

Evaluation of dentists' approach to retreatment in Turkey: A survey study

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Abstract

Aim: This study aimed to evaluate the approaches that dentists working in Turkey take to retreatment.

Methods: A questionnaire with 16 questions regarding gender, institution, specialty, experience, and root canal treatment stages was distributed to 223 dentists. The collected questionnaires were analyzed in R 4.0.0 programming language. A chi-square test analyzed the categorical variables. The statistical analyses were performed at a 5% significance level.

Results: A statistically significant relationship was found between the years spent practicing dentistry and the methods of determining the length of root canal treatment ($p < 0.05$). The relationship between the choices of irrigation agents for canal treatment and the professional title was found to be statistically significant ($p < 0.05$). No significant relationship was found between gender and other parameters ($p > 0.05$). A statistically significant difference was found between the treatment protocol applied in molar teeth with lesions, the success rate of the patients who underwent retreatment, and the practitioners' specializations ($p < 0.05$). The relationship between retreatment in unsuccessful root canal treatments and the institution studied was also statistically significant ($p < 0.05$). A total of 66% of dentists working in Oral and Dental Health Center, 88% of dentists working in private clinics, and 90% of dentists working at universities reported that they performed retreatment. The relationships among the frequency of endodontic treatment, the use of magnification while performing root canal treatment, the group of teeth that was most often treated, and the institutions in which dentists work were also found to be statistically significant.

Conclusion: In this survey study, which was conducted to evaluate the practice of endodontic treatment, the rate of dentists performing endodontic treatments was found to have increased. Endodontists performed retreatment cases at a higher rate than general practitioners. Dentists with less professional experience had higher rates of endodontic treatment for difficult-to-treat molars than those with more professional experience.

Keywords: Retreatment, endodontics, endodontics practice, survey

Introduction

Endodontic treatment is applied to prevent tooth loss by curing root canal pathologies through the elimination of microorganisms in root canals (1). Successful endodontic treatment is achieved by cleaning the root canal system of necrotic and infected pulp tissues, eliminating existing microorganisms, and filling the root canal system three-dimensionally and hermetically to prevent reinfection (2). Despite endodontic treatment having a 90% success rate, failures can occur (3). If endodontic treatment is unsuccessful, the root canal filling is renewed (4). This process is called retreatment, the renewal of treatment, or revision (5). Its success and failure are determined by examining radiographic and clinical findings (6). The conditions that requires retreatment typically consist of microbial infection caused by inadequate endodontic treatment, the orthograde reinfection of root canals (7), the ineffective cleaning or insufficient filling of root canals (8), and unsuccessful apical resection cases (9).

The factors reducing the success rate of retreatment are as follows: perforations occurring in the root canal, step formation, instrument fractures, external root resorptions, patient compliance, dentist's level of knowledge, the ability of the dentist performing the treatment, and cast restorations that may cause too much damage to the tooth in case of removal. Although old, incomplete canal fillings can easily be removed, the removal of an overfilled root canal is so difficult that surgical intervention may be necessary. When there is too much damage or caries for a tooth to be restored or poor periodontal prognosis, the success rate of retreatment decreases which may lead to the tooth extraction. The success rate of retreatment also decreases in teeth with calcified, curved roots (10).

In two studies comparing general practitioners and endodontists, Eriksen (11) and Weiger et al. (12) found that the success rates of endodontists performing root canal treatment were higher. Studies have evaluated the preferences of dentists working in Turkey in endodontic treatment and the effect of demographic characteristics on these preferences. In 2012, Unal et al. (13) and Kaptan et al. (14) conducted cross-sectional studies across Turkey and in 2015, Demir et al. (15) conducted a cross-sectional study in Gaziantep.

This study aimed to evaluate the approach to retreatment among dentists working in Turkey.

