



Levels of Anxiety and Fear Related to Non-Surgical Root Canal Treatment Performed by Endodontic Residents and Endodontists

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Objectives: Despite advances in endodontic treatment procedures, root canal treatment is still associated with anxiety and fear. This may cause care avoidance and subsequent oral complications due to untreated endodontic infections. Anxiety and fear levels in response to non-surgical root canal treatment performed by endodontic residents and endodontists were analyzed.

Methods: A descriptive, cross-sectional survey was conducted among patients visiting the endodontic clinics at the University Dental Hospital. The questions addressed the participant's demographics, previous root canal treatment visits, clinician's level of training, and post-treatment experience.

Results: Demographics play a role in anxiety and dental fear in root canal treatment. Men scored significantly lower in the high-anxiety category than women, and patients treated by endodontic residents expressed lower levels of anxiety. Post-treatment experience of an endodontist or endodontic resident was a significant factor in reducing dental fear and anxiety.

Conclusion: The level of anxiety and fear related to root canal experience of endodontists or endodontic residents is very low. Most of the patients expressed willingness to undergo further root canal treatment to save a tooth.

Keywords: dental anxiety, dental fear, emotional state, root canal therapy, unpleasant experience

INTRODUCTION

Preoperative fear and anxiety have been identified as distinct emotional states and are a significant problem for patients and dental care providers alike. Together, they can be a significant contributor to refusal of dental treatment and deterioration of oral and dental health (1). By definition, fear and anxiety act as a signal of danger, or threat, to trigger appropriate adaptive responses. Fear is aroused by specific external stimuli, whereas anxiety is a generalized response to an unknown threat or internal conflict (2). Therefore, some patients may feel afraid of dental care because of past experiences, while others may have anxiety related to uncertainty of events to come. According to many ethologists, anxiety may be a more elaborate form of fear (3). Nevertheless, dental anxiety and dental fear are highly correlated (4). Research indicates that dental anxiety is a mental health issue and a public health concern (5).

Despite advances in dentistry, many people still consider root canal treatment a highly unpleasant experience (6). Among dental events, endodontic treatment ranked seventh among procedures that were most fear-arousing (7). A recent public opinion commissioned by the American Association of Endodontists on most common public fears showed that 59% of those sampled were more afraid of undergoing root canal treatment than speaking in public (8).

Despite quadrupling in the number of patients who describe this dental procedure as painless, the most persistent myth about root canal treatment is extreme pain (9, 10). However, ~96% of patients with a history of root canal treatment would be willing to have another root canal treatment if needed (11). Another study illustrated that the pulpectomy procedure was associated with less significant pain than extraction (12).

Patient perceptions of dental care procedures, including anesthetic infiltration, drilling, and rotary instrumentation, could contribute to overall patient anxiety and fear (13, 14). Studies addressing patient's perceptions of anxiety toward endodontic treatment placed endodontic procedures at the top of the list on provoking patient anxiety (15–17). This emotional state can cause a patient to reject endodontic treatment in favor of tooth extraction (18). The percentage of reported dental treatment avoidance related to fear ranges from 5 to 15% in different populations (19, 20). Interestingly, previous endodontic experiences do not increase fear; however, negative hearsay does (6). Carter et al. (21) analyzed endodontic fear in relation to ethnicity and suggested that different ethnicities could adopt different pathways for fear. The most commonly reported pathway for fear and anxiety of endodontic procedures among patients of White, Arab, and African descents is the cognitive conditioning pathway (21). However, findings also show that information that dissipates negative beliefs can reduce dental anxiety and fear (4).

Limited evidence exists to address whether patient or treatment factors might influence anxiety and fear specific to root canal treatment (22). Therefore, the purpose of this study is to better understand dental fear and anxiety associated with endodontic experience specifically, including what factors might change public attitudes toward endodontic treatment. Toward this end, the study questioned patients before and after endodontic treatment to assess their self-reported fear and anxiety levels in search of factors that may either exacerbate or dispel dental fear and anxiety associated with endodontic treatment.

