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Questionnaire survey on the use of rotary nickel titanium instruments by dentists in Udaipur

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Abstract

Aim: To ascertain the extent of the adoption and use of rotary nickel- titanium (NiTi) instruments and techniques in general dental practice in Udaipur city.

Methodology: A questionnaire survey was done to determine the use of rotary NiTi instruments by dentists in Udaipur. The series of questions covered demographics, patterns of rotary NiTi usage, issues associated with NiTi usage and training in NiTi use.

Results: Overall 63.8% dentists responded. A total of 78% of respondents are using rotary NiTi. ProTaper universal was one of the most commonly used file system followed by ProTaper Next. There was a co-relation between the years of experience and the file re use frequency, preparation technique, file separation and the management of file separation all of which was case dependent. Dentists agreed that NiTi saves time making the procedure more efficient, despite its limitations.

Conclusion: The results indicate a sensible and responsible approach to the incorporation of rotary NiTi instruments and techniques into root canal treatment. The general dental practitioners are taking steps to become familiar with the properties and behavior of the instruments.

Keywords: NiTi Alloy, Rotary Instruments, Instrument Separation, Preparation Techniques.

Introduction

Root canal treatment is technically one of the most challenging procedures in dentistry and its success depends on the diagnostic acumen, instruments used and the technologies adopted.[1]

Traditionally, stainless steel instruments were used for canal shaping but they lacked flexibility which lead to procedural errors resulting in decreased success rate of the treatment.[2] In 1988, root canal instruments manufactured from nickel-titanium (NiTi) alloy were introduced to overcome the rigidity of stainless steel.[3]

NiTi alloy was discovered by William J. Buehler et al., and named it Nitinol (nickel, titanium, Naval ordinance Laboratory).[4] In endodontics, NiTi was initially used by Walia HM et al.[5] Continuous advancements are made in the instrument design to achieve improved shaping efficiency to reduce the probability of procedural errors like transportation or file separation. Each NiTi system has different mechanical properties and clinical performance based on its geometrical characteristics and manufacturing methods.[2] NiTi instruments offer better instrumentation attributable to its property of super elasticity and shape memory, they are two to three times more flexible and have superior torsional resistance as compared to stainless steel.[6]

The aim of this study was to conduct a questionnaire survey to accumulate the information regarding various NiTi rotary instruments and their usage techniques by general dental practitioners in Udaipur city.

Materials and methods

The study was conducted in the Department of Conservative Dentistry and Endodontics. Darshan Dental College and Hospital, Udaipur, Rajasthan India.

A questionnaire was sent to 175 general dental practitioners in Udaipur via post office mail. Questionnaire was framed by using check boxes, multiple choice options with the option for free text.

The questions were based on information gathered from recent reviews from journals and textbooks on root canal preparation techniques. The questionnaire consisted of 25 questions, many of which had multiple options and every question was indicated as mandatory. A questionnaire was used for collecting information from each individual regarding demographics, experience with rotary instruments, usage of file systems and techniques, frequency of reuse, occurrence of instrument separation during canal preparation, reasons for separation, and its management. Out of 175 questionnaire sent, 112 were received.

Statistical Analysis

Responses received were formatted to allow analysis by using the SPSS version 19.0 (IBM Corp, Armonk, NY, USA). Percentages were calculated based on the number of responses or respondents to each question.

Results

This study achieved an overall response rate of 63.8%. From the 175 questionnaires sent, a total of 112 were answered. The mean age of participants was 35 years. 28.1% respondents reported the use of NiTi instruments for more than 5 years, followed by 35.9% who were using it from 1-5 years and 22.3% who started using since last 6 months to 1 year and only 13.8% started using since last 6 months.

Most practitioners (45.5%) performed 6-10 root canal treatments each week while only 19% performed more than 10 RCT's/week (Table 1). A total of 85% of the respondents agreed to the use of nickel titanium rotary instrumentation routinely (Table 2). The dentists have been using rotary NiTi instruments since different time

periods, 45.5% have been using the instruments since 4-6 years followed by 7-10 years (20%), and only 14.4% have been using the instruments for 1-3 years (Table 3).

