Patients' Perceptions and Experience towards Root Canal Treatment: A Prospective Analytical Study

Pradhan SP,[1] Nepal M,[1] Chakradhar A,[1] Mahanta SK,[2] Adhikari S[3]

[1]Department of Conservative Dentistry and Endodontics,

[2]Department of Community Dentistry,

[3]Department of Oral Medicine and Radiology,

Kathmandu University School of Medical Sciences,

Dhulikhel, Kavre, Nepal.

Corresponding Author

Siras Prasad Pradhan

Department of Conservative Dentistry and Endodontics,

Kathmandu University School of Medical Sciences,

Dhulikhel, Kavre, Nepal.

E-mail: sirasechs@gmail.com

Citation

Pradhan SP, Nepal M, Chakradhar A, Mahanta SK, Adhikari S. Patients' Perceptions and Experience towards Root Canal Treatment: A Prospective Analytical Study. *Kathmandu Univ Med J.* 2025; 91(3): 375-80.

ABSTRACT

Background

Although Root Canal Treatment (RCT) is considered to be a painful procedure, it actually alleviates the pain of endodontic origin. Patient may avoid root canal treatment mainly due to anxiety and fear of pain, resulting in treatment avoidance and eventual tooth loss through extraction.

Objective

To overview the patients' perceptions towards Root Canal Treatments and compare those perceptions to their post treatment actual experiences.

Method

A prospective analytical study was conducted at the Department of Conservative Dentistry and Endodontics, Kathmandu University School of Medical Sciences (KUSMS), Dhulikhel. A structured questionnaire was administered to the patients before starting of the root canal treatment and immediately after placement of the root canal filling materials. Multiple-choice questions were used to assess patient concerns, levels of nervousness, and perceptions of anticipated versus experienced pain.

Result

Before initiation of treatment 38 patients (16.7%) anticipated root canal treatment to be painless, while 171 (75.3%) and 18 (7.9%) expected it to be painful and extremely painful respectively. Following treatment 123 patients (54.2%) reported no pain, whereas 98 (43.2%) and 6 (2.6%) experienced it as painful and extremely. While pain associated with the treatment was the highest pretreatment concern 60 (26.4%), the post treatment concern was time 38 (16.7%).

Conclusion

The study provided insights into patient's perceptions regarding root canal treatment. Pain experienced during endodontic treatment was frequently less than anticipated pain. There was a 100% satisfaction rate with root canal treatment, and most patients expressed willingness to undergo the treatment again if needed.

KEY WORDS

Anticipated pain, Experienced pain, Pain perception, Root canal treatment

INTRODUCTION

Root canal treatment (RCT) is indicated in patients with an irreversibly damaged or necrotic pulp with or without clinical and/or radiological findings of apical periodontitis. Elective devitalization is performed to provide post space, prior to construction of an overdenture, doubtful pulp health prior to restorative procedures, likelihood of pulpal exposure when restoring a (misaligned) tooth and prior to root resection or hemisection.[1]

Root canal treatment is widely perceived to be a painful procedure. A survey by the American Association of Endodontists reported 67% of Americans say fear of pain most concerns them about having root canal treatment.[2] Anticipated pain has also been demonstrated to be consistently higher than the actual pain experienced during RCT.[3,4] For many patients, fear of dental pain and avoidance of dentistry are synonymous.[3]

Although believed to be a painful procedure, this procedure actually alleviates pain of endodontic origin and only 17% of subjects described it as their most painful dental experience.[5] The cost and time invested might also be the reason for hesitation towards treatment. Assessing patient's pretreatment perception enables clinicians to effectively manage their patients and mitigate negative post treatment responses, which is potential to change the attitudes of the public, thus allowing more natural teeth to be retained. The review of literature shows there is no data till date about the perception and experiences of RCT among patients in Nepalese population. Thus, this study aims to overview the patients' perceptions towards RCTs and compare those perceptions to their post treatment actual experiences.

METHODS

This prospective analytical study was conducted among the patients who required Root Canal Treatment, visiting the Outpatient Department of Conservative Dentistry and Endodontics, Kathmandu University School of Medical Sciences (KUSMS), Dhulikhel Hospital, Kavrepalanchok for the duration of six months between 2024 September 01 to 2025 February 28. Ethical approval was obtained from the Institutional Review Committee, KUSMS (Ref. 279/24).