Materials and Methods

Ethics committee approval was granted by the Dicle University, Faculty of Dentistry, Research Ethics Committee on January 29, 2020, with protocol number 2020-3. The survey questions were prepared on an internet platform providing a survey service (Google Forms). The link providing access to the created form was shared between March 2020 and April 2020 on various social platforms that dentists frequent.

A total of 223 dentists participated in the study. The study participants were 58.3% male and 41.7% female. A total of 39% of participants had 5 years or less experience, 23.8% had 6-10 years of experience, 14.8% had 11-16 years of experience, and 22.4% had 16 years or more experience. A total of 13.9% worked in a university hospital, 31.8% worked in Oral and dental health center (ODHC) and 54.3% worked in a private clinic. A total of 78.4% were general practitioners, 9% were endodontists, and 12.6% worked in other specialties (Table 1).

Table 1. Distribution of gender, experience, institution, and professional title of dentists who participated in the study

	% (n)	Total
Gender		
Male	58.3	130
Female	41.7	93
Professional experience		
0-5 years	39	87
6-10 years	23.8	53
11-15 years	14.8	33
16+ years	22.4	50
Institution		
University hospital	13.9	31
Oral and dental health center	31.8	71
Private clinic	54.3	121
Professional title		
General practitioner	78.4	175
Endodontist	9	20
Other specialization	12.6	28

Information was collected about the materials and devices dentists used in endodontic treatment and retreatment in Turkey, and their perspectives were evaluated.

In the first part of the questionnaire, dentists' were asked questions about their demographics, such as experience, gender, workplace, and title. In the second part, dentists were asked how often they performed root canal treatment and how they determined how long it took. They were also asked other treatment related questions such as whether they used augmentation during treatment, which irrigation agents they used, and which group of teeth they treated. The participants were then asked about the success rates of the retreatment they performed (Table 2).

Table 2. Distribution of gender, experience, institution, and professional title of dentists who participated in the study

SURVEY QUESTIONS	
1. How many years have you been working as a dentist?	a. 0-5 years b. 6-10 years c. 11-15 years d. 16+ years
2. What is your sex?	a. Female b. Male
3. In which type of institution do you work?	a. Private clinic b. Oral and dental health center c. University hospital
4. What is your title?	a. General practitioner b. Endodontist c. Other specialization
5. How often do you perform endodontic treatment?	a. 1-5 per month b. 6-20 per month c. 21-40 per month d. 50 or more per month
6. How do you determine the working length in root canal treatment?	a. With radiography b. With hand sensitivity c. With an electronic apex locator d. With radiography and an electronic apex locator
7. Do you use magnification when performing root canal treatment?	a. Yes b. No
8. Which group of teeth do you mostly treat?	a. Incisors b. Premolar teeth c. Molar teeth
9. Which of the following do you use as an irrigation agent while performing root canal treatment?	a. NaOCl b. EDTA c. Chlorhexidine d. Distilled water
10. What types of failure do you see with root canal treatment?	a. Pain that does not go away b. Swelling c. Tool fracture d. Short/overfilled root canal treatment
11. Do you provide retreatment following unsuccessful root canal treatments?	a. Yes b. No
12. If you do provide retreatment, in which situations do you provide it?	a. Short filled root canal treatment b. Overfilled root canal treatment c. Patients whose pain does not go away despite ideal root canal treatment d. Teeth where lesions have developed without pain and have been detected by the dentist