Most commonly preferred file systems was Protape Universal, used by 48.2% of the respondents (Table 4), followed by the use of Protaper Next system (42.1%). Many respondents use One Shape system (14.4%) and M Two system (12.5%) of rotary files. 37.7%practitioners use file systems other than the ones mentioned in the survey.

66.5% practitioners reported the use the rotary systems due to their ease of use followed by the time factor (63.5%). 59.2% use rotary NiTi files as it follows the root canal anatomy better and 56.2% use it as they consider that it has better cleaning efficiency compared to hand instrumentation. However, 0.2% use it because it is in trend (Table5).

A total of 54.2 % practitioners follow the crown down technique for the canal preparations and 27% follow the sequential manner. 41.4% use the hybrid technique. Only 0.2% of the practitioners follow the step back technique for canal preparation (Table 6).

Of the total respondents, 76.2 % do not prefer the use of rotary instrumentation in the maxillary anterior teeth and only 23% use for maxillary anterior teeth (Table 7).

Of the total respondents 63.9% indicated that they use each file in 5-10 canals, while 3-5 canals were indicated by 29%. Only 3% agreed for more than 10 canals (Table 8).

A total of 55.2% respondents (Table 9) agreed discarding the file after repeated re use followed by 26.8% who discarded the file after they feel reduction in the cutting efficiency of the file. 11.9 % discarded the file after the separation of the instrument.

57.4% of the practitioners remember the number of times they have used the file by putting markings on the file followed by recording on paper by 30%. 6% removed the petals while 5% indicated other methods (Table10).

The data regarding the instrument separation (Table 11) revealed that 35.6% of respondents experienced file separation after a continuous use in 20 canals followed by 15 canals (22.1%). Around 13.9% agreed to the separation after use in 12 canals

The frequency of file separation in root canal was indicated once in a month by 37.5% of respondents, less than five times a year by 31% followed by 13.2% who responded to once in 15 days and only 11% agreed that separation of instrument took place rarely (Table 12).

A total of 93.3% agreed that the separation of file has decreased with their increase in experience on the use of rotary file system (Table 13).

Of the total respondents (Table 14) 72.7% reported that the majority of the file separation occurs in the mesio lingual canal of the mandibular molars followed by the mesio buccal canals of the mandibular molars (58.2%). 31.2% agreed that separation took place in the mesio buccal canal of the maxillary molars. Few of them (0.6%) agreed to the separation occurring in the palatal canals of the upper premolars. The minimum separation was reported in the maxillary anteriors and lower premolars (0.2%).

Regarding the most common location of the instrument separation 88.2% agreed that it takes place in the apical one third. 11% agreed that separation takes place at the middle one third and only 0.8% indicated the separation at the coronal one third (Table 15).

According to 96.6% respondents the incidence of file separation decreases with the use of hand piece with speed and torque control (Table 16)

90.4% respondents agreed that the irrigation protocol decreases the file separation while 9% disagreed to it. 0.2% respondents believed that the irrigation protocol

decreases the file separation to some extent and advocated the use of EDTA. (Table 17).

There are multiple reasons for instrument fracture (Table 18). 79.5% indicated that excessive pressure on file is the most common reason for file separation in the canal, 58.5% indicated that over usage is the reason followed by infrequent irrigation of the canal (51.4%).

For the management of the separated instruments (Table 19), 81.2% practitioner agreed that they bypass the separated instrument followed by 41.2% of them retrieve the instrument and 40% prefer obturating over the separated instrument. 0.2% use variable methods depending on the case.

84.5% agreed that the advantage of using rotary file system is that it is time saving thus more efficient followed by the ease of use of the instruments (64.6%). 48% of them agreed to the decreased procedural errors with rotary NiTi files. While others 7.7% indicated that the file system maintains the working length and 7.5% agreed that patient factor is also one of the advantages (Table 20)

Of the disadvantages (Table 21), 75.6% indicated that excessive removal of dentin is the most common disadvantages of using rotary NiTi files followed by file separation (67.5%). Others reported binding of the file (15.5%), ledging of the canal (11%), transportation (9%) and expenses (4%) as the disadvantages.

A high proportion (75%) of respondents had attended one or more courses in the rotary NiTi (Table 22), 65% of them attended courses run by the universities and 35% attended courses run by dental companies (Table 23). 99% of the practitioners feel postgraduate training in the use of NiTi root canal treatment instrumentation would be beneficial to practitioners of Udaipur (Table 24).

Discussion

This is an observational study based on questionnaire investigating the use of Endodontic Rotary Instrumentation by general dental practitioners in Udaipur. The questionnaire was sent to 175 general dental practitioners and was answered by 112.

The multiple answers provided to many questions indicated that the practitioners appreciated that clinical circumstances can direct the course and sequence of the instrumentation phase. This study had an overall response rate of 63.8%, which was acceptable for dental surveys (50-70%). Purpose of this questionnaire survey was to gain insight into the experiences and beliefs of dentists concerning the new endodontic technology of rotary NiTi instrumentation as the successful introduction of new NiTi rotary technology into daily clinical practice would require not only effective products, but also the appropriate and adequate data with quality information for the benefit of the practitioners.

The questions were designed to ascertain the problems, patterns of use and to identify areas of perceived or potential concern. Purpose of this questionnaire survey was to gain insight into the experiences and beliefs of dentists concerning the new endodontic technology of rotary NiTi instrumentation. This survey revealed that 45% of respondents used the rotary instruments five times or more weekly.

Experienced operators combined instruments from different file systems and used different instrumentation techniques to achieve best chemo-mechanical preparation, resulting in minimum a procedural error which is in accordance to the study conducted by WC Lee et al.[3] There are so many factors governing the safe re-use of NiTi rotary file systems which mainly depends on: the number of re-uses, preparation technique employed, glide path preparation prior to rotary instrumentation and initial

apical preparation. It also includes enlargement of the canal using hand K files, sufficient orifice enlargement or the coronal preparation, and the use of adequate irrigant and lubrication with the file system (T Patil et al 2017).[1]

The preparation technique was associated with the frequency of file separation. Operators who use the sequential total length technique tended to experience file separation more than crown down and hybrid preparation technique. The crown down technique has been used for more effective cleaning and shaping as it minimizes coronal interference, decreases the torque load of each instrument and reduces procedural errors which is in accordance to the study conducted by WC Lee et al.[3] Experienced operators had a strong tendency of reusing the files 6-10 times. This was due to the experience based opinion that a file can be safely re-used which supports the study conducted by M Locke et al 2013.[11]

The survey revealed instrument fracture occurs during preparation of the root canal when the canal is narrow. The majority of the fractures had occurred in molars; the most frequently involved root canals were the mesial canals of mandibular molars followed by buccal canals of maxillary molars. Instrument separation was 33.5 times more likely to occur in the apical one third versus the coronal one third of the tooth. The responses obtained were comparatively similar with that of the PennEndo database study conducted by Iqbal MK et al in 2006.[7]

Respondents agreed that excessive pressure on the file is one of the major reasons for file separation followed by over usage and use of infrequent irrigation. Majority of the respondents agreed that the incidence of file separation decreases with the irrigation protocol and with hand piece having speed and torque control which are in accordance with the study conducted by T Patil et al in 2017.[1] The management of separated files is multifactorial; the removal of the fractured NiTi instruments is influenced by factors such as the anatomy of tooth, degree of root canal curvature, and the location of fragment than the specific technique used (Hulsmann M et al, 1999).[13] A majority of respondents around 40% agreed that they would obturate and review the case if retrieval or bypassing the fragment was not possible, which demonstrates a conservative attitude presumably because of the perception that prognosis is favorable despite an instrument fracture, which is in support of the study conducted by Parahos P & Messer HH in 2004.[9]

According to this study, 84.5% of the participants agreed that major advantage of using rotary file system is that it is time saving followed by the ease of use i.e. around 64.6%, thus, making the treatment more efficient. The major disadvantage of the file system involves the excessive removal of the dentin, to which 75.6 % participants agreed followed by file separation 67.5%.

Despite the limitations of the instruments, dentists are taking steps to become familiar with the properties and behavior of the instruments. The finding that 75% of respondents currently using rotary NiTi had attended at least one educational course in the use of the instruments supports this. Such courses enable dentists to update their theory and learn new techniques. 35% of respondents had attended training courses run by dental trade companies implying that dentists are actively seeking out knowledge and instruction (Parahos P and Messer HH, 2004)[9]

This survey shows clearly that there is a demand for NiTi education, which must be broad and unbiased. The study addresses to the various instruments and instrumentation technologies of rotary NiTi which will help in understanding the clinical implications providing a better platform for the dentists to carefully select and eliminate different instrument systems and methods catering to the future prospects to the dental practitioners in Udaipur.