The study involved patients completing two questionnaires: a pretreatment questionnaire completed prior to the initial endodontic appointment and a posttreatment questionnaire administered immediately after root canal filling was placed. Patients who had completed the pretreatment questionnaire were given post treatment questionnaire. The pre-validated questionnaire developed by Chandraweera et al. with slight modifications was adopted in this study.[6] Patients aged 15 years and older were invited to participate. Dental surgeons were responsible for inviting the patients to participate in study and distribution of pre- and post-treatment questionnaire.

Informed consent was obtained from all participants after providing detailed information about the study purpose and procedures. Participants were not provided any assistance in filling out the questionnaire.

The sample size was calculated using the formula:

$n = (Z_{\alpha/2} + Z_{\beta})^2 * (p_1(1-p_1) + p_2(1-p_2)) / (p_1-p_2)^2$

Sample size based on differences in proportions of pain associated with treatment. Values taken from a similar study done by Varatharajan et al.[7]

P_1: 37%

P_2: 19%

Sample size calculated to be 132 per group. Total sample size 264.

Sample size calculated at 80% power, 95% CI.

z critical value is 1.64

Sample size calculated in G Power.

Inclusion criteria

• Patient aged above 15 years.

• American Association of Anesthesiologists physical status classification I or II.

• Those who can read / write either Nepali or English language.

Exclusion criteria

• Patients who disagree to participate.

• Mentally and physically unfit patient.

• Illiterate patients who can't read / write structured questionnaire and sign the consent form.

• If a patient did not complete the RCT or the posttreatment survey, their responses will be eliminated from the analysis.

The data were entered in Microsoft excel and analyzed using SPSS (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY, USA). The analysis was performed using methods of descriptive statistics. The obtained data are presented in table and figure.

RESULTS

The study group included 227 patients who met the inclusion criteria based on their pretreatment survey replies. The posttreatment surveys were completed by 100% of these patients. Out of those, 112 (49.3%) participants were males and 115 (50.7%) were females. The participants ranged in age from 15 to 72 years old with the mean age of 34.4 ± 14.1 years. The highest education levels of the patients were secondary school (51, 22.5%), high school (85, 37.4%), bachelor's degree (59, 26%), post-graduate degree (16, 7.04%) and unknown (16, 7.04%).

In a pretreatment questionnaire, regarding prior RCT experience 121 (53.3%) of the patients had prior experience while 106 (46.7%) had not undergone prior RCT. Similarly, 151 (66.5%) think that RCT is indicated only when pain associated with the tooth is present and 76 (33.5%) responded that the tooth might need RCT, even if it doesn't hurt. A total of 93 (41%) patients reported no nervousness, 115 (50.7%) felt nervous, and 18 (7.9%) were extremely nervous during RCT. Likewise, 38 (16.7%) patients expected RCT not to be painful, 171 (75.3%) and 18 (7.9%) expected it to be painful and extremely painful, respectively. The tooth was not painful in 55 (24.2%), slightly painful in 88 (38.8%), moderately painful in 70 (30.8%) and extremely painful in 14 (6.2%). Regarding the importance of keeping teeth, 5 (2.2%) felt it is not important while 93 (41%) and 129 (56.8%) felt that it is important and extremely important, respectively. Similarly, cost for RCT was not an issue for 61 (26.9%) patients, as expected for 139 (61.2%) and extremely expensive for 27 (11.9%) patients. (Table 1)

Table 1. Pre-treatment responses to the questions regarding knowledge and perceptions about endodontic treatment

Question	Response	Total
Have you ever had a RCT?	Yes	121 (53.3)
	No	106 (46.7)
When do you think RCT is indicated for a tooth ?	Only when pain associated with tooth is present	151 (66.5)
	The tooth might need RCT, even if it doesn't hurt	76 (33.5)
How do you feel about having RCT?	Not nervous	93 (41)
	Nervous	115 (50.7)
	Extremely Nervous	18 (7.9)
Are you expecting RCT to be painful?	Not painful	38 (16.7)
	Painful	171 (75.3)
	Extremely Painful	18 (7.9)
Are u currently experiencing any pain with your tooth?	Not painful	55 (24.2)
	Slightly Painful	88 (38.8)
	Moderately Painful	70 (30.8)
	Extremely Painful	14 (6.2)
How important is keeping your tooth?	Not important	5 (2.2)
	Important	93 (41)
	Extremely important	129 (56.8)
How do you feel about the cost of RCT?	Cost not an issue	61 (26.9)
	As expected	139 (61.2)
	Extremely Expensive	27 (11.9)