13. On which group of teeth do you provide retreatment?

- a. Incisors
- b. Premolar teeth
- c. Molar teeth

14. What is your treatment protocol for root canals on filled incisive and premolar teeth with lesions?

- a. Extraction
- b. Apical resection
- c. Retreatment

15. What is your treatment protocol for root canals on filled molar teeth with lesions?

- a. Extraction
- b. Apical resection
- c. Retreatment

16. What is your success rate with patients who have undergone retreatment?

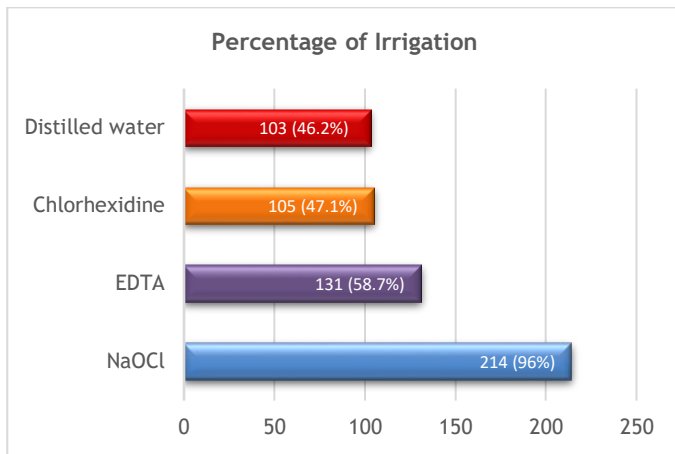
- a. 0-20%
- b. 21-40%
- c. 41-60%
- d. 61-80%
- e. 81-100%

Data analysis was conducted using the R 4.0.0 program (Auckland, New Zealand) with car, tidyverse, gdata, and plyr libraries. Categorical data were evaluated using the chi-square test. The probability level for statistical significance was determined as $\alpha = 0.05$

Results

Gender had no statistically significant effect of on the responses ($p > 0.05$). The effect of professional experience was found to be statistically significant in the responses to the questions, “How do you determine the working length in root canal treatment?” and “Do you use magnification when performing root canal treatment?” ($p < 0.05$).

The relationship between the questions “How often do you perform endodontic treatment?” and “Which of the following do you use as an irrigation agent when performing root canal treatment?” and professional title was found to be statistically significant ($p < 0.05$) (Tables 3 and 5). Fifty-one percent of general practitioners (GP), 70% of endodontists, and 3% of dentists in other specialties stated that they performed 50 or more endodontic treatments per month. While endodontists indicated that they did not prefer using distilled water, chlorhexidine, or NaOCl alone, or using EDTA and distilled water together, EDTA and chlorhexidine together, or NaOCl and distilled water together as irrigation agents, it was determined that general practitioners used all of these agents alone. Eighty percent of endodontists reported that they used all four agents—NaOCl, EDTA, chlorhexidine, and distilled water—in combination. In addition, participants answered the question, “Which of the following do you use as irrigation agents when performing root canal treatment?” as NaOCl (96%), EDTA (58.7%), chlorhexidine (47.1%), and distilled water (46.2%) (Fig. 1).

Figure 1. Percentages of irrigation agents used.

A statistically significant difference was found between the responses to the questions, “What is your

treatment protocol in molar teeth with lesions?” and “What is your success rate with patients who have undergone retreatment?” and professional title ($p < 0.05$). While 100% of the endodontists answered as retreatment, 58% of the practitioners gave the answer as retreatment and 41% as the extraction. The success rate of endodontists in patients who underwent retreatment was found to be higher than that of general practitioners (Table 4). The correlation between responses to the question “Which of the following do you use as an irrigation agent while performing root canal treatment?” and responses to the question about the institution where they work was statistically significant ($p < 0.05$); 42% of dentists working in Oral and Dental Health Center stated that they used NaOCl (alone or together with other irrigants), while 35% of dentists working in private clinics and 48% of dentists working in universities stated that they used any combination of NaOCl, EDTA, distilled water, and chlorhexidine (Table 5).