MATERIALS AND METHODS

The study was approved by the Institutional Review Board (Ref. No. E-20-4881), the ethics committee at King Saud University. The participants were patients referred for non-surgical endodontic treatment to the endodontic clinics at the University Dental Hospital-Medical City King Saud University. All the participants were informed of the confidentiality of their responses. Patients were selected if they met the following inclusion criteria: adult patients aged 18 years and older who

were referred for non-surgical endodontic treatment. All patients with mental, psychological, or neurogenic disorders, or those taking antidepressants, anxiolytics, sedative medications, or medications related to the conditions mentioned above were excluded. The survey provided detailed information about the purpose of the study and instructions for the participants.

The descriptive cross-sectional survey was developed and sent to be reviewed by a consultant from the American Dental Association (ADA) and generated using Microsoft forms (Microsoft Corp., Redmond, WA, United States). The survey instrument consisted of twenty-eight questions, including a pre-treatment questionnaire adapted from the Modified Dental Anxiety Scale (MDAS) (23) and Dental Fear Survey (DFS) (13) numbers 1–20 and post-treatment questionnaire numbers 21–26 to address post-treatment experience, number of root canal treatments received, most feared dental procedures, and clinician level of training, in addition to demographic information (sex, age, education level, and employment status) numbers 1–4. The questionnaires were provided in two languages, English and Arabic. Both surveys have been used to assess dental anxiety and dental fear, and have been reported as valid and reliable methods in different populations (13, 23–26). The patients were given a hard copy of the survey instrument or the option to scan the barcode to complete the responses electronically. Each question asked the patients to rate their anxiety and fear responses toward root canal treatment using a five-point Likert scale. They marked one of the five responses (that were later assigned numerical values) as: 1, relaxed; 2, a little uneasy; 3, tense; 4, anxious; 5, extremely anxious or 1, Not at all; 2, a little; 3, some-what; 4, much; 5, very much.

DATA ANALYSIS

All raw data were transferred from the survey forms to an Excel spreadsheet. Analyses were conducted using the Statistical Package for the Social Sciences (SPSS, Version 25). Data were evaluated by Kruskal Wallis one-way ANOVA to compare patient anxiety and fear levels toward endodontic treatment before and post-treatment, and to calculate the mean scores of each. Anxiety and fear scores were dichotomized into 1–2 (low anxiety) and 3–5 (high anxiety). A chi square test was administered to detect any significant differences between self-reported anxiety and variables of previous root canal experience, levels of clinician training, number of root canal treatments received, post-treatment experiences, and other demographic variables. The role of confounding variables was explored by multivariate regression analysis. The level of significance was set at $p < 0.05$ and, confidence intervals were determined at 95% for all statistical calculations. A *post-hoc* power analysis was performed using G*power 3.1.9.4 to calculate the power of the sample size recruited.

RESULTS

The MDAS and DFS were completed by 127 participants. Responses for baseline demographics, MDAS, and DFS are

presented in **Table 1**. At alpha 0.05 with an effect size of 0.35 and a sample size of 127 participants, the power was equal to 0.88 (**Figure 1**). This study included 80 women and 47 men; 56 participants were 30–39 years, while 41 were under 30; the rest of the sample were above 40 years old. The different age groups did not show any differences in the level of anxiety (**Table 2**). However, a significant gender difference was found; the men scored significantly lower in the high anxiety category than the women (**Figure 2**). The response to the general question (How fearful are you of having a root canal procedure done?) showed that approximately 20% of the participants reported some fear of root canal treatment. Only 12 to ~1% would postpone or cancel their endodontic appointment because of dental fear (**Table 1**).

Regarding the patient's level of education and employment status, half of all the respondents had college-level education, 26% completed formal schooling or less, and the rest earned higher degrees. Participants with a bachelor's degree scored significantly higher on anxiety than those who had only completed formal schooling. In contrast, retired participants scored significantly lower on anxiety than employed participants (**Table 3**).