In a posttreatment questionnaire, RCT experience was worse than expected in 1 (0.4%), as expected in 115 (50.7%) and better than expected in 111 (48.9%) patients. Similarly, RCT was not painful for 123 (54.2%), painful and extremely painful for 98 (43.2%) and 6 (2.6%), respectively. Likewise, 198 (87.2%) felt very happy, 23 (10.1%) felt indifferent, and 6 (2.64%) would rather have their tooth extracted rather than RCT. If RCT was needed again, 223 patients (98.2%) indicated they would undergo the procedure, while 4 (1.8%) stated they would not. If the patients had to have RCT again, after the treatment, 184 (81.1) wouldn't feel while 38 (16.7) and 5 (2.2) would still feel nervous and extremely nervous, respectively. Regardless of all the factors, 100% patients were satisfied with the outcome of their RCT. However, 91 (40.1%) thought that the teeth would become weaker after RCT while 136 (59.9) thought it wouldn't (Table 2).

Table 2. Post-treatment responses to the questions regarding experience about endodontic treatment

Question	Response	Total
Having had RCT, was the experience better or worse than you expected?	Worse than expected	1 (0.4)
	As expected	115 (50.7)
	Better than expected	111 (48.9)
Did you experience any pain with your RCT?	Not painful	123 (54.2)
	Painful	98 (43.2)
	Extremely Painful	6 (2.6)
After having RCT, how happy are you to have kept your tooth?	Very happy	198 (87.2)
	Indifferent	23 (10.1)
	Rather have had tooth extracted	6 (2.64)
Would you have RCT again if it was needed?	Yes	223 (98.2)
	No	4 (1.8)
If you had to have RCT again, how would you feel about it?	Not Nervous	184 (81.1)
	Nervous	38 (16.7)
	Extremely Nervous	5 (2.2)
Overall, are you satisfied with the outcome of your RCT?	Yes	227 (100)
	No	
Do you think teeth become weaker after RCT?	Yes	91 (40.1)
	No	136 (59.9)

Figure 1 illustrates data relating to the patients' concerns associated with RCT. Patients reported no pretreatment concerns regarding RCT in 26.4% of cases. This increased to 51.98% after treatment. A majority of respondents reported pain associated with treatment 26.4% and time 23.8% as some of their higher concerns prior to treatment. Post-operatively, time was the greatest cause of dissatisfaction 16.7%, with both cost and treatment failure, each concerning 7.5% of patients. However, only 7% of patients reported dissatisfaction as a result of pain.

DISCUSSIONS

In Nepal, oral health is not yet regarded as a high priority by people, thus ignoring their oral health to an extent that when they eventually seek dental treatment, the teeth are more likely to be involved with pulpal or periradicular disease which requires either RCT or extraction. Root canal treatment obviously alleviates pain of endodontic origin and helps in retention of the natural teeth that

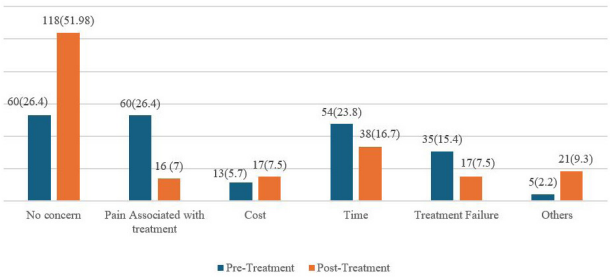

Figure 1. Patient concern prior to and following completion of RCT

would otherwise likely be extracted, but the perception and experiences of RCT among Nepalese population has not yet been subject of research. RCT is often perceived as painful procedure by the patient. Despite of oral problems many patients avoid treatment because of anxiety and fear of pain. Studies have shown that actual pain is far more less than anticipated pain.[3,6] Therefore, it is of utmost importance to know about the pretreatment patients' perceptions of RCT and compare those with their actual posttreatment experiences.