Table 3. The relationship between professional title and the frequency of endodontic treatment

	GP		Endodontist		Other		p
	%	Value	%	Value	%	Value	
How often do you perform endodontic treatment?							
1-5 per month	0.13	24	0	0	0.35	10	0.00002
6-20 per month	0.3	53	0.05	1	0.46	13	
21-40 per month	0.25	44	0.25	5	0.14	4	
50 or more per month	0.29	51	0.7	14	0.03	1	

Table 4. The relationship between professional title, treatment protocol in teeth with lesions, and retreatment success rate

	GP		Endodontist		Other		p
	%	Value	%	Value	%	Value	
What is your treatment protocol for root canals on filled incisive and premolar teeth with lesions?							0.15
Extraction	0.12	21	0.05	1	0.21	6	
Apical resection	0.09	17	0	0	0.14	4	
Retreatment	0.78	136	0.95	19	0.64	18	
What is your treatment protocol for root canals on filled molar teeth with lesions?							0.0003
Extraction	0	0	0	0	0.03	1	
Apical resection	0.41	72	0	0	0.33	9	
Retreatment	0.58	102	1	20	0.62	17	
What is your success rate with patients who have undergone retreatment?							0.03
0-20%	0.03	5	0	0	0.14	3	
21-40%	0.08	11	0	0	0.09	2	
41-60%	0.33	45	0.15	3	0.38	8	
61-80%	0.37	51	0.3	6	0.28	6	
81-100%	0.17	24	0.55	11	0.09	2	

Table 5. Relationship between the irrigation agent used and the dentist's professional title and institutional affiliation

	GP		Endodontist		Other		p	ODHC		PC		University		p
Which ones do you use as an irrigation agent while performing root canal treatment?	%	Value	%	Value	%	Value		%	Value	%	Value	%	Value	
Distilled water	0.01	2	0	0	0	0	0.02	0	0	0.01	2	0	0	0.05
EDTA, Distilled water	0.005	1	0	0	0	0		0	0	0.008	1	0	0	
EDTA, Chlorhexidine	0.01	2	0	0	0	0		0	0	0.008	1	0.03	1	
Chlorhexidine	0.02	4	0	0	0	0		0	0	0.03	4	0	0	
NaOCl	0.32	57	0	0	0.32	9		0.42	30	0.23	29	0.22	7	
NaOCl, Distilled water	0.04	7	0	0	0.07	2		0.02	2	0.04	5	0.06	2	
NaOCl, EDTA	0.09	17	0.05	1	0.10	3		0.16	12	0.07	9	0	0	
NaOCl, EDTA, Distilled water	0.06	12	0.1	2	0.17	5		0.08	6	0.08	10	0.09	3	
NaOCl, EDTA, Chlorhexidine	0.08	15	0.05	1	0.14	4		0.07	5	0.11	14	0.06	2	
NaOCl, EDTA, Chlorhexidine, Distilled water	0.27	47	0.8	16	0.14	4		0.12	9	0.35	43	0.48	15	
NaOCl, Chlorhexidine	0.03	6	0	0	0	0		0.07	5	0.008	1	0	0	
NaOCl, Chlorhexidine, Distilled water	0.02	4	0	0	0.03	1		0.02	2	0.01	2	0.03	1	

The relationship between the answer to the question “If you are performing retreatment, in which situations do you perform it?” and the dentist's professional title was found to be statistically significant ($p < 0.05$). While the rate of retreatment was 70% for endodontists, it was only 11% for general practitioners in all cases involving short canals, overfilled canals, patients whose pain does not go away despite the performance of the ideal canal treatment, and teeth with a lesion detected by the dentist without pain, which were among the answers to the question (Table 6). The relationship between the answer to the question “If you are performing retreatment, in which situations do you perform it?” and the dentist's institutional affiliation was also found to be statistically significant ($p < 0.05$).

Fourteen percent of the dentists working in Oral and Dental Health Center, 14% of those working in private clinics, and 39% of those working at universities had cases involving short canals, overfilled canals, patients whose pain did not go away despite the performance of the ideal root canal treatment, and patients who had no pain but developed a lesion detected by the dentist (Table 6). The relationship between the answer to the question “Do you perform retreatment after an unsuccessful root canal treatment?” and the dentist's institutional affiliation was also statistically significant ($p < 0.05$); 66% of the dentists working in Oral and Dental Health Center, 88% of those working in private clinics (PC), and 90% of those working at universities answered “yes” to the question (Table 7).

Table 6. Relationship between the dentist's professional title and institutional affiliation and the cases in which retreatment was performed

	GP			Endodontist			Other			p			ODHC			PC			University			p		
	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value
If you are doing retreatment, in which situations do you do it?																								
Teeth with lesion developed without pain and detected by the dentist	0.05	8	0	0	0.04	1							0.06	3	0.03	4	0.07	2						
Patients whose pain does not go away despite ideal root canal treatment	0.08	11	0.05	1	0.04	1							0.08	4	0.08	9	0.03	1						
Patients whose pain does not go away despite the ideal root canal treatment, Root canal treated teeth with no pain and lesion detected by the dentist	0.06	9	0.05	1	0.04	1							0.02	1	0.07	8	0.07	2						
Short filled canals	0.16	23	0	0	0.19	4							0.19	9	0.15	16	0.07	2						
Short filled canals, Root canal treated teeth with no pain and lesion detected by the dentist	0.10	14	0	0	0.04	1							0.10	5	0.09	10	0	0						
Short filled canals, Patients whose pain does not go away despite ideal root canal treatment	0.11	15	0	0	0.04	1							0.17	8	0.06	7	0.03	1						
Short filled canals, Patients whose pain does not go away despite the ideal root canal treatment, Root canal treated teeth with no pain and lesion detected by the dentist	0.11	16	0.05	1	0.14	3							0.02	1	0.17	18	0.03	1						0.015
Short filled canals, Overfilled canals	0.05	7	0	0	0.09	2							0.06	3	0.04	5	0.03	1						
Short filled canals, Overfilled canals, Root canal treated teeth with no pain and lesion detected by the dentist	0.02	8	0	0	0	0							0.04	2	0.01	2	0	0						
Short filled canals, Overfilled canals, Patients whose pain does not go away despite the ideal root canal treatment	0.05	4	0.10	2	0.09	2							0.04	2	0.06	7	0.10	3						
Short filled canals, Overfilled canals, Patients whose pain does not go away despite the ideal root canal treatment, Root canal treated teeth with no pain and lesion detected by the dentist	0.11	16	0.7	14	0.14	3							0.14	7	0.14	15	0.39	11						
Overfilled canals	0.01	2	0.05	1	0	0							0.04	2	0	0	0.03	1						
Overfilled canals, Root canal treated teeth with no pain and lesion detected by the dentist	0.007	1	0	0	0.09	2							0	0	0.009	1	0.07	2						
Overfilled canals, Patients whose pain does not go away despite the ideal root canal treatment	0.01	2	0	0	0	0							0	0	0.009	1	0.03	1						

Table 7. Relationship between whether retreatment is performed after an unsuccessful root canal treatment and the dentist's institutional affiliation

				ODHC		PC		University		p
				%	Value	%	Value	%	Value	
Do you do retreatment in unsuccessful root canal treatments?										
Yes				0.66	47	0.88	105	0.90	28	0.0003
No				0.33	24	0.11	14	0.09	3	

The relationships between the dentist's institutional affiliation and the answers to the questions of "How often do you perform endodontic treatment?", "Do you use magnification while performing root canal treatment?", and "Which group of teeth do you mostly treat?" were also found to be statistically significant ($p < 0.05$). The frequency of performing endodontic treatment was 50 or more times a month for 53% of the dentists working in ODHC, 6-20 times a month for 42% of the dentists working in private clinics, and 6-20 times a month for 29% of the dentists working at universities. The ratios of dentists who answered "yes" to the question "Do you use magnification while performing root canal treatment?" according to the dentists' institutional affiliations were as follows: 2% for those working in ODHC, 29% for those working in private clinics, and 9% for those working at universities. To the question "Which group of teeth do you mostly treat?" 47% of the dentists working in ODHC, 43% of those working in private clinics, and 48% of those working at universities answered "molar

teeth," and 24%, 38%, and 38%, respectively, answered "incisive, premolar, and molar teeth."