When the respondents were asked about the most feared experience among different dental procedures, only 29% were most fearful of root canal treatment. Most of the sample (93%) had experienced at least one root canal treatment. Approximately half of the participants had been treated by an endodontist. Neither the previous root canal experience nor the number of root canal treatments showed a significant difference in anxiety level or fear scores (**Tables 3, 4**). When we compared those who had a previous root canal experience with patients with no previous treatment experience, we found no significant difference in anxiety levels (**Table 2**).

In our study, most of the patients (61%) underwent root canal treatment performed by endodontists, while the remaining 39% received treatment from an endodontic resident. No significant difference was found in patient fear scores or the number of root canal treatments performed by clinicians (**Table 4**). However, the patients reported feeling more relaxed, with a significant difference in anxiety mean scores when a resident clinician treated them compared to an endodontist (**Tables 2, 3**). Overall, most of the patients (96%) were prepared to undergo further root canal treatment to save a tooth. In general, post-treatment experience scored significantly less in the mean scores for dental anxiety and fear, $P < 0.05$ (**Tables 3, 4**). Only some of the participants expressed fear.

We conducted a multivariate logistic regression analysis using self-reported fear as the dependent variable and all other factors (age, sex, education, employment, previous root canal experience, clinician level of training, post-treatment experience, and number of root canal treatments received) as independent variables. This showed a significant relationship between post-treatment experience and self-reported anxiety (low vs. high anxiety; $B = 1.34$, odds ratio 3.323, $p < 0.01$) (**Table 5**).

DISCUSSION

Previous data have reported avoidance of dental appointments due to dental fear ranging between 5 and 15% in different populations (19, 20). Our findings support this, because only a small percentage of the participants were likely to postpone or cancel their appointments because of dental fear. Most of our sample expressed willingness to undergo further root canal treatment to save a tooth, indicating their awareness and understanding of the importance of root canal treatment. This study showed that 43 (33%) of the participants fell in the high-anxiety category for self-reported fear and anxiety specifically associated with endodontic treatment, of which 43 were female. Anxiety level among the women was higher than that among the men. This finding is congruent with most dental fear studies (1, 6, 11, 27). The observed differences may be due to women having greater readiness to acknowledge their feelings (28), but others reported real differences in neural circuit and emotional reactivity (29–31). The samples consisted of different age groups, and there was no significant difference between anxiety levels and age. This finding is consistent with other studies that conclude that age is not a significant factor affecting self-reported anxiety (6, 14, 32, 33).

Previous studies have found that education can affect anxiety. Petertz et al. (1) reported that those with higher education levels demonstrated lower levels of anxiety. In contrast, we found that patients with bachelor's or higher degrees reported higher levels of anxiety compared to respondents with less formal education. An informative pathway that assumes subjects learn a negative experience from others also impacts patient's health behavior and attitude toward pain (21). The retired participants in our population expressed less anxiety than the employed participants. The results must be interpreted with caution, as this is a small sample.

Previous experience with endodontic treatment did not result in any differences in anxiety levels. A reason for this may be that half of the sample was treated by endodontists, whose level of training means that patients are less likely to experience dental trauma. These echo the findings of previous studies that avoidance of dental treatment and dental fear come mainly from cognitive conditional pathways that originate from their past dental experiences (21).

An interesting result of this study is that the patients treated by an endodontic resident were more relaxed; they had lower self-reported anxiety compared to those treated by endodontists. All the participants were referred for non-surgical root canal treatment. Regardless of the complexity of the case (behavioral or technical), the patients were treated randomly by endodontists or residents based on clinician availability. This may imply that endodontists usually treat more complex cases (34) or that residents may spend more time educating their patients. However, the participants were not aware of any recommendations and the clinic's policy prohibits patient choice. Moreover, distinction of the fear and anxiety expressed by patients treated by endodontists or residents is not the focus of this study. The results obtained have more focused answers to this question without memory biases related to the clinician's

TABLE 1 | Modified Dental Anxiety Scale (MDAS), Dental Fear Survey (DFS), and baseline demographics questionnaires.

