Original Article

Endodontic factors associated with satisfaction of patients after root canal treatment

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Abstract

Objective: Understanding patients' perspectives is essential for treatment planning and assessing healthcare efficacy. This study explored the influential factors in root canal treatment (RCT) on patient satisfaction.

Methods: This prospective study involved 390 eligible patients who underwent RCT at the Department of Conservative Dentistry and Endodontics, B. P. Koirala Institute of Health Sciences, Dharan, Nepal. We collected data by assessing endodontic factors before treatment and using a post-treatment semantic differential scale questionnaire. Patients' satisfaction was measured using a visual analogue scale (VAS) from 0 (least satisfaction) to 10 (highest satisfaction possible). Mann-Whitney U-test and Kruskal-Wallis test were employed for data analysis, and P-value<0.05 was considered statistically significant.

Results: Patients expressed high levels of satisfaction post-endodontic treatment (VAS 8.08). Patients were particularly satisfied with improved chewing ability (VAS 7.77), overall comfort (VAS 7.76), and aesthetics (VAS 7.63) after treatment. However, concerns were raised about treatment cost (VAS 5.97) and duration (VAS 5.86). Several factors were significantly associated with higher patient satisfaction levels including a diagnosis of pulpitis, younger age, lower DMFT (Decayed, Missing, Filled Teeth) score, fewer teeth requiring treatment, absence of flare-ups, teeth not used as an abutment for prosthesis, primary endodontic therapy, treatment of either molar or non-molar teeth (as opposed to both conditions), smaller periapical lesion size, and single-visit treatment

Conclusions: Our findings reveal high overall general satisfaction, with chewing ability generating the highest contentment. Cost and treatment duration were areas of concern. Demographics, clinical variables, and treatment settings played roles in shaping perceptions. These findings offer insights for enhancing endodontic care and patient satisfaction outcomes.

Keywords: Endodontics, Healthcare costs, Patient satisfaction, Quality of life, Root canal therapy, Treatment outcome

Introduction

Dental pain related to the pulp and/or periapical tissue is a common reason why people seek dental care (1, 2). The goal of dentistry is to preserve natural teeth whenever possible, and root canal treatment (RCT) plays a crucial role in achieving this goal. The survival rate of teeth following RCT, particularly in the short term, is very high, and success rates based on radiographic criteria were up to over 90% (3, 4). Despite these clinical achievements, contemporary dental care emphasizes a patient-centered approach that recognizes the significance of patient experiences and satisfaction.

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Recent studies in the field of endodontics have underscored the importance of understanding patient perspectives and outcomes as essential components of modern dental healthcare (5). Patient satisfaction influences treatment planning and the overall effectiveness of dental interventions.

Endodontic patients present various pulpal and periapical conditions (6). Understanding the importance of treatment-related factors and their impact on patient satisfaction is essential for determining treatment needs and treatment success (7). Moreover, understanding the problem and its implications for treatment planning from the dentist's and patient's perspectives is crucial. It is worth noting that public perceptions of root canal treatment have historically been unfavorable, often attributed to reports of pain associated with the procedure (8). A study by Wali et al. (9) revealed that approximately 13% of 200 patients chose to cancel their endodontic appointments due to fear of pain. These perceptions highlight the need for a more patient-centered approach in endodontic care.

Recent years have witnessed a paradigm shift in healthcare towards patient-centered care, where RCT outcomes are assessed through patient evaluations of their oral health and oral health-related quality of life (10). Key areas of focus include factors that commonly contribute to patient dissatisfaction, such as treatment costs, duration, pain, aesthetics, function, and overall pleasantness (11). However, factors such as high costs, poor post-operative aesthetics, and prolonged duration of treatment seem to reduce their satisfaction (11, 12, 13).