The relationship between the answer to the question "What is your treatment protocol for root canal-treated molar teeth with advanced lesions?" and the dentist's institutional affiliation was found to be statistically significant ($p < 0.05$). To this question, 38% of the dentists working in ODHC, 71% of those working in private clinics, and 86% of those working at universities answered "retreatment" (Table 8).

The relationship between the answer to the question "Do you use magnification when performing root canal treatment?" and the number of years spent in the profession was found to be statistically significant ($p < 0.05$). While the rate of use of magnification was higher among the dentists with 11-15 years of professional experience, there were dentists with at least 16 years of professional experience who were also using magnification (Table 9).

Table 8. Relationship between the treatment protocol and the institution employed in root canal treated molar teeth with advanced lesions

		ODHC		PC		University		p
		%	Value	%	Value	%	Value	
What is your treatment protocol for root canal filled molar teeth with lesion?								0.0009
Extraction		0	0	0	0	0,03	1	
Apical resection		0,61	44	0,28	34	0,1	3	
Retreatment		0,38	27	0,71	87	0,86	26	

Table 9. Relationship between the use of magnification and professional experience in root canal treatment

		0-5 y		6-10 y		11-15 y		16+ y		p
		%	Value	%	Value	%	Value	%	Value	
Do you use magnification when performing root canal treatment?										0.0002
Yes		0.09	8	0.24	8	0.38	19	0.07	4	
No		0.90	79	0.75	25	0.61	30	0.92	49	

Discussion

The care that people show for their dental health and dentists' tendency to keep people's teeth in their mouths are increasing. With the rising awareness of the importance of oral and dental health, the demand for endodontic treatment is also increasing.

In a survey study, general practitioners with more than 20 years of professional experience and general practitioners with 0-10 years of experience were compared in terms of whether they used magnification while performing root canal treatment. The rate of use of magnification was found to be higher among general practitioners with 0-10 years of experience (16). In our study, the lowest rate of use of magnification was found among dentists with at least 16 years or more of experience; the highest rate of use was among dentists with 11-15 years of experience.

In another survey conducted in Turkey in 2012, it was found that dentists with 5 years or less professional experience had a higher rate of endodontic treatment (14). It is thought that the reason for this is that newly graduated dentists learn about new materials and techniques during their education. Similarly, in our study, the professional experience of majority of the dentists who performed 50 or more root canal treatments per month varies between 1-5 years.

In our study, we found that dentists with 1-5 years of professional experience were more likely to apply endodontic treatment to molar teeth than dentists with 11-15 years of professional experience and 16 years and above of experience. Dentistry requires careful mental and physical work, and dentists may have increasing health problems in the later years of their professional lives (17). Therefore, it is believed that molar teeth are likely to receive less treatment from dentists with more professional experience because such teeth are more difficult to treat endodontically compared to other tooth groups. The inability of dentists to work in all positions due to their occupational diseases and to achieve a sufficient field of view with age may keep them from providing endodontic treatment. Therefore, one of the recommendations for dentists to overcome such problems is to use magnification devices specifically designed (18). In our study, root canal treatment was performed with magnification by 9% of those with 1-5 years of professional experience, 24% of those with 6-10 years, 38% of those with 11-15 years, and 7% of those with 16 years or more. The low usage of magnification devices by those with 16 years or more experience can be caused by the difficulties in changing the routine practices.

There is a consensus regarding the need for retreatment in the presence of periapical pathology, swelling, fistula, persistent pain, and missing canal filling (19, 20). In our study, 14% of dentists working in ODHC, 14% of dentists working in private clinics, and 39% of dentists working at universities performed the retreatment of teeth with lesions that had developed in

the canals. Their patients were found to be patients with short filled canals or overfilled canals, whose pain did not go away despite the ideal root canal treatment, and who did not have pain and were identified having a lesion by the dentist.

