailability of endomotor/handpiece, 96 (70.1%), followed by inadequate knowledge about its 37 (27.0%). Out of the 55 respondents that had used it before, 24 (43.6%) respondents used the conventional slow speed hand piece to power the rotary files. Of the 55 respondents that had used rotary files before, the reciprocating file system was the most common type used, 31 (56.4%). Only 20 (36.4%) of the respondents that had used rotary files in practice make single use of these files and 27 (49.1%) discard the rotary files when there is a decrease in the cutting efficiency. Only 10 (28.6%) of participants keep paper inventory on the number of times the files are re-used

On the scope of use of rotary instrumentation, table 2 revealed that 173 (90.1%) respondents knew that it could be used for canal preparation while 43 (22.4%) stated that it could be used for re-treatment. Over 60% identified all the components of the system rightly while 59.9% stated that the crown down technique is the preparation technique adopted during rotary instrumentation

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Table 1: Socio-demographic characteristics of respondents and sources of information about rotary endodontics

Variable	Frequency (n=214)	Percentage
Age group (years)		
21-30	89	41.6
31-40	105	49.1
>40	20	9.3
Gender		
Female	110	51.4
Male	104	48.6
Ethnic group		
Yoruba	136	63.6
Igbo	38	17.7
Hausa	11	5.1
Others	29	13.6
Dental qualification		
House officer	71	33.2
Dental officer	27	12.6
Resident	66	30.9
Senior resident	36	16.8
Consultant	14	6.5
Years of practice		
≤5	89	41.6
6-10	78	36.4
>10	47	22.0
Source of information about rotary endodontics (Multiple responses)		
Lecture	119	55.6
Seminars	76	35.5
Training workshops	52	24.3
Media	23	10.7
Products distributors	11	5.1
Never heard about it	22	10.3
Previous use of a rotary endodontic system		
Yes	55	25.7
No	159	74.3

Table 2: Knowledge about the components and technique of rotary instrumentation

Variable	Frequency (n=192)	Percentage
Scope of use of rotary instrumentation (Multiple responses)		
Canal preparation	173	90.1
To remove/ retrieve broken instrument	64	33.3
Widens the canal	59	30.7
Canal retreatment	43	22.4
Obturation	18	9.4
Don't know	2	1.0
Components of the rotary system (Multiple responses)		
Motor	117	60.9
Headpiece	152	79.2
Rotary files	166	86.5
Irrigant connector	17	8.9
Materials rotary instrument are made from		
Ni-Ti alloy	151	78.6
Stainless steel	9	4.7
Don't know	32	16.7
What is required to power the rotary headpieces		
Motor system	121	63.0
Headpiece	14	7.3
Compressor	49	25.5
Don't know	8	4.5
What drives the rotary file?		
Motor system	109	56.8
Headpiece	59	30.7
Compressor	21	10.9
Don't know	3	1.6
Preparation technique that should be adopted during rotary instrumentation		
Crown down technique	115	59.9
Hybrid preparation technique	19	9.9
Sequential manner	18	9.4
Step back	18	9.4
Don't know	22	11.5

Table 3: Patterns of usage and barriers encountered in the use of rotary endodontic systems

Variable	Frequency	Percentage
Reasons for non-usage of rotary instrumentation in practice (n=159)		
Expensive rotary equipment/ files	16	10.1
Unavailability of endomotor/rotary files	96	60.4
Lack of continuous supply of the rotary files to restock	7	4.4
Inadequate knowledge of rotary endodontics	37	23.3
No workshop or training in this specialty	20	12.6
Lack of confidence to commence the practice	3	1.9
Types of rotary file system ever used (n=55)		
Continuous file system	19	34.5
Reciprocating file system	31	56.4
Self-adjusting file system	5	9.1
Use of conventional slow speed headpiece to drive rotary files (n=55)		
Yes	24	43.6
No	31	56.4
Frequency of re-use of rotary files (n=55)		
Single usage	20	36.4
Twice	14	25.5
3-5 times	12	21.8
6-10 times	8	14.5
>10 times	1	1.8
When should rotary files be discarded n=55 (Multiple responses)		
After decrease in the cutting efficiency	27	49.1
After a single use	20	36.4
After several repeated use	12	21.8
After the file separation	4	7.3
After using in curved canal	4	7.3
How respondents keep inventory on the number of times the files are re-used n=35		
Marking on the files	3	8.6
Recording on paper	10	28.6
Others	22	62.8

Table 4 shows that 124 (64.6%) of respondents cited better cleaning efficiency as the main advantage of using rotary instrumentation over hand instrumentation. This was followed by a decrease in

procedural errors, 95 (49.5%). However, the cost of armamentarium was the most observed disadvantage, 130 (67.7%). A higher proportion of the respondents did not know any advantage of using reciprocating file system over continuous rotary file system 53 (27.6%) while 40 (20.8%) opined that reduced incidence of file separation was the advantage of using self-adjusting file system over the other type of rotary file system

Overall, 98 (45.8%) of respondents had good knowledge about rotary endodontics while 116 (54.2%) had poor knowledge.