Conclusion

Increased success rates of root canal treatment is still not a conclusive finding with the rotary instrumentation but there is evidence in the endodontic literature which proves that rotary instruments have several advantages over traditional hand filing techniques.

The adoption of new endodontic technologies among endodontists in India has significantly contributed to the enhancement of the quality of endodontic treatment. The present survey provided the qualitative and quantitative information regarding the various aspects of rotary NiTi systems. Questionnaire based studies can serve as a useful tool in creating awareness among the practitioners and aid in a successful practice.

Data Regarding Demographics

1.How many root canal treatment do you perform each week?		No. of practitioners	Percentage
	1-5	37	35.5%
	6-10	49	45.5%
	10+	15	19%

Table 1

2. Do you routinely use nickel titanium rotary instrumentation?		No. of practitioners	Percentage
	No	16	15%
	Yes	95	85%

Table 2

3. Since how many years are you using nickel titanium rotary instrumentation?		No. of practitioners	Percentage
	<1	22	20%
	1-3 Years	16	14.5%
	4-6 Years	49	45.5%
	7-10 Years	22	20%

Table 3

Data regarding rotary file system used

4. Which file system are you using now?		No. of practitioners	Percentage
	Protaper Next	47	42.1%
	Protaper	53	48.2%
	M Two	14	12.5%
	RaCe	11	10.5%
	Revo S	16	15%
	One Shape	6	14.4%
	Hyflex	11	13.2%
	Reciproc	1	2.7%

	Hero Shaper	1	0.9%
	Light Speed	1	0.5%
	Wave One	1	2.4%
	Wave One Gold	1	0.2%
	Other	42	37.7%

Table 4

Data Regarding Rotary Technique

5. Why do you use rotary file system?		No. of practitioners	Percentage
	Follows the canal anatomy better	66	59.2%
	Better cleaning efficiency	63	56.9%
	Time Factor	71	63.5%
	Fracture Resistance	10	9.4%
	Ease of use	74	66.5%
	Cost Factor	51	46.4%
	Mostly Used	3	0.2%

Table 5

6. What is your preparation technique?		No. of practitioners	Percentage
	Crown Down Technique	54	54.2%
	Hybrid preparation technique	44	41.4%
	Sequential manner	30	27%
	Step Back	1	0.2%

Table 6

7. Do you prefer rotary instrumentation in upper anterior teeth?		No. of practitioners	Percentage
	No	85	76.2%
	Yes	26	23.8%

Table 7

Data on re-use of rotary file system

8. How many times do you re use your rotary file system?		No. of practitioners	Percentage
	2 canals	3	2.7%
	3-5canals	32	29%
	5-10 canals	71	63.9%
	More than 10 Canals	3	3.4%
	Single Canal	2	0.4%

Table 8

9. When do you discard rotary file system?		No. of practitioners	Percentage
	After decease in the cutting efficiency	30	26.8%
	After repeated re use	61	55.2%
	After the file separation	13	11.9%
	After using in curved canal	7	6.1%

Table 9

10. How do you remember the number of times the files are used?		No. of practitioners	Percentage
	Marking on files	65	57.4%
	Recording on paper	34	30.6%
	Removal of petals	7	6.4%
	Others	6	5.6%

Table 10

Data Regarding File Separation

11. What is the estimated frequency of file separation in the root canal (after how many cases)?		No. of practitioners	Percentage
	After 1	8	8.0%
	After 10	56	5.0%
	After 2	12	11%
	After 3	7	7.0%
	After 4	4	3.9%
	After 5	15	13.9%
	After 6	24	22.1%
	After 7	5	5.2%
	After 8	39	35.6%
	After 9	3	3.0%
	After more than 10	4	4.4%