The study was conducted in the Department of Conservative Dentistry and Endodontics, Kathmandu University School of Medical Sciences (KUSMS), Dhulikhel Hospital, which is one of the tertiary health care centers of Nepal, where the patients representing a large number of populations from various backgrounds seek the treatment. The study group included 227 patients, out of those 112 (49.3%) participants were males and 115 (50.7%) were females, and the mean age of participants was 34.4 ± 14.1 years. The study done by Acharya et al. also observed the more need of endodontic therapy among female patients (58%) compared to males (42%) and the mean age was 34.97 ± 14.34 years, which is similar to our results.[8]

In this study, the patients were asked to complete two questionnaires, one before the start of the treatment and another immediately after obturation. Only patients who had completed the pretreatment questionnaire and had their RCT completed within the research period were eligible to participate in posttreatment questionnaire. Among 270 patients, 227 (84.07%) patients were included in the study who completed the treatment. There are many reasons why patients do not proceed with treatment after initiation which includes, inter-appointment vertical crack or fracture in the root thereby the tooth not being suitable for RCT and instead required extraction, the patient chose extraction after initiation, or the patient did not return for the treatment because of the burden of the cost, the length of the procedure and pain. After the removal of infected pulp, the pain may be alleviated without completing the whole treatment for few months and the patient may also discontinue the treatment until the symptoms reoccur.[6,9]

In a pretreatment questionnaire, regarding prior RCT experience 121 (53.3%) of the patients had prior experience while 106 (46.7%) had not undergone prior RCT. One study analyzing the experiences of patients regarding endodontic treatment, it was found that 69% of people in the past had experienced the procedure of root canal treatment.[10] The study done by Chandraweera also reported 71% of the patients had prior RCT experience.[6] In contrast to our findings, one study reported that only 23.33% of patients had knowledge about the treatment due to their own previous RCT experience.[11] Similarly, Manasa et al. also reported 90 out of 300 (30%) patients had a previous history of RCT.[12]

Apart from an irreversibly damaged or necrotic pulp with or without clinical and/or radiological findings of apical periodontitis, elective devitalization is also indicated as a part of prosthetic rehabilitation. Moreover, chronic periapical abscess which is painless and is associated with draining sinus which prevents pressure development in the tooth, also requires RCT. However, one study found that the main reason for initiation of root canal treatment was to relieve symptoms, mainly pain due to pulpal necrosis or pulpitis (64.9%).[13] Likewise, in our study, 151 (66.5%) think that RCT is indicated only when pain associated with the tooth is present and 76 (33.5%) responded that the tooth might need RCT, even if it doesn't hurt. Similar to our study, the study done by Bansal et al. revealed that, 76% patients think tooth has to be associated with pain if indicated for RCT.

Psychological factors such as fear of dental treatment and anxiety are known to influence pain perception.[14] In one study, anxiety and pain showed a significant association. This suggests that the fear of endodontic treatment may be primarily psychological rather than directly caused by biological factors such as pain.[15] In our study, 93 (41%) of patients were not nervous, 115 (50.7%) were nervous and 18 (7.9%) were extremely nervous while having RCT. The same study reported that 38.9% patients were not anxious and 61.1% of patients were anxious before treatment, which is similar to the result of our study.[15]

Pain may be anticipated, experienced, recalled, and communicated by patients in the pretreatment, treatment, and posttreatment phases. Consequently, implementing effective pain management strategies throughout root canal therapy is essential to eliminate the misconception that the clinician is responsible for inducing or intensifying pain. One study reported that 93% of patients anticipated pain during RCT.[6] Similarly, our study reported, 83.2% expected it to be painful and extremely painful. In the current investigation, the tooth was not painful in 55 (24.2%), slightly painful in 88 (38.8%), moderately painful in 70 (30.8%) and extremely painful in 14 (6.2%). In a systematic review, Pak and White reported that 68% of patients had pretreatment pain, and less than 10% of them had posttreatment pain at 7 days. Pretreatment RCT associated pain prevalence is high, but drops moderately within one day of treatment, and to minimal levels in a week.[5]

In our study, the majority of subjects 97.3% expressed

considerable satisfaction with their decision to undergo root canal treatment rather than opt for tooth extraction, highlighting the perceived value of preserving natural dentition. Studies have reported that 97.1% of patients were satisfied with their decision to have RCT rather than extraction.[6] In contrast to our study, 16% of respondents preferred extraction over RCT.[11] One study reported that approximately 13.19% of respondents expressed no concern regarding tooth loss and prioritized immediate pain relief.[9]