Table 4: Assessment of knowledge about rotary instrumentation and procedure

Variable	Frequency (n=192)	Percentage
Advantages of using rotary instrumentation over hand instrumentation (Multiple responses)		
Maintaining the canal anatomy and curvature better	86	44.8
Better cleaning efficiency	124	64.6
Decrease in procedural errors	95	49.5
Time saving	142	74.0
Ease of use	100	52.1
Maintain working length	47	24.5
Easier canal obturation	61	31.8
More affordable	14	7.3
Less file fracture	55	28.6
Disadvantages of using rotary instrumentation compared to hand instrumentation (Multiple responses)		
Ledging of the canal	30	15.6
Transportation	14	7.3
Strip perforation	31	16.1
Straightening of the canal	21	10.9
Binding/locking of the file in the canal wall	21	10.9
File separation	25	13.0
Excessive dentine removal	53	27.6
Expensive	130	67.7
Advantage of using reciprocating file system over continuous rotary file system (Multiple responses)		
Reciprocating motion	43	22.4
Single file compare multiple file sequence	21	10.9
Time factor	27	14.1
Reduce incidence of file sequence	24	12.5
Does not require glide path	16	8.3
Others	1	0.5
Not sure of any advantage	53	27.6
Advantage of using self-adjusting file system over the other types of rotary file systems (Multiple responses)		
Continuous irrigation	39	20.3
Time factor	18	9.4
Reduce incidence of file separation	40	20.8
Better cleaning and shaping	38	19.8
Canal anatomy is preserved	36	18.8
Cost	11	5.7
Suitable for one circular canal	11	5.7
No obvious advantage over the other types of rotary files	16	8.3

Bivariate analysis of the relationship between socio-demographic characteristics and awareness as well as usage of rotary endodontics in table 5 revealed that respondents >40 years of age, senior registrars/ consultants and those that had practiced dentistry for >10 years were significantly more likely to be aware about rotary endodontics (p<0.001). Bivariate analysis of the relationship between socio-demographic characteristics and knowledge of rotary endodontics in table 6 revealed that respondents >40 years of age, senior registrars/ consultants and those that had practiced dentistry for >10 years were significantly more likely to have good knowledge about rotary endodontics. (p<0.001). Table 7 shows the independent predictors of awareness and usage of rotary file system among respondents. Logistic regression analysis of explanatory variables that showed statistical significance during bivariate analysis were introduced with awareness and usage of rotary file system among respondents as dependent variables revealed that consultants (OR =5.893; CI =1.431-22.110) and those that had practiced dentistry for >10 years (OR =2.701; CI= 1.301-9.441) were significantly more aware of rotary endodontics than other respondents. Similarly, consultants (OR =5.051; CI =1.431-45.811) and those that had practiced dentistry for >10 years (OR =4.255; CI= 0.849-21.323) were significantly more likely to use rotary endodontics than other respondents.

Table 5: Bivariate relationship between socio-demographic characteristics and awareness about and usage of rotary endodontics

Variable	Yes	No	χ^2	p-value
AWARENESS OF ROTARY ENDODONTICS (n=192)				
Age group (years)			29.304	**<0.001***
21-30	68(76.4)	21(23.6)		
31-40	104(99.0)	1(1.0)		
>40	20(100.0)	0(0.0)		
Dental qualification			32.375	**<0.001***
House officer	52(73.2)	19(28.6)		
Dental officer	25(92.6)	2(7.4)		
Resident	65(98.5)	1(1.5)		
Senior resident	36(100.0)	0(0.0)		
Consultant	14(100.0)	0(0.0)		
Years of practice			29.340	**<0.001***
≤5	68(76.4)	21(23.6)		
6-10	77(98.7)	1(1.3)		
>10	47(100.0)	0(0.0)		
USAGE OF ROTARY ENDODONTICS (N=55)				
Age group (years)			4.129	0.127
21-30	15(22.1)	53(77.9)		
31-40	31(29.8)	73(70.2)		
>40	9(45.0)	11(55.0)		
Dental qualification			14.205	**0.007***
House officer	10(19.2)	42(80.8)		
Dental officer	9(36.0)	16(64.0)		
Resident	14(21.5)	51(78.5)		
Senior resident	13(36.1)	23(63.9)		
Consultant	9(64.3)	5(35.7)		
Years of practice			10.875	**0.004***
≤5	13(19.1)	55(80.9)		
6-10	20(26.0)	57(74.0)		
>10	22(46.8)	25(53.2)		

