

Endodontic Practice in North Cyprus: A Questionnaire Survey Study

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Abstract

BACKGROUND/AIMS: Much equipment and many materials have been introduced to improve endodontic treatment outcomes and shorten its treatment time. This study aimed to gather information on the materials and methods employed in root canal treatment by dentists in North Cyprus.

MATERIAL AND METHODS: A questionnaire regarding endodontic practice was designed and distributed to dentists in North Cyprus. One hundred and seventeen dentists were asked face-to-face to complete this survey. The structured questionnaire comprised 25 questions about the materials and techniques used in endodontic treatments. Data were statistically analyzed using chi-square tests to find out the effect of the years of professional experience on the preference of irrigation solutions and obturation techniques. Statistical significance was set at $p < 0.05$.

RESULTS: One hundred and seventeen respondents completed the questionnaire and 47% were female and 53% male. There was a wide range between the dentists' years of professional experience. 14.1% of them reported that they did not use periapical films in their clinics. The majority of dentists replied that they had never used a rubber dam (83%). There was an association between their years of professional experience and their preferred irrigation solutions ($p < 0.05$). For root canal preparation, 54.7% stated using rotary Nickel-Titanium instruments. There was also an association between their years of professional experience and their preferred canal obturation technique ($p < 0.05$).

CONCLUSION: The need for endodontic training after graduation seems to be a common opinion among practitioners. Hands-on courses may help practitioners to adopt advances in endodontics into their practice.

Keywords: Dentist, endodontics, materials, North Cyprus, techniques

INTRODUCTION

The ultimate objective of endodontic practice is for patients to retain their natural teeth for function and aesthetics.¹ The success of root canal treatment is related to many factors such as maintaining the original root canal anatomy during and after instrumentation, maintaining the apical constriction shape, achieving sufficient root canal irrigation for cleaning and disinfection, and creating an impermeable fluid-tight seal of the root canal.² A great variety of endodontic equipment, materials and treatment modalities have been proposed and used in endodontic treatment in order to achieve these goals.³ However, endodontic

treatment is one of the most technically challenging clinical procedures and considered an uninteresting procedure for general dentists.⁴

In recent decades, technological advancements in the field of endodontics have allowed dental practitioners to shorten the duration of treatment, to simplify the treatment procedures and to make the treatment outcome more predictable.⁵ Some of these advancements include new-generation Nickel Titanium instruments with torque controlled endodontic motors with adjustable kinematics in different directions, improved apex-locators which are the most reliable tool for working length determination, negative pressure irrigation systems,

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new-generation cone-beam computed tomography devices, and surgical operating microscopes which greatly enhance the clinician's ability to view the tiniest details inside the tooth.³ Also, several techniques and materials have been improved for better and condensed filling of the root canal with apical sealing. Regardless of the techniques and materials used, the European Society of Endodontology have proposed quality guidelines to clarify the standard care in endodontics and these guidelines should be followed by dentists when performing endodontic treatment.⁴

In essence, there are a great number of techniques, instruments, and materials used in endodontic treatment. Additionally, there are numerous dental schools and universities worldwide which give various teaching methods in dentistry.⁶ For these reasons, this current study was carried out to gather information on the materials and methods employed in root canal treatment by dentists in North Cyprus and to find out the opinions of practitioners on their levels of practice and their training needs. In addition, within the scope of this study, it was also hoped to determine whether the years of professional experience of the dentists affected their choice of irrigation solution and canal obturation technique.

MATERIALS AND METHODS

After receiving ethics committee approval from Near East University Ethics Committee (approval number: YDU/45-378), a questionnaire dealing with current endodontic practice was designed to be suitable for our research with the help of previous studies.^{7,8} This questionnaire was distributed to the dental practitioners in North Cyprus who were registered with the Chamber of Turkish Cypriot Dentists. One hundred and seventeen dental practitioners, who were general and specialist dentists, completed the questionnaire. After making appointments with the respondents, all of them were interviewed face-to-face and the questionnaire was filled out by two researchers (A.S., D.K.). The interview between the respondents and the two researchers took at least 20 minutes to fill out the questionnaire. The respondents' names were not recorded in the questionnaire to maintain privacy.

