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Original Article

Endodontic Practice in Northern Cyprus: A Questionnaire Survey Study

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Abstract

Background/Aims: Many equipment and materials have been introduced to improve the endodontic treatment outcomes and shorten the treatment time. This study aimed to gather information on the materials and methods employed in root canal treatment by dentists in Northern Cyprus.

Material and Methods: A questionnaire dealing with endodontic practice was designed and distributed to the dentists in Northern Cyprus. One hundred 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 seventeen respondents completed the questionnaire and 47 % were female and 53 % male. There was a wide range between the dentists' professional experience years. 14.1 % of them reported that they did not use periapical films in their clinics. The majority of dentists replied that they never used a rubber dam (83 %). There was an association between years of professional experience with the preferred irrigation solution ($P < 0.05$). For root canal preparation, 54.7 % stated using rotary NiTi instruments. There was an association between years of professional experience with the preferred canal obturation technique ($P < 0.05$).

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

Keywords: Dentist, Endodontics, Materials, Northern Cyprus, Techniques

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Introduction

The ultimate objective of endodontic practice is for patients to retain their natural teeth in 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, sufficient root canal irrigation for cleaning and disinfection, and 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 this goal (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, the technological advancements in the field of endodontics, have allowed dental practitioners to shorten the duration of treatment, simplify the treatment procedures and make the treatment outcome more predictable (5). Some of these advancements include new-generation Nickel Titanium instruments for 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, new-generation cone-beam computed tomography devices, and surgical operating microscopes that greatly enhances 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 technique and materials used, the European Society of Endodontology (ESE) proposed quality guidelines to clarify the standard care in endodontics and these guidelines should be followed by the dentists when performing the endodontic treatment (4).

In one word, there is a large count of techniques, instruments, and materials used in endodontic treatment. On the other hand, there are lots of dental schools and universities

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worldwide that give various teaching methods in dentistry (6). For these reasons, this study was carried out to gather information on the materials and methods employed in root canal treatment by dentists in Northern Cyprus and to find out the opinions of practitioners on their levels of practice and their training needs. In addition, the scope of the study was also to determine whether the years of professional experience affected the choice of irrigation solution and canal obturation technique.

Materials and Methods

After receiving ethics committee approval from Near East University (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 Northern Cyprus who were registered to the Chamber of Turkish Cypriot Dentists. One hundred seventeen dental practitioners, who were general and specialist dentists, completed the questionnaire. After making an appointment with the respondents, all of them were asked face to face and the questionnaire was filled by two researchers (AS, DK). The interview between the respondents and the two researchers took at least 20 minutes to fill 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, experience years, graduation year, general practitioner or specialist, the name of the university that was graduated from, and if performing root canal treatment or not. The second part included questions about the used radiograph techniques, determination working length methods, and using the rubber dam. 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 Nickle-Titanium (NiTi) systems. Questions regarding root canal obturation materials and techniques were also included in the last part of the questionnaire.

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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 remainders 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 the patients to a specialist. These respondents (9.4 %) were excluded from the next questions of this survey. Thus, only the participants that reported performing root canal treatment (90.6 %) were included when evaluating the responses about root canal treatment. However, there was a wide range between the dentists' professional experience years in which, 5 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 dentists had 5-10 professional years, 17 % of 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, ≤ 30 years (49 dentists) and > 30 years (57 dentists).

Of the 106 dentists, 88 dentists (83 %) stated that they did not use any of the magnification tools, and 18 dentists (17 %) stated that they used a dental loupe while performing root canal treatment. No one of the respondents reported using a dental microscope in the practice.

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The dentists were asked about the type of periapical radiographs used in their clinics. Of the 106 participants, 45.3 % used The RadioVisioGraphy (RVG) imaging system, 32.1 % used conventional periapical radiography, 8.5 % stated that they used 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 diagnosis propose before the 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 using periapical radiographs for all root canal treatment steps (diagnosis, working length, master cone, and canal obturation). The respondents were asked about the canal working length determination methods that they used in the practice and 36.8 % of them used a digital tactile sense to determine the working length, 18.9 % used periapical radiographs, 10.35 % used the apex locator, 20.75 % used radiograph with apex locator, 9.4 % combined radiographs with tactile sense, 2.8 % apex locator with tactile sense, and 0.9 % stated that they combined radiographs with apex locator and tactile sense.