*Significant

Table 6: Bivariate relationship between socio-demographic characteristics and overall knowledge about the rotary instrumentation procedure

Variable	Good	Poor	X^2	p-value
Age group (years)				
21-30	9(10.1)	80(89.9)	86.107	**<0.001***
31-40	69(65.7)	36(34.3)		
>40	20(100.0)	0(0.0)		
Dental qualification				
House officer	2(2.8)	69(97.2)	95.620	**<0.001***
Dental officer	16(59.3)	11(40.7)		
Resident	35(53.0)	31(47.0)		
Senior resident	32(88.9)	4(11.1)		
Consultant	13(92.9)	1(7.1)		
Years of practice				
≤5	11(12.4)	78(87.6)	75.914	**<0.001***
6-10	4760.3)	31(39.7)		
>10	40(85.1)	7(14.9)		

*Significant

Table 7: Independent predictors of awareness and usage of rotary file system among respondents

AWARENESS	Odd ratio	95% C I	p-value
Age group (Years)			
21-30	1		
31-40	3.890	0.253, 59.715	0.330
>40	6.369	0.231, 76.111	0.291
Dental qualification			
House officer	1		
Dental officer	1.389	0.240, 8.053	0.312
Resident	2.700	0.123, 9.496	0.110
Senior resident	2.911	0.451, 11.310	0.195
Consultant	5.893	1.431, 22.110	**0.023***
Years of practice			
≤5	1		
6-10	1.934	0.248, 59.217	0.391
>10	2.701	1.301, 9.441,	**0.011***
USAGE			
Age group (years)			
21-30	1		
31-40	0.615	0.172, 2.199	0.455
>40	0.296	0.047, 1.858	0.194
Dental qualification			
House officer	1		
Dental officer	1.961	0.417, 9.225	0.394
Resident	1.800	0.146, 4.385	0.797
Senior resident	1.545	0.222, 9.424	0.700
Consultant	5.051	1.431, 45.811	**0.031***
Years of practice			
≤5	1		
6-10	2.132	0.526, 8.634	0.189
>10	4.255	0.849, 21.323	**0.034***

*Significant

Table 8 shows that respondents that were >40 years old and all cadres of dentists above house officers were significantly more likely to have good knowledge about rotary endodontics than other respondents (p< 0.05).

Table 8: Independent predictors of knowledge about rotary instrumentation procedure among respondents.

	Odd ratio	95% C I	p-value
Age group (years)			
21-30	1		
31-40	1.994	0.641, 6.203	0.233
>40	3.091	1.041, 10.411	**0.042***
Dental qualification			
House officer	1		
Dental officer	2.199	1.392, 3.722	**0.032***
Resident	4.420	1.432, 5.018	**0.001***
Senior resident	5.091	2.120, 20.039	**0.001***
Consultant	9.212	2.541, 40.041	**<0.001***
Years of practice			
≤5	1	1	
6-10	1.125	0.361, 3.507	0.839
>10	1.326	0.298, 5.599	0.7111

*Significant

DISCUSSION

Endodontics is a specialty that is constantly evolving with the introduction of various technologies in its field ranging from new instruments to modern techniques in performing endodontic procedures.[1] New instruments and techniques make the treatment outcome predictable, decrease the duration of treatment sessions and simplify the treatment procedures. Several studies have shown that proper and correct use of new instruments, as well as the practitioners' knowledge, experience and expertise result in a success rate of up to 90% in endodontic treatment.[28] It is therefore essential for clinicians to constantly get updated, trained and become proficient in modern endodontic treatment approaches in the best interest of their patients and the clinic itself.[1]

To the authors' knowledge, this study is the first to provide published information on the knowledge and practice of Nigerian dental practitioners on rotary endodontics. The sample was widely drawn and representative. We had a high response rate of 89.2 % for our study which is higher than that obtained in other similar studies and this is possibly due to the fact that we collected the questionnaires by hand after the respondents completed them instead of postal questionnaire or online survey forms.