The structured questionnaire comprised 25 questions about the materials and techniques used in the dental clinics for root canal treatment. The first part of the questionnaire contained personal questions about the respondents including gender, years of experience, graduation year, whether they were a general practitioner or a specialist, the name of the university graduated from, and if they were performing root canal treatment or not. The second part included questions about the radiograph techniques used, methods of determining working length, and the use of rubber dams. In the next part, data were collected about the materials and instruments used while performing root canal treatment such as irrigation solutions, root canal medicaments, canal preparation instruments, and Nickel-Titanium (NiTi) systems. Questions regarding root canal obturation materials and techniques were also included in the last part of the questionnaire.

Statistical Analysis

The data was entered into Excel software (Microsoft Corporation, Redmont, WA, USA) and processed with the statistical software IBM SPSS Statistics (version 22.0; IBM Corp., Armonk, NY, USA) using the chi-square test to find out the effect of the years of professional experience (≤ 30 and > 30 years) on the selection of materials and techniques. The significance level was set at $p < 0.05$.

RESULTS

All the 117 respondents completed the questionnaire since the questions were asked face-to-face by the two researchers with a response rate of 100%. Table 1 summarizes the respondents' answers in this survey. Of the respondents, 47% were female and 53% male. Most of the respondents (81.2%) were general dentists whereas the remainder were specialists. A total of 106 of the participants reported performing root canal treatment, representing a rate of 90.6%. Eleven respondents reported that they did not perform root canal treatments in their clinic and they directed their patients to a specialist. These respondents (9.4%) were excluded from the next questions of this survey. Thus, only those participants who reported performing root canal treatment (90.6%) were included when evaluating the responses to questions regarding root canal treatment. However, there was a wide range between the dentists' years of professional experience. Five dentists (4.7%) stated that they had < 5 years of professional experience. The highest percentage of dentists had worked for more than 30 years (53.8%). 9.4% of the dentists had 5-10 professional years, 17% of the dentists had worked for 11-20 years, and 15.1% had 21-30 years in dental practice. However, the years of professional experience were divided into two groups, namely, ≤ 30 years (49 dentists) and > 30 years (57 dentists).

Of the 106 dentists who performed root canal treatment, 88 dentists (83%) stated that they did not use any magnification tools, and 18 dentists (17%) stated that they used a dental loupe while performing root canal treatment. None of the respondents reported using a dental microscope in their practice.

The dentists were asked about the type of periapical radiographs used in their clinics. Of the 106 participants, 45.3% used the RadioVisioGraphy imaging system, 32.1% used conventional periapical radiography, 8.5% stated that they used the phosphor plate imaging system, 1.9% used cone beam computed tomography, while 14.1% reported that they did not use periapical films in their clinics. Of the 106 respondents, 64 dentists (60.3%) stated that they used periapical radiographs for diagnostic purposes before treatment, 42 respondents (39.6%) used them for working length determination, 25 respondents (23.5%) for examining the master cone, and 67 respondents (63.2%) used periapical radiographs after root canal obturation. Fifteen dentists (15.9%) reported that they did not use periapical radiographs while performing root canal treatment. On the other hand, 25 dentists (23.5%) stated that they used periapical radiographs for all root canal treatment steps (diagnosis, working length, master cone, and canal obturation). The respondents were asked about their canal working length determination methods which they used in their practice and 36.8% of them used a digital tactile sense to determine the working length, 18.9% used periapical radiographs, 10.35% used an apex locator, 20.75% used radiograph with apex locator, 9.4% combined radiographs with tactile sense, 2.8% used an apex locator with tactile sense, and 0.9% stated that they combined radiographs with an apex locator and tactile sense.

The responses to the isolation technique questions were as follows; the majority of the dentists replied that they never used rubber dams for isolation and they only used cotton rolls (83%), 14.15% used rubber dams occasionally, while 2.83% always used rubber dams in addition to cotton rolls. All of the dentists used saliva suction during all of their root canal treatments.