Analysis of existing clinical and economic data suggests that root canal treatment is a highly cost-effective first-line intervention.[16] Tooth replacement costs exceed those of root canal treatment followed by its prosthetic rehabilitation; thus, patients should be counseled on tooth preservation and the economic burden of prosthetic replacement. In the present study, cost for RCT was not an issue for 61 (26.9%) patients, as expected for 139 (61.2%) and extremely expensive for 27 (11.9%) patients. In contrast to our study, a majority of respondents reported cost 55% associated with treatment their concern prior to treatment.[6] Similarly, Bansal et al. also indicated that 64.67% of patients considered RCT to be too costly.[11] As this study was carried out in a community-based hospital where the quality service outweighs profit, so the treatment charge is minimum that ranges from NRs 3500 - NRs 6000 which equates $25-$43, thus the discrepancies between studies may result from difference in the study site.

In the posttreatment questionnaire, patients were inquired about their treatment experience, whether they experienced pain during or following the procedure, their perspective on the importance of preserving the natural tooth, and their willingness to undergo root canal therapy again if required.

The result showed that RCT experience was worse than expected in 1 (0.4%), as expected in 115 (50.7%) and better than expected in 111 (48.9%) patients. The study done by Alroomy et al. reported 21.1% had bad experience and 78.9% had good experience, which is in contrast to our study.[15] Similarly, RCT was not painful for 123 (54.2%), painful and extremely painful for 98 (43.2%) and 6 (2.6%), respectively. Segura-Egea et al. reported that pain was absent in 54% of the cases. The pain experienced was slight, moderate and intense in 34%, 9% and 3% of the cases respectively, and the result obtained is similar to that of our study.[17] However, Varatharajan et al. reported that only 7% of patients experienced pain during treatment.[7] This low prevalence may be attributed to the influence of specific risk factors that increase both the likelihood and severity of intraoperative pain. Greater pain was observed in root canal procedures involving teeth with irreversible pulpitis and acute apical periodontitis. Additionally, patient age, the type of tooth treated, and the overall treatment duration were identified as variables significantly associated with a higher risk of intraoperative pain.[17]

In line with the pretreatment assessment, 198 patients (87.2%) reported being very satisfied, 23 patients (10.1%) expressed indifference, and 6 patients (2.64%) indicated that they would prefer extraction over RCT. Similarly, when asked whether they would undergo RCT if indicated in the future, 223 patients (98.2%) responded affirmatively, while only 4 patients (1.8%) declined. The reasons behind patients avoiding to undergoing RCT may be misconceptions about its success, time and cost concerns, and the preference for immediate pain relief through extraction. Furthermore, when asked about undergoing RCT again, 184 patients (81.1%) reported they would not feel nervous, while 38 patients (16.7%) indicated they would feel somewhat nervous, and 5 patients (2.2%) stated they would feel extremely nervous. This may be due to the fear of RCT, often stemming from anticipated or previously experienced pain.

Loss of tooth tissue from decay, fracture, or conservative access cavity preparation minimally affects biomechanics, reducing stiffness by approximately 5%, while subsequent instrumentation and obturation have negligible impact on fracture resistance.[18] Our study found that the majority of patients (59.9%) believed that teeth do not weaken following root canal treatment (RCT), whereas 40.1% perceived a reduction in tooth strength. In contrast, Bansal et al. reported that 79.11% of their participants believed that RCT-treated teeth become weak.[11]

Regardless of all the factors, 100% patients reported satisfaction with the results of their root canal treatment. Similarly, Chandraweera et al. found that every participant expressed overall satisfaction with the completed RCT.[6] High satisfaction ratings with RCT are evident in the literature, with a majority of patients (90% - 97.1%) electing for future treatment if necessary.[19,20]

Regarding patients' concerns related to RCT, prior to treatment, 26.4% of patients reported having no concerns, which increased to 51.98% following treatment. Before undergoing RCT, the most commonly reported concerns were pain (26.4%), treatment duration (23.8%) and treatment failure (15.4%). The study done by Janczarek et al. also reported that the pain associated with treatment (44%) and the associated high costs (42%) followed by the possible complication of having to remove a tooth despite taken treatment (34%) and the long duration of the visit (25%) as concerns.[10]

After the procedure, treatment time emerged as the primary source of dissatisfaction (16.7%). Evidence from the literature suggests that the majority of practitioners (52.4%) complete RCT within three visits, whereas 26.8% perform the procedure in a single sitting. