

Dentists' Experience and Knowledge of Rotary Nickel-Titanium Endodontic Systems: A Questionnaire Survey

Emilia Karova PhD¹, Violeta Dogandziyska PhD²

Department of Conservative Dentistry, Faculty of Dental Medicine, 1 blvd "St. George Sofijski", 1431 Sofia, Bulgaria

Tel: +359 888238662

Email: dogandziyska[at]gmail.com

Abstract: ***Aim:** The aim of this questionnaire survey was to examine the experience, preferences, confidence and skills of Bulgarian dental practitioners in the use of NiTi rotary instruments. **Methods:** The target group consisted of 650 dental practitioners chosen on a random basis from all Bulgarian administrative districts. They received an online questionnaire consisting of 15 questions via their regional professional organizations. **Results:** The questionnaire forms were filled and returned by 197 (30.31%) of the respondents, as 53.2% of them practicing in the capital and 34% in the regional cities. About 70% of participants have graduated in the last two decades. Treatment with rotary NiTi files was always preferred by 40.1% of them and very often by 22.8%, with higher rates registered in the capital and regional cities. Half of the respondents had experience in using several rotary NiTi systems with different types of rotation and their choice was dependent on the difficulty of the clinical case. Confidence in the use of NiTi rotary systems was significantly dependent on the year of graduation. About 60% of respondents assessed their skills in using rotary NiTi files as excellent and very good and the satisfaction rate depended on the graduation year. **Conclusions:** The knowledge and experience in the use of rotary NiTi instruments by Bulgarian dentists is constantly increasing, especially in the capital and regional cities. Younger practitioners, convinced of the benefits of these contemporary systems, feel more confident and ready to introduce them in the daily practice.*

Keywords: dental practitioner, experience, questionnaire, nickel-titanium rotary system, practical skills

1. Introduction

Treatment outcome and long lasting prognosis are highly dependent on the thorough cleaning and proper shaping of the root canal space. [4, 8, 19, 22] Recently, with the invention, manufacturing and introduction of rotary nickel-titanium (NiTi) instruments into dental practice, the chances of success have increased. The nitinol alloy subjected to specific treatment processes and improvements [2, 8, 10, 11, 13, 19, 20, 25] resulted in the appearance of new brands of instruments with improved cutting efficiency and better resistance to cyclic fatigue and torsional overloading. [14, 26-28, 30] Nowadays, different modes of rotation of NiTi files (continuous, reciprocating and adaptive) enable root canal shaping and decrease procedural errors. [7, 9, 24, 33, 34] Due to their extreme flexibility, superelasticity and ability to preserve the root canal anatomy [12, 32], nickel-titanium instruments are preferred in the treatment of teeth with narrow and severely curved canals.

In the last decades, the popularity of rotary NiTi systems among dental practitioners is constantly increasing. Trading companies with their lecturers and practical courses and the implementation of rotary instrumentation in university programs have introduced these modern systems to daily dental practice and improved the success rate of endodontic treatment.

The questionnaire forms are inexpensive, easily delivered tools, addressing large groups of the population that allow quick and objective results. The data from questionnaire surveys in Denmark [6], Belgium [29], Australia [21, 23], Sudan [1] and Saudi Arabia [3, 18] confirm the preference to

the new brands of rotary NiTi systems. The same tendency of constantly increasing interest towards properties, behavior and clear benefits of NiTi instruments over traditional instrumentation was established in a recent study among Bulgarian dental practitioner [15]. It is still not clear what the preferences of Bulgarian dentists are and how confident and skillful they are when using rotary NiTi instruments.

The purpose of this questionnaire survey was to examine the experience, preferences, confidence and skills of Bulgarian dental practitioners in the use of NiTi rotary instruments.

2. Methods

Questionnaire design

A specially designed online questionnaire (available from the authors) was created for the purpose of this cross-sectional study. A pilot set of questions was tested on 20 general dental practitioners and based on their comments and understanding of the investigation, 15 closed-format questions were approved – 8 multiple-choice type and 7 with a positive or negative statement. Respondents answered to questions concerning their dental practice location, the year of high-school graduation and their professional experience and satisfaction with the use of NiTi rotary instruments. The understanding of the importance of the glide path creation, the taper of the shaped root canal and the factors affecting the fracture rate of instruments was assessed. The efficiency of NiTi systems in shaping narrow and/or severely curved canals was compared with that of stainless steel hand files. No personal data were collected.

The anonymous online questionnaire form was accompanied by a letter explaining the objectives of the study and requesting for participation.

Distribution and collection of the questionnaire forms

A Google template allowing immediate answers was sent to dental practitioners in Bulgaria via their regional professional organizations. The completed forms were automatically sent by the web system to the researchers. The sample consisted of 650 dental practitioners chosen on a random basis from all administrative districts in Bulgaria. The data were collected from January 2021 to May 2021.

Statistical analysis

The collected data were automatically entered into a Microsoft Excel spreadsheet, with each response allocated in a separate column, and analyzed using SPSS, Version 19. Chi-square test, with a level of significance set at $p < 0.05$, was used for statistical analysis.

3. Results

The questionnaire forms were filled and returned by 197 (30.31%) of the respondents. Almost half of them (53.2%) practice in the country capital Sofia, 34%-in regional cities, 11.8% in towns with smaller population and 1% in rural areas.

Most of the participants have graduated and started their work experience in the last two decades – 52% after 2006 and 19.6%-in the period 1996-2005. For 15.7% of them the graduation was in the period 1986-1995 and for 12.7%-before 1985.

Endodontic treatment was typical for almost all dental practices, with positive responses reaching 98.5%.

The preference to NiTi rotary systems was tested by selecting one of the four variables: *never*, *sometimes*, *very often* and *always*. The analysis revealed that 40.1 % always used them, 22.8%-very often, 21.3%-sometimes and 15.8 %-never. Dentists' preferences differed and expectedly, higher rates were registered in the capital and regional cities. (Table 1)

Table 1: Preference to nickel-titanium rotary systems according to the practice location and graduation year

Question	Variable	Usage of NiTi rotary systems			
		Never (%)	Sometimes (%)	Very often (%)	Always (%)
Practice location	Capital (Sofia)	10, 4	24, 5	27, 4	37, 7
	Regional city	16, 2	20, 6	20, 6	42, 6
	Small towns and rural areas	39, 1	8, 7	13, 0	39, 1
Graduation year	Before 1985	26, 9	19, 2	26, 9	26, 9
	1986-1995	9, 4	18, 8	28, 1	43, 8
	1996-2005	13, 2	15, 8	18, 4	52, 6
	After 2006	16, 3	25, 0	21, 2	37, 5

Rotary systems were always used by many of the respondents but their choice was not significantly influenced by the year of graduation. (Table 1)

The preference to NiTi rotary systems was further considered by defining:

- the number of systems used

Half of the participants (53.3%) had experience in using several systems, almost a third (29.1%) preferred one system and 17.6% did not use rotary NiTi instruments.

- the type of file rotation

Continuous rotation was preferred by 19.1% of respondents, followed by reciprocating movement (13.9%) and adaptive rotation (12.4%). For 54.6% of dentists the choice of system depends on the difficulty of the clinical case.

- the case difficulty

The preference for rotary NiTi systems was 56.4%, regardless of the case difficulty, 34.9% for teeth with straight and relatively wide canals and 8.7% in cases with narrow and severely curved canals.

Dentists' confidence during root canal shaping with different types of instruments was measured by choosing one of the five variables: *hand stainless steel*, *hand nickel-titanium*, *NiTi files with continuous rotation*, *reciprocating NiTi files* and *NiTi instruments with adaptive motion*. Almost equal were the results for the groups of hand stainless steel (27.2%), hand NiTi files (24.6%) and NiTi files with continuous rotation (20.5%). Lower rates were registered for reciprocating NiTi files (13.3%) and NiTi instruments with adaptive motion (14.4%). Confidence in the use of NiTi rotary systems was significantly dependent on the year of graduation of the respondents. (Table 2). The later the graduation, the greater the knowledge and confidence in using NiTi rotary systems.

Table 2: Relationship between confidence in using shaping instruments and graduation year

Graduation year	Confidence in using shaping instruments					P
	Hand stainless Steel, n (%)	Hand NiTi n (%)	NiTi with continuous Rotation, n (%)	Reciprocating NiTi, n (%)	NiTi with adaptive Rotation, n (%)	
Before 1985	7 (29, 2)	10 (41, 7)	-	1 (4, 2)	6 (25, 0)	0, 014
1986-1995	6 (18, 8)	8 (25, 0)	4 (12, 5)	8 (25, 0)	6 (18, 8)	
1996-2005	8 (22, 9)	6 (17, 1)	12 (34, 3)	6 (17, 1)	3 (8, 6)	
After 2006	32 (31, 4)	24 (23, 5)	24 (23, 5)	9 (8, 8)	13 (12, 7)	

Skills in root canal shaping with rotary NiTi instruments were self-assessed as: *satisfactory, very good, excellent, cannot define them as these instruments are not used*. Half of the respondents (48.5%) evaluated their work as very good, 18.7% as excellent and 16.2% as satisfactory. For 16.7% of participants, NiTi instruments were not part of their armamentarium. A cross tabulation reveals that satisfaction with treatment results and skillfulness depend on the graduation year, although the level is not significant. (Table 3)

Table 3: Relationship between self-assessment of skills in using NiTi instruments and year of graduation

Graduation year	Self-assessment of skills in using NiTi instruments			Level of significance
	Satisfactory n (%)	Very good n (%)	Excellent n (%)	
Before 1985	6 (31, 6)	10 (52, 6)	3 (15, 8)	0, 056
1986-1995	13 (44, 8)	15 (51, 7)	1 (3, 4)	
1996-2005	8 (22, 9)	16 (45, 7)	11 (31, 4)	
After 2006	39 (44, 8)	34 (39, 1)	14 (16, 1)	

Basic knowledge of treatment protocols and some features of rotary NiTi instruments were evaluated by answering 6 questions presented in Table 4.

Table 4: Basic knowledge of treatment protocols and some features of rotary NiTi instruments

Question	Yes (%)	No (%)
Awareness of protocols and instruments for glide path creation	89, 5	10, 5
Preliminary creation of a glide path influences instruments fracture rate	92, 8	7, 2
Root canal taper influences the irrigation effectiveness	93, 4	6, 6
Fracture resistance of NiTi files is ensured only by their superelasticity and extreme flexibility	28, 0	72, 0
NiTi files follow the original root canal anatomy better than stainless steel hand instruments	63, 1	36, 9
NiTi file protocols are faster and less strenuous for the operator	89, 5	10, 5

4. Discussion

Similar to the design of the Al Shwaimi study [3], data from Bulgarian dental practitioners were collected via an online questionnaire created to examine their experience, preferences, confidence and skills in the use of NiTi rotary instruments. Electronic communication with the target group facilitated the contact and collection of completed forms. Other researchers [1, 6, 21, 23] believe that sending their questionnaires by mail is more reliable for examining the preferences of general practitioners and specialists for rotary instrumentation.

The response rate in our study was not very high, as one third of the dentists filled out the forms, but it was large enough to achieve our goal. We assume that one of the possible reasons for the low interest may be the lack of direct contact with the respondents and the inability to remind them to become part of the survey. The cooperation of the studied group was similar in other investigations [3, 5], as in one of them it reached even 25% [29].

The analyses of our data revealed a constantly growing interest to rotary instrumentation, regardless of the year of graduation. It became apparent that 62.9% of participants always or very often used rotary NiTi instruments for root canal shaping. The registered preferences were more typical for the dental practices in the capital and the regional cities. Similar results were received in surveys in Saudi Arabia [3] and Australia [21, 23]. To have a practice in a larger city makes easier the contact with sales representatives and facilitates participation in lectures and workshops organized by trade companies. Another reason may be the financial capabilities of the rural population.

Half of the respondents had experience in using several rotary NiTi systems with different types of rotation and their choice was dependent on the difficulty of the clinical case. The awareness of treatment protocols of many contemporary systems was reflected in the almost equal preferences for systems with continuous, reciprocal and adaptive rotation. The prevailing part of participants demonstrated sufficient knowledge of the importance of the creation of a glide path, the taper of the shaped root canal and the basic features of NiTi instruments.

Nowadays, dentists gain their experience in rotary instrumentation not only from commercial courses, but especially from the university undergraduate programs. The results of our survey revealed that recent years graduates feel more confident in using NiTi systems than their older colleagues. This finding is supported by the results of Koch et al. [17] and in our previous study among students in the Faculty of Dental Medicine in Sofia [16]. As a part of a grant project, several NiTi systems were included in the program, enabling students to acquire knowledge and skills to work with them. Undergraduate training is considered the best time to learn new techniques, which allows for easier and faster introduction of innovations into daily practice. [18, 23, 31].

The experience in using NiTi files was rated as excellent and very good by about 60% of the respondents. It was found that still one-fifth of them do not use rotary instrumentation even in the treatment of the simplest cases. The registered high self-assessment scores and greater confidence depended on the year of graduation, thus clearly emphasizing the importance of university training for achieving better treatment results.

5. Conclusion

The knowledge and experience in the use of rotary NiTi instruments by Bulgarian dentists is constantly increasing, especially in the capital and regional cities. Younger practitioners, convinced of the benefits of these contemporary systems, feel more confident and ready to introduce them in the daily practice.

The authors report no conflict of interest.

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Author Profile



Dr Emilia Karova has graduated Faculty of Dental Medicine, Medical University, Sofia, Bulgaria with excellent grades. She is an Associate Professor in the Department of Conservative Dentistry and Vice Dean of Students' Affairs in the same faculty. Successfully defended her dissertation thesis in 2012. Her research interests are in the field of endodontics, especially in nickel-titanium instruments, and in esthetic restorations.



Dr. Violeta Dogandzhiyska is an assistant professor at the Department of Conservative Dentistry, Faculty of Dental Medicine, Sofia, Bulgaria. Successfully defended her dissertation thesis in 2016. Her research interests are in the field of endodontics, aesthetic restorations and laser dentistry.