Table 1. Summary of the respondents' answers in the survey	
Variable	Number (percent)
1. Gender	
Female	55 (47.01%)
Male	62 (52.99%)
2. Specialty	
General practitioner	95 (81.2%)
Specialist	22 (18.8%)
3. Years of professional experience	
<5	5 (4.7%)
5-10	10 (9.4%)
11-20	18 (17%)
21-30	16 (15.1%)
>30	57 (53.8%)
4. Magnification tools	
Dental loupe	18 (17%)
Not used	88 (83%)
5. The type of periapical radiographs	
RVG	47 (45.3%)
Conventional film	33 (32.1%)
Phosphor plate films	9 (8.5%)
Cone beam computed tomography	2 (1.9%)
Not used	15 (14.1%)
6. The purpose of radiograph	
Diagnosis	64 (60.3%)
Working length determination	42 (39.6%)
Master cone	25 (23.5%)
Root canal obturation	67 (63.2%)
All root canal treatment steps	25 (23.5%)
7. Working length determination methods	
Digital tactile sense	39 (36.8%)
Periapical radiographs	20 (18.9%)
Apex locator	11 (10.35%)
Radiograph with apex locator	22 (20.75%)
Radiograph with tactile sense	10 (9.4%)
Apex locator with tactile sense	3 (2.8%)
Radiographs with apex locator and tactile sense	1 (0.9%)
8. Irrigation solution	
Sodium hypochlorite	44 (41.5%)
Chlorhexidine	23 (21.7%)
Sodium chloride	10 (9.4%)
Combination solutions	29 (27.4%)
9. The reasons for not using NiTi rotary instruments	
Lack of experience	27 (56.4%)
No extra benefits	8 (16.8%)
Fear of complication	7 (14.5%)
The cost	4 (8.5%)
Harmful	2 (4.2%)

Table 1. Continued	
Variable	Number (percent)
10. The frequency of using NiTi instruments	
Until distortion occurred	27 (46.5%)
At most 3 times	18 (31.1%)
4-6 times	11 (18.9%)
Once	2 (3.4%)
11. Root canal sealer	
AH plus	46 (43.4%)
Endomethasone	33 (31.2%)
AH 26 sealer	21 (20.2%)
Calcium hydroxide	6 (5.6%)
12. Obturation technique	
Cold lateral compaction	55 (51.9%)
Single cone	41 (38.7%)
Warm gutta-percha	10 (9.4%)
RVG: RadioVisioGraphy, NiTi: Nickle-Titanium.	

After dividing the experience years into two groups (≤ 30 and >30 years), the chi-square test was applied and it showed that there was a significant association between the years of professional experience and the preferred irrigation solution ($p < 0.05$). In the <5 years group, 40% used a combination of sodium hypochlorite (NaOCl), chlorhexidine (CHX), and ethylenediaminetetraacetic acid (EDTA) for root canal irrigation. Most of the dentists in the 5-10 and the 11-20 professional years' groups used combination solutions for irrigation. The majority of respondents in the 21-30 and the >30 years' groups preferred to use NaOCl alone in endodontic treatment. In general, regardless of the years of professional experience, 41.5% of the participants stated that they used NaOCl alone for root canal irrigation, 21.7%, 27.4%, and 9.4% used CHX alone, combination solutions, and sodium chloride alone, respectively (Table 2).

The majority of respondents (68%) reported using calcium hydroxide as a root canal medicament between sessions, 24.84% placed Cresophene (Cresophene, Septodont Ltd., UK) in the canal as an inter-appointment medicament, 5% of the dentists left the canal empty while 4 practitioners performed the root canal treatment in one session in all cases.

Of all the total 106 participants, 54.7% (58 dentists) used rotary NiTi instruments for root canal preparation. Those dentists who did not use rotary NiTi were asked to indicate their reasons from a list of five options. The most commonly chosen reason was "lack of experience" (56.4%) followed by these reasons respectively; "no extra benefits" (16.8%), "fear of complication" (14.5%), "the cost" (8.5%), and "harmful" (4.2%). The majority of respondents (65%) used the ProTaper Universal NiTi system (Dentsply Maillefer, Ballaigues, Switzerland) when they were asked about the type of NiTi system. The second most common type was the ProTaper Next system (Dentsply Maillefer, Ballaigues, Switzerland) (17%) followed by the Hero Shaper system (Micro Mega, Becacon, France).

The frequency of using NiTi instruments was also investigated in the questionnaire. Twenty-seven dentists stated that they used instruments or the files until distortion occurred, 18 used them at most 3 times, 11 dentists used instruments 4-6 times, and 2 dentists reported using them only once.

The type of endodontic motor was investigated and 51.72% used the electric endomotor with cable in rotation motion, 22.41% used a contra-angle hand-piece attached to the micro-motor, 13.8% used an electric Endomotor with cable in rotation and reciprocal motions, and 8.6% used an electric Endomotor without cable in a rotation motion.

The type of temporary filling used between the sessions was investigated and the majority of the respondents (about 60%) stated that they used Cavit (ESPE America, INC., Norristown, PA, USA) temporary filling. 12.6% used glass ionomer, 9.1% used zinc phosphate, 8.4% filled with zinc oxide eugenol, and 7% used Coltosol F (Coltosol group, Coltène Whaledent, Cuyahoga Falls, OH, USA) as a temporary filling.

Over 43.4% of the respondents used gutta-percha with AH plus sealer (Dentsply DeTrey, Konstanz, Germany) for root canal obturation. Additionally, 31.2% used gutta-percha with Endomethasone (Septodont, Saint-Maur-des-Fossés, France) and about 20.2% replied that they used gutta-percha with AH 26 sealer (Dentsply Maillefer, Ballaigues, Switzerland). 6 dentists reported that they filled the root canal with gutta-percha and calcium hydroxide sealer (Sealapex, Sybron Kerr, Romulus, MI).

According to the chi-square statistical analysis test, there was an association between the years of professional experience (≤ 30 and >30 years) and the preferred canal obturation technique (Cold lateral compaction, Single cone and Warm gutta-percha) ($p < 0.05$). However, in the 11-20 experience years group, 72.2% of the dentists obturated the root canal via the single cone technique. Those practitioners with 21-30 professional years of experience stated that they filled the canals via cold lateral compaction or single cone techniques with rates of 56.3% and 43.8%, respectively. The majority of respondents (66.7%) in the >30 years group filled the canals by the cold lateral compaction technique. In general, regardless of their professional years, the dentists in this survey stated that they performed obturation of the root canals by cold lateral compaction, single cone, and warm gutta-percha techniques

with rates of 51.9%, 38.7%, and 9.4%, respectively (Table 3). Most of the practitioners who used warm techniques stated that they used the Thermafil system. The Obtura, MicroSeal, vertical compaction, and lateral compaction techniques were rarely used.

DISCUSSION

The purpose of this study was to evaluate the selection and preference of the instruments, materials, and methods used during root canal treatment by dentists in North Cyprus and to determine whether the years of professional experience affected the choice of canal irrigation solution and obturation techniques. One of the factors which enhances the validity of this survey is that all or most of the respondents answered the questionnaire. In this study, all the respondents completed the questionnaire since they were asked face-to-face. This is in contrast to previous studies in which the questionnaires were sent by mail to the respondents and low response rates were reported.^{7,9} In one recent study, it was reported that a long questionnaire could decrease the response rate by the respondents.¹⁰ Therefore, we tried to make our questionnaire about the endodontic treatment as short and comprehensive as possible.

The results of the first part of our questionnaire showed that 47% of the respondents were female and 53% male, which are close to each other. In 2012, Unal et al.¹¹ reported that the percentage of male and female dentists were close to each other in Turkey. The majority of the respondents (90.6%) stated that they performed endodontic treatment in their practice, which was considered to be a high percentage. The questions about root canal treatment were asked only to those dentists who performed this procedure and the response rates are according to their replies.

In the literature, a comparison between the outcomes of root canal treatment with or without magnification was made, however, it was challenging due to many confounding factors.¹² Several studies supported that using magnification during endodontic treatment

Table 2. The preferred irrigation solution with respect to years of experience

Years in the profession	Irrigation solution			
	Sodium hypochlorite	Chlorhexidine	Combination (NaOCl + CHX + EDTA)	Sodium chloride
<5 years	1 (20%)	2 (40%)	2 (40%)	0 (0%)
5-10 years	0 (0%)	3 (30%)	7 (70%)	0 (0%)
11-20 years	3 (16.7%)	5 (27.8%)	10 (55.6%)	0 (0%)
21-30 years	7 (43.8%)	3 (18.8%)	2 (12.5%)	4 (25%)
>30 years	33 (57.9%)	10 (17.5%)	8 (14%)	6 (10.5%)
Total	44 (41.5%)	23 (21.7%)	29 (27.4%)	10 (9.4%)

NaOCl: sodium hypochlorite, CHX: chlorhexidine, EDTA: ethylenediaminetetraacetic acid.

Table 3. The preferred obturation technique with respect to years of experience

Years in the profession	Obturation technique		
	Cold lateral compaction	Single cone	Warm gutta-percha
<5 years	0 (0%)	3 (60%)	2 (40%)
5-10 years	3 (30%)	2 (20%)	5 (50%)
11-20 years	5 (27.8%)	13 (72.2%)	0 (0%)
21-30 years	9 (56.3%)	7 (43.8%)	0 (0%)
>30 years	38 (66.7%)	16 (28.1%)	3 (5.3%)
Total	55 (51.9%)	41 (38.7%)	10 (9.4%)

enhanced treatment outcomes.¹³⁻¹⁵ However, in this study, only 18 respondents (17%) stated that they used a dental loupe while performing root canal treatment. Eighty-eight dentists (83%) did not use any magnification tool during endodontic treatment.

In addition to factors such as knowledge and skills, the ability to obtain accurate radiographs is critical for successful root canal treatment. Good radiographs serve the dentists during diagnosis, treatment, and follow-up.¹⁶ In endodontics, the periapical radiograph is important before, during, and after root canal treatment. The results of this study showed that 15 respondents (14.1%) did not use any type of periapical radiographs in their practice. The remainder stated that they used periapical radiographs in different stages of the treatment. Only 25 dentists (23.5%) stated that they used periapical radiographs in all stages of the treatment, namely, for diagnosis, working length determination, master cone examination, and root canal filling.

Accurately determining working length is the key factor in the success of root canal treatment. Accurately observing the working length determines the end point of the canal preparation and filling.¹⁷ Among the most common methods of determining the working length are the radial methods and electronic methods. There are other methods such as paper point measurements, apical periodontal sensitivity and digital tactile sense, but they are imprecise and liable to significant intra-subject differences.¹⁸ According to our data, 0.9% stated that they used a combination of radiographs with apex locator and digital tactile sense to determine the working length, which is considered a low percentage when compared to previous studies.^{8,19}

Especially during endodontic treatment, the rubber dam is an ideal instrument for the isolation of teeth and a standard of care in dentistry.⁴ In addition to isolation from oral and salivary contamination, the rubber dam has many advantages such as patient protection by preventing inhalation or ingestion of endodontic instruments, preventing the soft tissues from retracting, and cross-infection prevention between the dentist and patient. Although the rubber dam has many advantages, using it for isolation during endodontic treatment in dental practice is still not accepted in many countries.²⁰ The drawbacks of using the rubber dam include it being a time-consuming process, challenges in placement techniques, insufficient experience and training of the practitioner, and the cost of the rubber dam's equipment and materials.²¹ In addition, patient discomfort and rejection have been considered as other drawbacks of using the rubber dam.²² Unfortunately, 83% of the dentists replied that they never used rubber dams for isolation during root canal treatment. Previously, a survey carried out in Turkey showed that >70% of the participants had never used rubber dams during root canal treatment while 1.5% of dentists stated that they used it always in their dental practice.⁷ However, only 14.1% of the respondents in our study reported that they used the rubber dam occasionally.

Regardless of the concentrations, EDTA and NaOCl are considered the most important irrigation solutions in endodontic treatment because of their effects on lubrication, debridement, microbe destruction, and the dissolution of tissues as well as smear layer removal.²³ CHX digluconate is widely used in disinfection due to its high antibacterial activity against *Enterococcus faecalis*.²⁴ The results of this study showed that there was an association between years of professional experience and the preferred irrigation solution. 41.5% of the participants stated that they used NaOCl alone for root canal irrigation, 21.7%, 27.4%, and 9.4%

used CHX alone, combination solutions, or NaOCl alone, respectively. The most frequently used irrigation solution in this survey was NaOCl which is in agreement with other reports in the literature.^{9,19,25}

In the present study, the majority of respondents reported using calcium hydroxide as a root canal medicament between sessions, and 24.8% placed cresophene in the canal as an inter-appointment medicament. Raouf et al.⁸ stated that the most used intra-canal medicament was calcium hydroxide, which is in agreement with the results of this survey. Using an inter-appointment medicament after root canal preparation and irrigation has been shown to improve disinfection significantly.²⁶ One of the most commonly used intra-canal medicaments is calcium hydroxide. Calcium hydroxide had many advantages such as its antibacterial properties and its ability to dissolve tissue.^{27,28} However, about 5% of the dentists stated that they did not use any medicament in the canal between sessions.

Rotary NiTi instruments have been developed in the field of endodontic treatment due to the super-elasticity of this alloy, which is superior to other traditional stainless-steel instruments. This attribute made them the preferred materials for preparing and shaping curved root canals.²⁹ The manufacture of rotary NiTi endodontic instruments has been developed with different chemical compositions and geometrical designs.³⁰ However, one of the main disadvantages of NiTi rotary instruments is their sudden breakage during endodontic treatment. Therefore, in order to optimize their flexibility and microstructure, NiTi endodontic tools were improved via several mechanical and thermal treatment technologies.³⁰ In the present survey, root canal preparation was performed using rotary NiTi instruments by 54.7% of the respondents. Elham and Sedigheh³¹ reported that 50.1% of their respondents used NiTi rotary system, which is similar to our result, while Parashos and Messer³² stated that 26% used rotary NiTi files. In the present survey, the reasons for not using these files given by the other dentists were "lack of experience" (56.4%), "no extra benefits" (16.8%), "fear of complication" (14.5%), "the cost" (8.5%), and "harmful" (4.2%). The most commonly used NiTi system was the ProTaper Universal NiTi system, followed by the ProTaper Next system. 46.5% of the respondents stated that they used the NiTi instrument until distortion occurred. 31.1% used the files at most 3 times and 3.4% stated that they used them only once.

In multiple-visit root canal treatment, using an effective temporary filling between sessions is considered essential. This temporary filling material in the time between sessions should seal the tooth, prevent leakage of bacteria, microorganism, and fluids to the canal from the oral cavity, and prevent the escape of medicaments from the canal to the oral cavity.³³ The type of temporary filling used between sessions was investigated and Cavit was the top choice for temporary restorative materials (60% of respondents), which is in agreement with a previous study.³⁴

Various core materials and sealers have been introduced as root canal fillings. The materials used should be biocompatible, prevent leakage, prevent re-infection, be easily adaptable to the canal wall, be easy-to-use, and also be radiopaque.³⁵ Several obturation techniques, including cold lateral compaction, single cone, and thermoplasticized injectable techniques have been introduced in an attempt to improve the hermetic filling of the root canal with the apical seal.³⁵ Over 43% of the respondents in this study used gutta-percha with AH plus sealer for root canal obturation. 31.2% used gutta-percha with endomethasone

and 18.9% replied that they used gutta-percha with AH 26 sealer. Thus, the most preferred sealer was a resin-based sealer, which is consistent with a study carried out in 2014 in Iran,⁸ and with another study in 2008 in the United States.³⁴ In this study, according to a chi-square statistical analysis test, there was an association between the years of professional experience and the preferred canal obturation technique. The dentists in this survey stated that they performed obturation of the root canal by cold lateral compaction, single cone, and warm gutta-percha techniques with rates of 51.9%, 38.7%, and 9.4%, respectively. This is in agreement with the results of another recent study.¹¹ Most of the practitioners who used warm techniques stated that they used the Thermafil system for root canal obturation.

MAIN POINTS

- The results of this study demonstrate that the majority of respondents did not use any magnification tools or rubber-dam during endodontic practice.
- About half of respondents reported using NiTi rotary files for root canal preparation. In addition, half of them used NaOCl solution alone for canal irrigation.
- It seems that the need for endodontic training after graduation is agreed upon among the participants. Hands-on courses may allow dentists to adopt advances in endodontics into their practice.

ETHICS

Ethics Committee Approval: The study protocol was approved by the Ethics Committee of Near East University (approval number: 2018-07).

Informed Consent: It was obtained.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: A.S., D.K., U.A., Design: M.A., U.A., Supervision: M.A., U.A., Fundings: U.A., Materials: U.A., Data Collection and/or Processing: A.S., D.K., U.A., Analysis and/or Interpretation: A.S., D.K., U.A., Literature Search: A.S., D.K., U.A., Writing: M.A., U.A., Critical Review: M.A., U.A.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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