In one study, it was reported that in the Gaziantep city of Turkey, dentists working in private clinics performed more retreatments than those working in the public sector (15). The possible reason for this may be not being able to perform retreatment under high level of patient inflow in public sector. Similarly, in our study, 88% of dentists working in private clinics and 66% of dentists working in ODHC stated that they performed retreatments. Another study found that the rate of retreatment among male dentists was higher than that among female dentists (21). Furthermore, while one study reported that female dentists preferred less risky treatments compared to male dentists, we did not find a statistically significant impact of gender in our study (22).

Given the complexity of the root canal system, it has been stated that no method or instrument can completely remove the debris from the canal walls (23). However, according to Jenkins et al., it is best to clean the root canal system chemically with antimicrobial agents (24). NaOCl is used as a primary irrigation agent in endodontic treatment due to its tissue dissolving properties (25). Similarly, NaOCl emerges in many studies as the preferred irrigation solution (13, 14, 26, 27). Of the general practitioners participating in our study, thirty two percent reported that they only used NaOCl as an irrigation agent, and 80% of the endodontists reported that they employed NaOCl, EDTA, chlorhexidine, and distilled water in combination. The distribution of dentists using only NaOCl as an irrigation agent, according to their professional experience, is as follows: 1-5 years 24%, 6-10 years 24%, 11-15 years 40%, 16 years and above 30%. The combined use of irrigation solutions during root canal treatment increases the success rate of the treatment (28).

Ricucci stated that one of the most important aspects of endodontic treatment is the correct determination of working length of root canal (29). Pratten reported that electronic apex locators were more reliable than radiography in determining working length (30). Hoer et al., however, stated that radiography and electronic apex locators should be used together for this purpose (31). In determining working length, radiography has often been expressed as the preferred method among dentists: 62.8% in Iran (32), 52.5% in America (33), 77.5% in Malaysia (34), and 40.7% in Saudi Arabia (35).

One study showed that dentists in Syria determined the working length with finger sensitivity at a rate of 68.6% (36). In another study, it was reported that 94% of endodontists in Brazil used electronic apex locator for working length detection (16). For Turkey, research has found that 42% of dentists relied on the method of determining working length with finger sensitivity (15) and 47.9% of dentists used radiography and electronic apex locators together in determining working length

(16). The practitioners who participated in our study used the following methods for detecting working length: 18% radiography, 32% electronic apex locator, 7% hand sensitivity, and 43% radiography and electronic apex locator. The endodontists who took part in our work determined working length with the following methods: 5% with radiography, 40% with electronic apex locator, 0% with hand sensitivity, and 55% with radiography and electronic apex locator.

Conclusion

In this survey study conducted to evaluate the practice of endodontic treatment, the rate of dentists performing endodontic treatments was found to be on the rise. Additionally, endodontists perform retreatments at a higher rate than general practitioners. Finally, dentists with less professional experience were found to have higher rates of endodontic treatment for molar teeth that are more difficult to treat than dentists with more professional experience.

We collected information about the materials and devices used by dentists in endodontic treatment and retreatment in Turkey and to evaluate their perspectives. We believe our results can help creating guidelines for retreatment procedure especially for standardization of the irrigation materials, usage of magnification devices, methods to measure working length of root canal.

Disclosures

Ethics Committee Approval: Ethics committee approval was received for this study from Dicle University, Faculty of Dentistry, Research Ethics Committee, in accordance with the World Medical Association Declaration of Helsinki, with the approval number: 2020-3.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - G.R.T.A.; Design - G.R.T.A.; Supervision - G.R.T.A.; Materials - G.R.T.A.; Data collection &/or processing - G.R.T.A.; Analysis and/or interpretation - G.R.T.A.; Literature search - G.R.T.A.; Writing - G.R.T.A.; Critical review - G.R.T.A.

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