Table 11

12. What is the estimated frequency of file separation in root canal?		No. of practitioners	Percentage
	In less than a week	2	2.2%
	Less than five times a year	31	31.0%
	Once in 15 days	12	13.2%
	Once in a month	39	37.5%
	Once in a week	5	5.2%
	Rare	12	11.0%

Table 12

13. Do you think that the separation of file has decreased with your increasing experience on rotary file system?		No. of practitioners	Percentage
	No	111	93.3%
	Yes	1	6.7%

Table 13

Data regarding file separation

14. Where does the majority of the file separation occur?		No. of practitioners	Percentage
	Lower anteriors	1	0.5%
	Upper premolars buccal root	1	0.5%
	Upper premolars palatal root	1	0.6%
	Upper molars mesiobuccal canal	34	31.2%
	Upper molars distobuccal canal	4	3.8%
	Lower molar mesiobuccal canal	65	58.2%
	Lower molar mesio lingual canal	81	72.7%
	Lower molars distal canal	1	0.9%
	Lower premolars	1	0.2%
	Upper anteriors	1	0.2%

Table 14

15. Where does the separation occurs most commonly?		No. of practitioners	Percentage
	Apical one third	98	88.2%
	Middle one third	12	11%
	Coronal one third	2	0.8%

Table 15

16. Do you think the incidence of file separation decreases with?		No. of practitioners	Percentage
	Hand piece with speed and torque control	108	96.6%
	Hand piece without speed and torque control	4	3.4%

Table 16

17. Does the irrigation protocol decreases the file separation?		No. of practitioners	Percentage
	Irrigation plays a minor role. I believe it's always a good glide path and extended duration of using hand files decrease the fractures	1	0.2%
	EDTA to be used properly	1	0.2%

	No	9	9.1%
	To some extent	1	0.2%
	Yes	109	90.4%

Table 17

Data Regarding Reasons for File Separation

18. What may be the common reason for file separation in the canal?		No. of practitioners	Percentage
	Excessive pressure on file	9	79.5%
	Incorrect insertion angle of the file	34	31.0%
	Non constant speed of rotations	9	8.2%
	High R P M	7	7.4%
	Infrequent irrigation	57	51.4%
	Calcified canals	23	21.2%
	Over Usage	65	58.5%
	Type of file	2	3.6%
	Complex root canal anatomy	30	28.5%
	Incorrect file sequence	60	54.2%
	File design	1	0.2%
	Unknown	1	0.6%

Table 18

Data regarding management of separated instruments

19. How do you manage separated instruments?		No. of practitioners	Percentage
	Retrieve the instruments	46	41.2%
	Bypass the separated instrument	90	81.2%
	Obturation over the separated instrument	34	40%
	Depends on preoperative infection status and level of fracture of instruments	1	0.2%
	Depends on the place of separation and irrigation protocol	1	0.2%
	Refer	0	0.2%
	Retrieve if in coronal otherwise bypass. If it doesn't happen to obdurate if patient is symptom free	1	1%
	Variable for each case	0	0.2%

Table 19

Data regarding advantages and disadvantages of rotary file system

20. What is the advantage of using rotary file system?		No. of practitioners	Percentage
	Decreased procedural errors	5	48%
	Time saving	94	84.5%
	Ease of use	72	64.6%
	Maintaining the canal anatomy an curvature better	1	0.2%
	Maintains working length	2	7.7%
	Easier canal obturation	3	23%
	Patient Factor	3	7.5%

Table 20

21. What are the disadvantages of using rotary file system?		No. of practitioners	Percentage
	Ledging of the canal	3	11%
	Transportation	2	9%
	Strip Perforation	4	5.6%
	Straightening of the canal	2	8%
	Binding of the file	17	15.5%
	File separation	75	67.5%
	Excessive dentin removal	84	75.6%
	Expensive	9	4%

Table 21

Data regarding NITI education

22. Have you attended the courses offered on NiTi education?		No. of practitioners	Percentage
	Yes	84	75%
	No	18	25%

Table 22

23. Attended courses offered by?		No. of practitioners	Percentage
	Universities	72	65%
	Companies	30	35%

Table 23

24. Do you feel postgraduate training in the use of NiTi root canal treatment instrumentation would be beneficial to practitioners of Udaipur?		No. of practitioners	Percentage
	Yes	110	99%
	No	2	1%

Table 24

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