Only 55 (28.6%) of the respondents in our study had previously used a rotary endodontic system indicating a low uptake of the technology in Nigeria. Some studies have investigated the knowledge of general dental practitioners and specialists (endodontists and paedodontists) of rotary endodontics and the adoption of this mode of treatment.[1,2,4,7,9,10] In contrast to our study, a recent survey of diplomates of the American Board of Endodontists suggested that hand files, likely in combination with rotary NiTi instruments, were used by 98% of endodontists.[28] Another study conducted amongst Australian dentists revealed that more endodontists (64%) than general dentists (22%) use rotary instruments for their endodontic practice.[10]

A study carried out by Mehta et al in 2017 reported that 85% of paedodontists practicing in India were in favour of using rotary instruments for canal preparation during root canal treatment, however, only 38.1% of these practitioners were actually using rotary endodontic instruments.[2] Forty five percent of the respondents had not attended any Rotary Endodontic Continuing Dental Education or Workshop. Factors cited as being implicated in the decision to avoid the use of rotary instruments were concerns of the cost-effectiveness of the rotary instruments (36.4%) and the fear of the curved canals (33.2%).[2]

Furthermore, Mozayeni et al. (2011) revealed that 98.4% and 50.6% of endodontists and general dental practitioners respectively in Tehran had adopted the

use of rotary instrumentation.[9] Locke et al. (2013) reported that 67% of general dental practitioners practicing in Wales routinely use rotary instruments during endodontic procedure and majority (85%) of these respondents that have adopted rotary instrumentation use ProTaper rotary files.[7] Despite a substantial body of studies showing a superior quality of NiTi instrumentation over conventional, the diffusion of this technology is still slower in Nigeria than other countries. Factors that have been known to influence the adoption of technology include varying levels by research, the effort of opinion leaders, the curriculum of postgraduate training, continuing education, and product marketing. The major source of information about the rotary endodontic system by our respondents was by didactic lectures rather than through hands on training indicating that a lot of work still has to be done in Nigeria to advance this technology.

On the scope of use of rotary instrumentation, 90.1% respondents knew that it could be used for canal preparation while only 22.4% opined that it could be used for re-treatment. Over 60% identified all the components of the system rightly and specified that the crown down technique is the preparation technique that should be adopted during rotary instrumentation. Bird et al. in 2009 reported the crown-down technique as the most frequent preparation method and this technique has proven invaluable with various rotary preparation systems using NiTi instruments.[23] This instrument minimizes coronal interference, reduces procedural errors, allows minimal engaging surface and decreases the torque load of each file. Similarly, the hybrid technique does not deviate from the principles of the crown-down preparation. Experienced operators have adopted different file systems with their respective treatment protocols to achieve the best biomechanical canal preparation results and resulting in the fewest procedural errors.[29,30]

The most cited reason for not using rotary systems among the respondents was unavailability of rotary equipment kit (70.1%) followed by inadequate knowledge about it. This was in consonance to a study in Welsh endodontic practices that observed that the major barriers to the use of NiTi rotary instruments were cost (65%), lack of training (16%) and the perceived risk of instrument fracture (10%).[7] Similarly, another survey conducted by Thomas et al. (2013) revealed that the principal reasons the respondents had not adopted rotary endodontic instrumentation in practice were cost (62% of responses), lack of training and the perceived lack of benefit.[31] Mozayeni et al. (2011) in Iran likewise stated that the main factors inhibiting uptake of NiTi technology by dental practitioners was lack of education.[7] On the contrary, the two main factors implicated by Australian Dentists in the decision not to adopt rotary instrumentation were 'no perceived advantage' and 'the file being too fragile.'' Majority of the Australian respondents (73%) had attended one or more continuing education courses.[10] Naidoo (2006) likewise reported 42% of study participants had some form of endodontic postgraduate training, 71% of which was by attending continuing dental education courses.[27]

It appears that the weak purchasing power of the Nigerian currency and limited opportunity for hands on training is hampering the adequate use of NiTi systems in Nigeria. The shift from hand instrumentation toward rotary instruments may be improved when practitioners are offered an educational package including hands-on training and lectures directed at nickel-titanium technology.[32] Advocacy for improved funding of the health sector and international collaboration is hence imperative to overcome these barriers.