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

After dividing the experience years into two groups (≤ 30 and > 30 years), Chi-square test was applied and showed that there was a significant association between the years of professional experience with the preferred irrigation solution ($P < 0.05$). However, in < 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 5-10 and 11-20 professional years' groups used combination solutions for irrigation. The majority of

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respondents in 21-30 and > 30 years' groups preferred to use sodium hypochlorite alone in endodontic treatment. In general, regardless of the professional experience years, 41.5 % of the participants stated using sodium hypochlorite alone for root canal irrigation, 21.7 %, 27.4 %, and 9.4 % used chlorhexidine 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 the 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 all cases in one session.

Of all the total 106 participants, 54.7 % (58 dentists) used rotary NiTi instruments for root canal preparation. Dentists who did not use rotary NiTi were asked to indicate the reasons from a list of five options. The most 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 ProTaper Universal NiTi system (Dentsply Maillefer, Ballaigues, Switzerland) when they were asked about the type of NiTi system. The second type was ProTaper Next system (Dentsply Maillefer, Ballaigues, Switzerland) (17 %) followed by Hero Shaper system (Micro Mega, Becacon, France).

The frequency of using NiTi instruments was also asked in the questionnaire. 27 dentists stated using the instrument or the file until distortion occurred, 18 used them at most 3 times, 11 dentists used the instruments 4-6 times, and 2 dentists reported using them only once.

The type of endodontic motor was asked and 51.72 % used electric Endomotor with cable in rotation motion, 22.41 % used contra-angle handpiece attached to the micromotor, 13.8 % electric Endomotor with cable in rotation and reciprocal motions, and 8.6 % electric Endomotor without cable in a rotation motion.

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The type of temporary filling that used between the sessions was asked and the majority of the respondents (about 60 %) stated using 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. Moreover, 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) with 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 by a single cone technique. The practitioners with 21-30 professional years stated filling the canals by cold lateral compaction and single cone techniques with rates of 56.3 % and 43.8 %, respectively. The majority of respondents (66.7 %) in > 30 years group filled the canals by cold lateral compaction technique. In general, regardless of the professional years, the dentists in this survey stated obturation 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 using thermafil system. Obtura, microseal, vertical compaction, and lateral compaction techniques were rarely used.

Discussion

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The current study was aimed to evaluate the selection and preference of the instruments, materials, and methods used during root canal treatment by dentists in Northern Cyprus and to determine whether the years of professional experience affected the choice of canal irrigation solution and obturation technique. One of the factors that make the survey succeed is that all or most of the respondents answer 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 the low response rates were reported (7, 9). In a recent study, it was reported that the long questionnaire could decrease the response rate by the respondents (10). Therefore, we tried to make the survey in this study short and comprehensive about the endodontic treatment as much as possible.

The results of the first part of our questionnaire showed that 47 % of the respondents were female and 53 % male whereas close to each other. In 2012, Unal et al. (11) reported that the percent 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 the practice which considered a high percent. The questions about root canal treatment were asked only to those dentists and the response rates were according to their replies.

In the literature, a comparison between the outcomes of root canal treatment with or without magnification was made and it was challenging due to many confounding factors (12). However, several studies supported that using magnification during endodontic treatment enhanced the treatment outcomes (13-15). In this study, only 18 respondents (17%) stated that they used dental loupe while performing root canal treatment. Eighty-eight dentists (83%) did not use any magnification tool during endodontic treatment.

In addition to the 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

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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 the practice. The remainders stated using periapical radiographs in different types. However, only 25 dentists (23.5 %) stated that they used periapical radiographs for diagnosis, working length determination, master cone examination, and root canal filling.

Accurate working length determination is a crucial part of successful endodontic treatment. Determining the working length accurately decides the apical end-point for the instrumentation and obturation (17). The most common methods for working length determination are radiographic methods and electronic methods. Other methods like digital tactile sense, apical periodontal sensitivity, and paper point measurements have also been used, but are unreliable and subjected to marked intra-subject differences (18). According to the existing data, 0.9 % stated using 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).

The rubber dam has been an ideal tool for tooth isolation and a standard of care in dentistry, especially during endodontic treatments (4). Besides the 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 retracting, and cross-infection preventing between the dentist and patient. Despite these advantages, rubber dam isolation during root canal treatment is still not adopted in dental practice in many countries (20). The major drawbacks of using rubber dam include challenging placement techniques, time-consuming, lack of training during undergraduate training, and cost of equipment and materials (21). In addition, patient discomfort and rejection have been considered as a drawback for using rubber dam (22). Unfortunately, 83 % of the dentists replied that they never used a rubber dam for isolation during root canal treatment. Previously, a survey was carried out in Turkey showed that more than 70 % of the respondents stated that they never used rubber dam during endodontic

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treatment while 1.5% replied that they always used it (7). However, only 14.1 % of the respondents in this study reported using the rubber dam occasionally.

NaOCl and EDTA in different concentrations are the most preferred root canal irrigants to provide debridement, lubrication, and destruction of microbes and dissolution of tissues as well as smear layer removal (23). Throughout irrigation, radicular and coronal dentin sections are exposed to solutions deposited in the pulp chamber. Proper chemical preparation may contribute to the survival of endodontically treated teeth and the success of endodontic treatment. Chlorhexidine 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 with the preferred irrigation solution. However, 41.5 % of the participants stated using NaOCl alone for root canal irrigation, 21.7 %, 27.4 %, and 9.4 % used CHX alone, combination solutions, and NaOCl alone, respectively. The most frequently used irrigant in this survey was sodium hypochlorite 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 the sessions, and 24.8 % placed cresophene in the canal as an inter-appointment medicament. Raoof et al. (8) stated that the most used intracanal medicament was calcium hydroxide which is in agreement with the results of this survey. The use of an inter-appointment medicament has been shown to significantly improve disinfection after chemomechanical procedures (26). Calcium hydroxide is a commonly used intracanal medicament. It possesses several advantages such as tissue dissolving ability and antibacterial properties (27, 28). However, about 5 % of the dentists stated that they did not use any medicament in the canal between the sessions.

Rotary NiTi instruments were introduced to the endodontic field because of their superelastic behavior over traditional stainless-steel instruments. This made them the materials of

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choice for the shaping of curved root canals (29). Manufacturing of rotary NiTi endodontic instruments with different geometrical designs and chemical compositions have been developed (30). However, sudden fracture of NiTi rotary files during root canal therapy remains a tremendous problem in the clinical aspect. Thus, recently, NiTi endodontic files were fabricated by various thermal and mechanical treatment technologies to optimize their microstructure and flexibility compared to the traditional NiTi files (30). In the present survey, root canal preparation was performed using rotary NiTi instruments by 54.7 % of the respondents. Elham and Sedigheh (31) reported that 50.1 % of the respondents used NiTi rotary system which is similar to our result, while Parashos and Messer (32) stated that 26 % used rotary NiTi files. In the present survey, the reasons for not using these files 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 used NiTi system was ProTaper Universal NiTi system followed by ProTaper Next system. However, 46.5 % of the respondents stated using the NiTi instrument until distortion occurred. 31.1 % used the files at most 3 times and 3.4 % stated using them only one time.

The use of an efficient temporary restoration between sessions of multiple-visit root canal treatment is irrefutable. During this time interval, these temporary filling materials must seal the tooth, preventing the entry of bacteria, fluids and organic materials from the oral cavity to the root canal system and at the same time prevent the escape of medicaments placed in the pulp chamber and/or the root canal system (33). The type of temporary filling that used between the sessions was asked 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 filling. The materials used should be biocompatible, prevents leakage, prevent re-infection, easily adaptable to the canal wall, easy to use, and 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 apical seal (35). Over 43 % of the

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respondents in this study used gutta-percha with AH plus sealer for root canal obturation. 31.2 % used gutta-percha with endomethasone and approximately 18.9 % replied that they used gutta-percha with AH 26 sealer. Thus, the most preferred sealer was 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 the Chi-square statistical analysis test, there was an association between years of professional experience with the preferred canal obturation technique. However, the dentists in this survey stated obturation 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. This is in agreement with the results of a recent study (11). Most of the practitioners who used warm techniques stated using thermafil system for root canal obturation.

Author Disclosure Statement

No competing financial interests exist.

Main Points

- The results of this study demonstrate that the majority of respondents did not use any magnification tools or rubber-dam in endodontic practice.
- About half of respondents reported using NiTi rotary files for root canal preparation. In addition, half of them used sodium hypochlorite solution alone for canal irrigation.
- The need for endodontic training after graduation seemed to be a common opinion among practitioners. Hands-on courses may help practitioners to adopt the advances in endodontics to their practice.

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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 of 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 %)
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 %)

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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 %)

Table 2. The preferred irrigation solution regarding experience years.

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

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Table 3. The preferred obturation technique regarding experience years.

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%)

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