Despite the growing emphasis on patient-centered care, studies directly investigating patient satisfaction with root canal treatment are limited. Furthermore, the interplay between demographic and clinical factors and their influence on patient satisfaction following RCT remains a relatively understudied subject. This research seeks to bridge this knowledge gap by examining the associations between various endodontic factors and patient satisfaction, offering valuable insights into the main influencing factors. The present study aimed to identify the association between endodontic factors and patient satisfaction after RCT.

Materials and Methods

Study design and sample collection

A prospective longitudinal study was conducted over six years from 2016 to 2022 in the Department of Conservative Dentistry and Endodontics at B. P. Koirala Institute of Health Sciences (BPKIHS), Dharan, Nepal. Ethical clearance was taken from the institutional review committee (IRC/635/015) at BPKIHS. Sample size calculation was based on a study (13) that assessed satisfaction with root canal treatment by subject characteristics and type of teeth, with a mean satisfaction score of 8.61 and a standard deviation of 0.09. The following formula was used to estimate the sample size using a 95% confidence interval and 80% power:

$$N = \frac{(Z_{\alpha} + Z_{\frac{\beta}{2}})^2}{(\delta - |\mu - \mu_0|)^2}\delta^2$$

Where: Zα: 1.96, Zβ: is 0.842, δ: the smallest change from the baseline considered trivial (0.08), and μ – μ0: the acceptable difference value between true mean and reference mean (0.05). The resulting sample size was determined as 325. To mitigate potential biases, an additional 20% was added to the calculated sample size, bringing it to 390.

This study included patients aged 15 years and older with fully developed roots, who were undergoing either initial RCT or retreatment. Eligible participants were in good general health, not taking medications, and did not have any mental disability. They also had adequate coronal tooth structure and did not need post and core placement. Patients were informed about the endodontic procedure and their enrolment in the study and informed consent was obtained.

Teeth with developmental defects, individuals currently undergoing orthodontic treatment and pregnant patients were excluded from the study.

Root canal treatment

Subjects received standard RCT from school staff and postgraduate residents under rubber dam isolation. Local anesthesia was administered with 1.8 mL of 2% lidocaine with 1:80,000 epinephrine (Lignospan Special, Septodont, France) via local infiltration or nerve block. Root canal preparation was conducted with nickel-titanium rotary files [ProTaper Universal, ProTaper Gold (Dentsply Maillefer, Ballaigues, Switzerland), HyFlex CM (Coltene Whaledent, Altstätten, Switzerland) and ISO K files (Mani, New Delhi, India). Irrigation was conducted via 17% EDTA (Meta Biomed Co. Ltd., Cheongju, South Korea) and 4% w/v sodium hypochlorite solution. Calcium hydroxide was used as an intracanal medication between the treatment sessions. Root canals were obturated with gutta-percha cones and AH Plus sealer (DeTrey, Dentsply, Ballaigues, Switzerland) or Bioceramic Sealer (BioRoot RCS, Septodont, Lancaster, Pennsylvania, USA). The post-obturation restoration was done with glass-ionomer cement (Shofu Inc, Kyoto, Japan) and light-cured composite (Coltene Whaledent, Altstätten, Switzerland). Single-visit or multiple-visit endodontic treatment was performed according to the case selection and treatment plan developed by the treating endodontic faculty member.

Data collection

The data collection process included patient assessments and clinical examinations conducted before the initiation of RCT. The diagnosis of the patient's dental condition was broadly categorized into two groups: pulpitis and periodontitis. The patient's age was recorded and subsequently categorized into two groups, namely, those aged ≤30 years and those aged >30 years.

The total number of teeth that required root canal treatment and the DMFT index (Decayed, Missing, and Filled Permanent Teeth) were recorded to assess the patient's dental condition. To assess the periapical condition, the periapical index (PAI) was employed, following the guidelines described by Ørstavik et al. (14): score 1: normal periapical anatomy, score 2: mild changes in bone pattern, score 3: changes in bone pattern with diffuse loss of mineral, score 4: apical periodontitis

with definite radiolucency in the periapical area, score 5: severe periodontitis with features of exacerbation. We documented whether the teeth undergoing RCT were intended for potential use as abutments for prosthetic rehabilitation, including the possibility of RPD (Removable Partial Denture) or FPD (Fixed Partial Denture) placement. We also assessed whether the tooth had undergone previous endodontic treatment and required retreatment, as well as whether the symptomatic condition of the tooth necessitated urgent endodontic intervention (emergency access). The category of teeth undergoing endodontic treatment was classified as molar, non-molar, or both.

Furthermore, we documented the location of the teeth undergoing endodontic treatment as within the maxillary or mandibular arch or both. Information regarding the occurrence of flare-ups during endodontic treatment, the endodontic treatment setting (single or multiple sessions), and the specific endodontic files used were also collected.

Fourteen days after the completion of the root canal treatment, patients were asked to complete a questionnaire in Nepali language. A semantic differential scale, or Likert scale, is a range of semantic values explaining an attribute. The questionnaire employed in this study utilized a semantic differential scale adapted from Dugas et al. (11) to assess patient satisfaction with the received endodontic treatment. This is a psychometric tool designed to gather specific information about aspects of endodontics important to patients. This scale probes patients' perceptions regarding cost, time required to complete the RCT, pain intensity during the procedure, aesthetics of the treated tooth, chewing ability on the treated tooth, pleasantness/comfort level, and overall satisfaction with the treatment (11). Participants were asked to rate, on a scale of 1 to 10, their level of satisfaction with various factors following the completion of endodontic treatment.

Data Analysis

The data were analyzed using SPSS 20.0 (IBM Inc., Chicago, IL, USA). The demographic, clinical, and treatment setting variables were categorized into two or three classes, and the overall satisfaction score was compared between different classes of each variable. The Mann-Whitney U-test was used to compare overall satisfaction scores between two groups, and the Kruskal-Wallis test followed by the Dunn-Bonferroni post hoc test was applied for comparison among three groups. The significance level was set at p-value <0.05.

Results

A total of 390 patients who had received endodontic treatment for at least one tooth were included. Gender distribution frequency consisted of 203 (52.1%) male and 187 (47.9%) female patients. The distribution of participants by age group is presented in Table 1. Participants' mean age was 40.53±12.58 years.

Patient Satisfaction with Endodontic Treatment

Table 2 provides a detailed overview of the study's results on patient satisfaction with endodontic treatment. The mean overall satisfaction score was 8.08 ±1.51. Among the different factors, participants' average satisfaction scores for treatment cost, treatment duration, intraoperative pain intensity, postoperative aesthetic, chewing ability post-treatment, and pleasantness/comfort were 5.97 ± 2.37, 5.86 ± 2.39, 6.78 ± 2.04, 7.63 ± 1.38, 7.77 ± 1.35, 7.76 ± 1.38, respectively.

Considering demographic factors, gender did not influence patient satisfaction with RCT. However, those under 30 years of age expressed significantly higher satisfaction levels ($p<0.001$). Patients with a DMFT index of 0 to 5 demonstrated significantly greater satisfaction ($p<0.001$).

Table 1: Distribution of age and gender among participants

Gender		Male	Female	Total
		203 (52.1%)	187 (47.9%)	390
Age (years)	15-20	8	10	18 (4.61%)
	21-30	37	30	67 (17.18%)
	31-40	56	60	116 (29.74%)
	41-50	59	44	103 (26.41%)
	≥51	43	43	86 (22.05%)
	Mean age			40.53 ± 12.58

Table 2: The association between various factors and overall satisfaction with root canal treatment

Variables		Overall satisfaction Mean±SD	P-value
Gender	Female (n=187)	8.14±1.51	0.43
	Male (n=203)	8.02±1.51	
Age (year)	≤ 30 (n=83)	8.72±1.31	<0.001*
	> 30 (n=307)	7.91±1.52	
DMFT score	0-5 (n=183)	8.70±1.26	<0.001*
	> 5 (n=207)	7.53±1.51	
Diagnosis	Pulpitis (n=163)	8.40±1.52	<0.001*
	Periodontitis (n=227)	7.85±1.47	
RCT setting	Single (n=65)	9.09±1.11	<0.001*
	Multiple (n=325)	7.88±1.50	
PAI category	Score 1-2 (n=242)	8.27±1.50	0.001*
	Score ≥ 3 (n=148)	7.77±1.49	
Endodontic flare-up	Yes (n= 54)	7.04±1.44	<0.001*
	No (n=336)	8.25±1.46	
Retreatment	Yes (n=31)	7.32±1.32	0.002*
	No (n= 359)	8.14±1.51	
Emergency access	Yes (n-32)	7.22±1.12	<0.001*
	No (n=358)	8.16±1.52	
Number of treated teeth	1 to 4 (n=380)	8.11±1.51	0.027*
	≥ 5 (n=10)	7.10±1.19	
Tooth category	Non-Molar (n=201)	8.30±1.53[a]	<0.001*
	Molar (n=124)	8.12±1.38[a]	
	Both (n= 65)	7.32±1.48[b]	
Jaw category	Max (n=201)	8.16±1.47[a]	<0.001*
	Mand (n=147)	8.19±1.56[a]	
	Both (n=42)	7.24±1.18[b]	
FPD	Yes (n= 49)	7.43±1.33	0.001*
	No (n= 341)	8.17±1.51	
RPD	Yes (n=29)	7.31±1.79	0.02*
	No (n= 361)	8.14±1.47	
Endodontic File	SS (n= 79)	8.19±1.44	0.44
	NiTi (n= 311)	8.05±1.53	

*indicates a statistically significant difference at P<0.05. SD: standard deviation
DMFT (Sum of decayed, missing, and filled permanent teeth), RPD (Removable Partial Denture), FPD (Fixed Partial Denture), PAI (Periapical Index), SS (ISO stainless steel endodontic file system), NiTi (Nickel Titanium Endodontic File System).

A diagnosis of pulpitis, single-session treatments, and a PAI score of 1 or 2 were all significantly correlated with increased patient satisfaction (p=0.001). On the contrary, patients undergoing retreatment, those who experienced endodontic flare-ups, and those who required emergency treatment reported significantly lower satisfaction (p=0.002). Patients who underwent RCT for only 1 or 2 teeth were more satisfied than those who needed RCT for multiple teeth (p<0.001).

Additionally, patients who received RCT for either molar or non-molar teeth as well as those treated for mandibular or maxillary teeth were significantly more satisfied than their counterparts who received treatment in both molar and non-molar teeth and both jaws (p<0.001). If the treated teeth were not intended to serve as abutments for RPD or FDP, patients showed greater satisfaction (p=0.001). The type of endodontic files utilized during the RCT did not impact patient satisfaction (P=0.44).

Discussion

In the present study, we aimed to assess patient satisfaction with endodontic treatment using a semantic differential scale. Our findings revealed a remarkably high level of overall general satisfaction among participants two weeks post-treatment, with a mean score of 8.08±1.51. This underscores the positive impact of endodontic procedures on patients' well-being. To provide context, previous studies have reported varying levels of overall satisfaction, which serves as a valuable basis for comparison.

Among the factors contributing to patient satisfaction, "chewing ability" emerged as the aspect generating the highest contentment, with a mean score of 7.77±1.35. Pleasantness (7.76±1.38) and postoperative aesthetics (7.63±1.38) also received favorable ratings, underscoring their significance in patients' perceptions of treatment outcomes. However, our study revealed that factors such as "cost" and the "duration of treatment" received lower scores, averaging 5.97 and 5.86, respectively. It is worth noting that despite common perceptions, our study suggests that pain during treatment was not the primary driver of dissatisfaction. Instead, patients often expressed

concerns about treatment duration and cost. These findings highlight the need to address cost-effectiveness and treatment efficiency in endodontic care.

Comparing our results with previous studies reveals variations in the factors influencing patient satisfaction. For instance, Dugas et al. (11) found slightly lower overall general satisfaction, with their highest satisfaction associated with postoperative aesthetics and procedural pain. Other studies reported a higher level of overall general satisfaction associated with "chewing ability" (13, 10). These differences highlight the multifaceted nature of patient satisfaction, influenced by various factors. Some studies reported high overall post-endodontic satisfaction but noted the highest dissatisfaction with cost and treatment time (15, 16, 17), or found satisfaction with treatment cost but dissatisfaction with treatment time and pain (18, 19).

Understanding what patients value in their decision-making process is vital. In some similar studies, communication, post-treatment aesthetics, cost, treatment survival, and pre-treatment pain emerged as crucial factors (20, 21). Patients also place importance on the absence of pain and swelling, the ability to chew, and the appearance of treated teeth (22, 23, 10). Additionally, patient satisfaction can be influenced by logistical aspects, such as the time between referral and appointment scheduling, as highlighted in qualitative research (24, 25).

Our study revealed several demographic and clinical factors affecting satisfaction levels. Patients diagnosed with pulpitis (or the absence of periodontitis) exhibited significantly higher satisfaction scores, which might be due to the relief from acute dental pain and improved functionality provided by successful endodontic treatment. Gender did not significantly impact satisfaction, consistent with prior research (11, 13). However, Torabinejad et al. (25) reported that anxiety levels were higher among women before treatment. Another study suggested that the women and patients who had preoperative pain had a greater improvement following endodontic treatment (26). Younger individuals (≤ 30 years) expressed greater satisfaction, aligning with findings from Hamasha et al. (13). However, age-related differences in pain, aesthetics, and chewing function may not always be significant (27). Grath et al. (28) found that the satisfaction level was affected by factors such as the ability to eat comfortably and the aesthetics of the teeth.

The DMFT score, the number of teeth requiring root canal treatment, the presence of endodontic flare-ups, and the use of teeth as abutment for denture prostheses, also played a role in patient satisfaction. Lower DMFT scores (0-5) were associated with significantly higher satisfaction levels, indicating the positive impact of oral health on overall well-being. Similarly, patients with fewer teeth in need of RCT reported greater satisfaction. The absence of endodontic flare-ups was correlated with higher satisfaction scores, emphasizing the importance of effective treatment. In contrast, patients requiring retreatment of failed endodontic procedures exhibited lower satisfaction, suggesting potential complexities in addressing cases with previous treatment failures (26).

Our study found that endodontic treatment in either molar or non-molar teeth resulted in higher satisfaction levels than treatment in both types of teeth. We observed significantly higher satisfaction levels in patients undergoing endodontic treatment in either mandibular or maxillary teeth compared to those with both jaw teeth. Furthermore, our study indicated that smaller periapical lesion (PAI) scores were associated with increased satisfaction, supporting Dugas et al. (11) suggestion that PAI scores can predict patient-reported satisfaction.

Our study demonstrated that single-visit endodontic treatment yielded significantly higher satisfaction compared to multiple visits. This finding resonates with previous research, indicating that a single-visit approach may enhance treatment outcomes and patient experiences (29, 30). In this study, patients who required emergency access opening due to severe pain or infection reported lower overall satisfaction scores (7.22 ± 1.12) compared to those who did not require emergency access (8.16 ± 1.52). This suggests that addressing urgent needs promptly may play a role in enhancing patient satisfaction.

It is important to acknowledge the limitations of this study. This study was conducted at a single dental center, which may limit the generalizability of the findings to a broader population. Patient satisfaction was assessed two weeks post-treatment, and longer-term follow-ups could provide insights into the sustainability of satisfaction levels and whether any issues or complications arise after a longer period. Additionally, patient satisfaction is a complex and subjective measure influenced by various factors, including personal expectations and experiences. While efforts were made to quantify this using a scale, it may not capture the full spectrum of patient experiences and perceptions.

Our study not only underscores the positive impact of root canal treatment on patients' well-being but also provides valuable insights into specific factors influencing their satisfaction. These insights have the potential to inform improvements in endodontic care,

leading to enhanced patient experiences and outcomes. Further research involving diverse geographic and socioeconomic populations, could contribute significantly to the field of endodontics and advance patient-centered care practices.

Conclusions

Our findings indicated a high level of overall general satisfaction, with an average rating of 8.08 on a scale of 1 to 10. Patients expressed the greatest satisfaction with improved chewing ability post-treatment, with an average score of 7.77, underscoring the importance of functional outcomes in enhancing patient contentment. However, areas of dissatisfaction were observed, particularly concerning treatment cost and the total duration of endodontic treatment

Demographics, clinical variables, and treatment settings played roles in shaping patients' overall satisfaction.

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Conflict of Interest

None declared

References

1. Eckerbom M, Flygare L, Magnusson T. A 20-year follow-up study of endodontic variables and apical status in a Swedish population. Int Endod J 2007; 40(12):940–948.

2. Elafifi-Ebeid H, Betancourt P, Parada-Avendaño I, Arnabat-Domínguez J. Post-endodontic pain evaluation after different intracanal laser assisted disinfection techniques. A Systematic Review. J Clin Exp Dent 2023;15(2):e149-e159.

3. Ng YL, Mann V, Rahbaran S, Lewsey J, Gulabivala K. Outcome of primary root canal treatment: systematic review of the literature-part 1. Effects of study characteristics on probability of success. Int Endod J 2007;40:921-939.

4. Torabinejad M, Lozada J, Puterman I, White SN. Endodontic therapy or single tooth implant? A systematic review. J Calif Dent Assoc 2008;36(6): 429–437.

5. Neelakantan P, Liu P, Dummer PM, McGrath C. Oral health–related quality of life (OHRQoL) before and after endodontic treatment: a systematic review. Clin Oral Investig.2020;24(1):25-36.

6. Liu P, McGrath C, Cheung G. What are the key endodontic factors associated with oral health-related quality of life?. Int Endod J 2014;47(3):238-245.

7. Locker D. Oral health and quality of life. Oral Health Prev Dent 2004;Suppl 1:247–253.

8. American Association of Endodontists. Public education report: surveys document more people choosing root canal therapy over extraction. Chicago, IL: American Association of Endodontists; 1987.

9. Wali A, Siddiqui TM, Gul A, Khan A. Analysis of level of anxiety and fear before and after endodontic treatment. J Dent Oral Health 2016;2(3):1-4.

10. Wigsten E, Al Hajj A, Jonasson P, EndoReCo, Kvist T, Bjørndal L, Dawson VS, Fransson H, Frisk F, Jonasson P, Markvart M. Patient satisfaction with root canal treatment and outcomes in the Swedish public dental health service: A prospective cohort study. Int Endod J 2021;54(9):1462–1472.

11. Dugas NN, Lawrence HP, Teplitsky P, Friedman S. Quality of life and satisfaction outcomes of endodontic treatment. J Endod 2002;28(12):819-827.

12. Gatten DL, Riedy CA, Hong SK, Johnson JD, Cohenca N. Quality of life of endodontically treated versus implant treated patients: a University-based qualitative research study. J Endod 2011;37(7):903-909.

13. Hamasha AA, Hatiwsh A. Quality of life and satisfaction of patients after nonsurgical primary root canal treatment provided by undergraduate students, graduate students and endodontic specialists. Int Endod J 2013;46(12):1131-1139.

14. Ørstavik D, Kerekes K, Eriksen HM. The Periapical Index: a scoring system for radiographic assessment of apical periodontitis. Endod Dent Traumatol 1986; 2:20–34.

15. Wigsten E, Kvist T, Jonasson P, Bjørndal L, Dawson VS, Fransson H, Frisk F, Markvart M, Pigg M, Wolf

E, Davidson T. Comparing quality of life of patients undergoing root canal treatment or tooth extraction. J Endod. 2020;46(1):19-28.

16. Varatharajan PN, Leburu A, Krishnamurthy M, Kumar VN. Patients' Perceptions on Root Canal Treatment and Their Experiences with It: Questionnaire-based Survey. J Oper Dent Endod 2021;6(2):78-81.

17. Variani R, Obi AL, Ayatullah MI. Analysis of factors of patient compliance with multi-visit root canal treatment in kupang city. Jurnal Ipteks Terapan 2022;16(4):669-679.

18. Sanz E, Azabal M, Arias A. Quality of life and satisfaction of patients two years after endodontic and dental implant treatments performed by experienced practitioners. J Dent 2022;125:104280.

19. Alsultan M, Srivastava S, Javed MQ, Khan M, Ulfat H, Alsultan MS. Influence of Root Canal Treatment on Oral-Health-Related Quality of Life (OHRQoL) in Saudi Patients: A Cross-Sectional Study. Cureus 2023;15(9).

20. Azarpazhooh A, Dao T, Ungar WJ, Da Costa J, Figueiredo R, Krahn M, Friedman S. Patients' values related to treatment options for teeth with apical periodontitis. Journal of endodontics. 2016;42(3): 365-370.

21. Aleid AA. Patients' perceptions and experiences about the root canal treatment: An exploratory study among Saudi population. Asian J Oral Health Allied Sci.2021;11(5).

22. Atmeh A, Al-Hadi Hamasha A. Outcome assessment of non-surgical root canal treatment by patients: what factors can influence their evaluation? Br Dent J. 2020;228(10):762-766.

23. Kvist T, Reit C. Postoperative discomfort associated with surgical and nonsurgical endodontic retreatment. Dent Traumatol 2000;16(2):71-74.

24. Melgaço-Costa JL, Martins RC, Ferreira EF, Sobrinho AP. Patients' perceptions of endodontic treatment as part of public health services: a qualitative study. Int J Environ Res Public Health 2016;13(5):450.

25. Torabinejad M, Anderson P, Bader J, Brown LJ, Chen LH, Goodacre CJ, Kattadiyil MT, Kutsenko D, Lozada J, Patel R, Petersen F. Outcomes of root canal treatment and restoration, implant-supported single crowns, fixed partial dentures, and extraction without replacement: a systematic review. J Prosthet Dent 2007;98(4):285-311.

26. Khoo ST, Ode W, Lopez V, Yu VS, Lai C, Lui JN. Factors influencing quality of life after surgical and nonsurgical interventions of persistent endodontic disease. J Endod 2020;46(12):1832-1840.

27. Zilinskaite-Petrauskiene I, Haug SR. A Comparison of Endodontic Treatment Factors, Operator Difficulties, and Perceived Oral Health–related Quality of Life between Elderly and Young Patients. J Endod 2021;47(12):1844-1853.

28. Grath CM, Bedi R, Gilthorpe MS. Oral health related quality of life--views of the public in the United Kingdom. Community Dent Health 2000;17(1): 3-7.

29. Manfredi M, Figini L, Gagliani M, Lodi G. Single versus multiple visits for endodontic treatment of permanent teeth. Cochrane Database Syst Rev 2016; 12(12).

30. Rossi-Fedele G, Rödig T. Effectiveness of root canal irrigation and dressing for the treatment of apical periodontitis: A systematic review and meta-analysis of clinical trials Int Endod J 2022;13777.