Out of the 55 respondents that had used rotary instruments before, 24 (43.6%) used the conventional slow-speed handpiece (powered by the air compressor of the dental unit) that is of poor control with respect to the recommended low speed and torque to drive the rotary files. Of these 55 respondents, the reciprocating file system was the commonest type of rotary system used (56.4%). Lee et al. (2009) reported that ProFile and ProTaper were the two most frequently used NiTi rotary instruments among general dentists.[28] Naidoo (2006) reported a hybrid combination of hand and rotary instrumentation (ProTaper being the most preferred rotary system) was preferred by 88% South African Dentists.[27] Thomas et al. (2013) also reported ProTaper being the most preferred rotary file system (86%) used by Welsh dental practitioners.[31] In a more recent survey conducted in 2017 among Indian endodontists, ProTaper (86.2%) was reported to be the commonest rotary file system used compared to the infrequent use of reciprocating files (Reciproc 2.7% and Wave One 2.4%).[4] The findings of this study is contrary to that of several studies. This is probably due to the fact that the reciprocating file system is a single file system which ultimately results in a reduced chair side time which is paramount in Nigerian public hospitals that have high patient load and limited number of dental chairs. Reciprocating files are the leading rotary system currently

promoted in Nigeria and these files have the new M-wire technology that is gaining grounds in the endodontic market. Interestingly, up to 53 (23.6%) respondents in this current study did not know of any advantage the reciprocating file system has over continuous rotary file system.

Only 36.4% of our respondents make single use of the file before discarding and 49.1% discard the rotary files after a decrease in the cutting efficiency. Only 28.6% of our respondents keep a paper inventory on the number of times the files are re-used. According to a UK survey, 32% of general dentists reported discarding their NiTi instruments after a single use, while 40% reported reusing them 2-5 times, and 27.2% reported reusing them more than 6 times.[25] In a US study conducted in 2009, Bird et al. reported that the majority of respondents used NiTi instruments on 2-4 patients before discarding them, whereas 21% used NiTi rotary instruments only a single time before discarding.[23] During the use of a NiTi rotary instrument, multiple factors are imposed on the instrument, such as cyclic fatigue, torsional forces, and environmental corrosion. The risk of instrument fracture increases with the amount of time that an instrument is used to prepare a root canal system as a result of the increased exposure to those factors. It is recommended that NiTi rotary instruments be discarded after a single use. A single use is ideal for reducing the risk of file separation; however, the high operating cost of NiTi files has forced clinicians to re-use them. Even though manufacturers often recommend only a single use, it is not unusual for clinicians to use NiTi instruments up to 5 times. Previous surveys also revealed no consensus on the re-usability of NiTi instruments.[23,25]

Better cleaning efficiency was the most cited known general advantage of using rotary instrumentation over hand instrumentation by 64.5% of our respondents followed by a decrease in procedural errors (49.5%). Faster and simpler preparation of root canals might be the reason for general practitioners using rotary instruments so commonly. Several studies have shown the superiority of NiTi rotary files over conventional hand files used for root canal instrumentation as regards decreased procedural errors, more efficient canal debridement, improved clinical outcome and promoting single visit treatment as a result of reduced chair side time[10,14,16,17,18,33] NiTi instruments has also gained popularity because of the unique super-elastic property along with their advanced design. These have made them favourable for effective and safe instrumentation of narrow and curved root canals when using low-torque and slow-speed handpieces.[34,35] Overall, 45.8% of our study respondents had good knowledge about rotary endodontics. Respondents >40 years of age, senior registrars and consultants and those that had practiced dentistry for >10 years were significantly more likely to have good knowledge about rotary endodontics. Similarly, senior registrars and consultants and those that had practiced dentistry for >10 years were also significantly more likely to have used it for root canal therapy. Recently, a study in the USA conducted by Bird et al (2009) revealed that there is a correlation between NiTi rotary instrument usage and the region, graduation date and type of practice.[23] Gupta and Rai (2013) on the contrary, however, noticed that a significantly higher number of dental practitioners of less than 5 years of experience used rotary instruments (68%) compared to those of greater than 15 years post-qualification (51%).[1]

CONCLUSION

Our study revealed a low rate of adoption of rotary endodontic technology among dental surgeons in Nigeria and the most commonly cited reason for this was the cost of the rotary instruments as well as inadequate exposure to hands on training. A concerted effort is required to improve the uptake and utilization of this technology in our environment.

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