Reference	Factor	Level	Number	%
Pre treatment questionnaire	1. If you were given an appointment to have a root canal procedure in endodontic clinics, how would you feel?	I would look forward to it	53	41.7
		I would not care one way or the other	6	4.7
		I would be a little uneasy about it	26	20.5
		I would be afraid that it would be unpleasant and painful	32	25.2
		I would be very frightened of what the endodontist might do	10	7.9
	2. When you are in the waiting room in this floor in endodontic clinics, waiting for your turn in the dental chair, how do you feel?	Relaxed	52	40.9
		A little uneasy	35	27.5
		Tense	28	22
		Anxious	7	5.5
		Extremely anxious that I almost feel physically sick	5	3.9
	3. When you are in the dental chair waiting for an endodontist to get ready to start the root canal on your tooth, how do you feel?	Relaxed	39	30.7
		A little uneasy	41	32.3
		Tense	28	22.0
		Anxious	9	7.1
		Extremely anxious that I almost feel physically sick	10	7.9
	4. You are in the dental chair to have a root canal treatment. While you are waiting and the endodontotistis getting out the instruments which will use to get the nerve out and clean your canals, how do you feel?	Relaxed	34	26.8
		A little uneasy	51	40.2
		Tense	21	16.5
		Anxious	13	10.2
		Extremely anxious that I almost feel physically sick	8	6.3
	5. If you are about to have a local anesthetic injection on a tooth needs root canal. How do you feel about it?	Relaxed	28	22.0
		A little uneasy	44	34.6
		Tense	24	18.9
		Anxious	18	14.2
Extremely anxious that I almost feel physically sick		13	10.2	
6. Has fear from root canal procedure caused you to put off making an appointment?	Never	87	68.5	
	Rarely	15	11.8	
	Sometimes	15	11.8	
	Often	6	4.7	
	Always	4	3.1	

(Continued)

TABLE 1 | Continued

Reference	Factor	Level	Number	%
	7. Has fear from root canal procedure caused you to cancel or fail to appear?	Never	104	81.9
		Rarely	14	11.0
		Sometimes	5	3.9
		Often	3	2.4
		Always	1	0.8
	8. During root canal treatment: My muscles become tense	Never	33	26.0
		Rarely	27	21.3
		Sometimes	41	32.3
		Often	14	11.0
		Always	12	9.4
	9. And My breathing rate increase	Never	54	42.5
		Rarely	27	21.3
		Sometimes	29	22.8
		Often	11	8.7
		Always	5	3.9
	10. I perspire	Never	85	66.9
		Rarely	24	18.9
		Sometimes	12	9.4
		Often	2	1.6
		Always	3	2.4
	11. I feel nausea and sick	Never	88	69.3
		Rarely	21	16.5
		Sometimes	12	9.4
		Often	6	4.7
		Always	0	0
	12. My heart beats faster	Never	64	50.4
		Rarely	26	20.5
		Sometimes	22	17.3
		Often	8	6.3
		Always	7	5.5
	13. Are you afraid to: Call to see an endodontist	Not at all	91	71.7
		A little	23	18.1
		Some-what	8	6.3
		Much	4	3.1
		Very much	1	0.8
	14. Approaching the endodontics clinic	Not at all	58	45.7
		A little	31	24.4
		Some-what	24	18.9
		Much	11	8.7
		Very much	3	2.4
	15. Sitting in the waiting room	Not at all	66	52.0
		A little	30	23.6
		Some-what	21	16.5
		Much	7	5.5
		Very much	3	2.4
	16. Sitting in dental chair waiting for an endodontist	Not at all	57	44.9
		A little	39	30.7

(Continued)

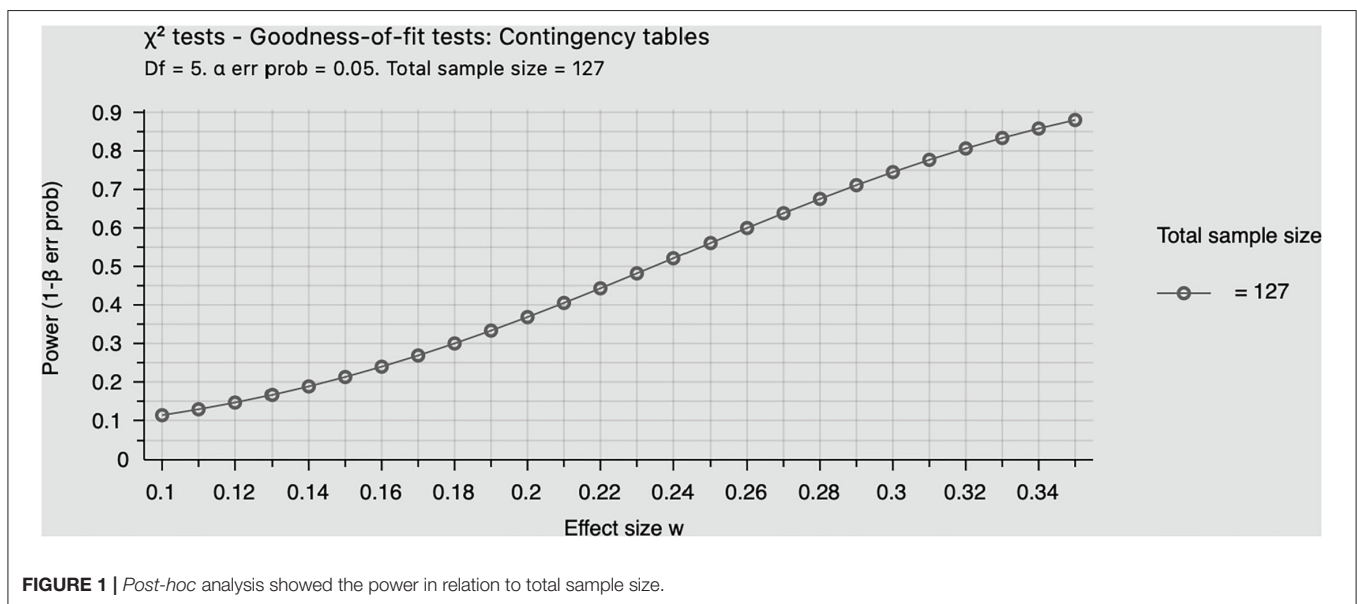
TABLE 1 | Continued

Reference	Factor	Level	Number	%
Post-treatment questionnaire	17. Seeing the treating endodontist walk in	Some-what	18	14.2
		Much	10	7.9
		Very much	3	2.4
		Not at all	74	58.3
	18. Seeing dental instruments	A little	19	15.0
		Some-what	21	16.5
		Much	7	5.5
		Very much	6	4.7
		Not at all	45	35.4
	19. Drilling on the tooth	A little	36	28.3
		Some-what	22	17.3
		Much	16	12.6
		Very much	8	6.3
		Not at all	31	24.4
	20. All things considered, how fearful are you of having root canal procedure done?	A little	32	25.2
		Some-what	29	22.8
		Much	26	20.5
		Very much	9	7.1
	21. Comparing your experience today after you had root canal today, how fearful you are? "post-treatment expirience"	Not at all	39	30.7
		A little	37	29.1
		Some-what	26	20.5
		Much	18	14.2
	22. Did an endodontistdo any previous root canal work?	Very much	7	5.5
		Not fearful	87	68.5
		A little fearful	27	21.3
		Somewhat fearful	10	7.9
23. Would you have root canal treatment again to save one of your teeth?	Very fearful	2	1.6	
	Extremely fearful	1	0.8	
24. Among the following procedures, which one are you fearful most?	Yes	71	55.9	
	Never	56	44.1	
25. How many root canal procedures have you experienced?	Yes	123	96.9	
	Never	4	3.1	
	Dental Extraction	81	63.8	
	Root canal treatment	37	29.1	
26. Today, you had root canal treatment performed by	Cleaning	2	1.6	
	Caps, crowns, and bridges	6	4.7	
	1-2	43	33.9	
	3-4	37	29.1	
	More than 5	38	29.9	
26. Today, you had root canal treatment performed by	Never	5	3.9	
	Endodontist	78	61.4	
	Endodontic Resident	49	38.6	

(Continued)

TABLE 1 | Continued

Reference	Factor	Level	Number	%
Baseline demographic	1. What is your gender?	Male	47	37.0
		Female	80	63.0
	2. What is your age?	<30	41	32.3
		30–39	56	44.1
		40–49	16	12.6
		50–59	9	7.1
		60 older	5	3.9
	3. Please select the option that best describes your education level	Less than a high school degree	8	6.3
		High school degree or equivalent	25	19.7
		Bachelor's degree	69	54.3
		Master's degree	21	16.5
		Doctorate	4	3.1
	4. Please select the option that best describes your employment status	Employed	70	55.1
		Unemployed	26	20.5
		Student	24	18.9
		Retired	7	5.5



rank. Nevertheless, to date, no studies have analyzed fear and anxiety levels associated with endodontic experience related to differences in clinician seniority.

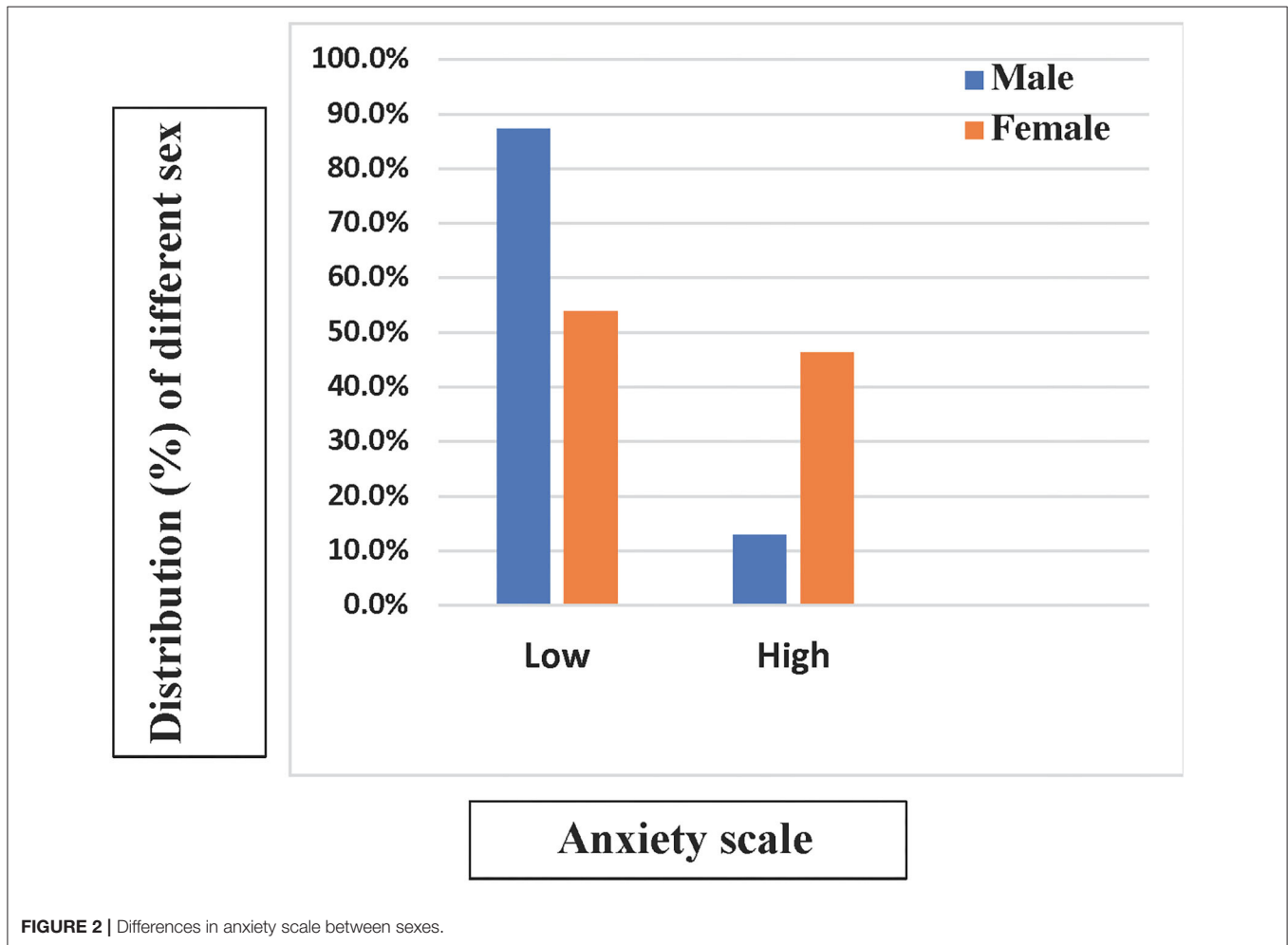
Most of the participants (96%) were prepared to have root canal treatment again to save a tooth. These results counter the findings of a recent public opinion poll commissioned by the American Association of Endodontists in 2019, in which almost 59% would avoid root canal treatment (8). A noteworthy aspect of our study was the finding that most of the participants did not feel fearful about their post-treatment experience, and this was the only factor associated with low anxiety. A recent systematic

review concluded that non-surgical root canal treatment-associated anxiety was moderate and diminished after treatment (22). Given that anxiety often decreases following treatment, more frequent dental visits could also lead to more comfortable and relaxed patients. Another proposal is for endodontic providers to integrate strategic behaviors designed to strengthen patient's inherent coping capacities (13, 35). Contemporary use of instruments, dental microscopes, and pharmacology techniques can encourage patients to relax during dental visits. These increase patient confidence and reduce fears associated with endodontic treatment (35). Good communication and

TABLE 2 | High and low anxiety scores among sex, age, and previous root canal expirience.

Factor	Level	Anxiety Low and High						P-value
		Low		High		Total		
		n	%	n	%	n	%	
Sex	Male	41	87.2	6	12.8	47	1	0.005*
	female	43	53.8	37	46.3	80	1	
Age	<30	25	61.0	16	39.0	41	1	0.344
	30–39	35	62.5	21	37.5	56	1	
	40–49	12	75.0	4	25.0	16	1	
	50–59	7	77.8	2	22.2	9	1	
	60 older	5	100.0	0	0.0	5	1	
Previous root canal experience	Yes	48	67.6	23	32.4	71	1	0.418
	Never	36	64.3	20	35.7	56	1	

*Test of significance between groups (P < 0.05).



patient education about the treatment process can reverse negative images and fear of root canal treatment, which are still widespread among the public. This study demonstrates that

different factors can play a role in dental anxiety and fear specific to endodontic treatment. It appears that root canal experience was a significant factor in reducing anxiety and fear and increased

TABLE 3 | Mean MDAS scores and SD related to education and employment status, number of root canal treatments received, clinician level of training, previous root canal treatment, and post-treatment experience.

Factor	Level	n (%)	Mean	SD	P-value	Lower bound	Upper bound
Education	Less than a high school degree	8 (6.3)	2.156	0.906	0.047*	1.399	2.913
	High school degree or equivalent	25 (19.7)	1.85	0.810		1.516	2.184
	Bachelor's degree	69 (54.3)	2.522	1.083		2.262	2.782
	Master's degree	21 (16.5)	2.036	1.067		1.55	2.522
	Doctorate	4 (3.1)	2.563	0.966		1.026	4.099
Employment status	Employed	70 (55.1)	2.464	1.053	0.021*	2.213	2.715
	Unemployed	26 (20.5)	2.337	0.827		2.002	2.671
	Student	24 (18.9)	1.990	1.157		1.501	2.478
	Retired	7 (5.5)	1.357	0.610		0.793	1.921
Previous root canal experience	Yes	71 (55.9)	2.261	1.058	0.746	2.010	2.5109
	Never	56 (44.1)	2.321	1.033		2.044	2.598
Number of the canals	1-2	43 (33.9)	2.471	1.116	0.4174	2.127	2.815
	2-3	37 (29.1)	2.236	0.985		1.908	2.565
	More than 5	38 (29.9)	2.099	0.925		1.794	2.403
	Never	5 (3.9)	2.750	1.311		1.122	4.378
	I don't know	4 (3.1)	2.00	1.513		-0.409	4.409
Clinician level of training	Endodontist	78 (61.4)	2.478	1.076	0.009*	2.235	2.720
	Endodontic Resident	49 (38.9)	1.985	0.921		1.720	2.249
Post-treatment experience	Not fearful	87 (68.5)	1.997	0.99	0.000*	1.7853	2.208
	a little fearful	27 (21.3)	2.805	0.928		2.4382	3.172
	Somewhat fearful	10 (7.9)	2.925	0.589		2.503	3.346
	Very fearful and extremely fearful	3 (2.4)	4.00	0		4.00	4.00

*Test of significance between groups ($P < 0.05$).

TABLE 4 | Mean DFS scores and SD related to number of root canal treatments received, clinician level of training, previous root canal experience, and post-treatment experience.

Factor	Level	n (%)	Mean	SD	P-value	Lower bound	Upper bound
Number of the canals	1–2	43 (33.9)	2.042	0.877	0.626	1.772	2.312
	2–3	37 (29.1)	1.934	0.738		1.687	2.180
	More than 5	38 (29.9)	1.824	0.71		1.590	2.054
	Never	5 (3.9)	2.287	1.1546		0.853	3.721
	I don't know	4 (3.1)	2.125	0.7482		0.934	3.315
Clinician level of training	Endodontist	78 (61.4)	2.04	0.809	0.099	1.867	2.232
	Endodontic resident	49 (38.9)	1.811	0.752		1.59	2.027
Previous root canal experience	Yes	71 (55.9)	1.967	0.832	0.877	1.771	2.164
	Never	56 (44.1)	1.945	0.749		1.745	2.146
Post-treatment experience	Not fearful	87 (68.5)	1.71	0.714	0.000*	1.558	1.863
	a little fearful	27 (21.3)	2.384	0.728		2.096	2.672
	Somewhat fearful	10 (7.9)	2.569	0.503		2.209	2.929
	Very fearful and extremely fearful	3 (2.4)	3.313	0.707		3.041	9.666

*Test of significance between groups ($P < 0.05$).

patient's likelihood of accepting future root canal treatment. It is noteworthy that advances in endodontic treatment aid the

acceptance of endodontic treatment and reduce the anxiety and fear associated with it.

TABLE 5 | Multivariable linear regression: influence of the independent variables (age, sex, previous root canal experience, clinician level of training, number of root canal treatments received, and post-treatment experience) on low anxiety.

Dependent variable	Significant independent variable	Beta	Exp (B) (Odds ratio, OR)	95% confidence interval		P-value
				Lower	Upper	
Low anxiety	Post-treatment experience [†]	1.201	3.323	1.423	8.996	0.001*

*Test of significance between groups ($P < 0.05$).

[†]All other variables were insignificant.

Within the limitations of this study, we study evaluated the anxiety and dental fear associated with non-surgical root canal treatment before and after the treatment by an endodontist or an endodontic resident in a single population. However, different interpretations by subjects could vary between different populations. Thus, qualitative studies may assist in understanding the factors associated and interplay with anxiety and dental fear of non-surgical root canal treatment.

CONCLUSION

In general, the level of anxiety and fear related to root canal experience conducted by endodontists or endodontic residents is very low. Most of the patients are prepared to undergo root canal treatment again to save a tooth.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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ETHICS STATEMENT

The study was conducted after approved by the Institutional Review Board (Ref. No. E-20-4881) King Saud University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

Both authors have contributed significantly and are in agreement with the manuscript. Both authors contributed to the article and approved the submitted version.

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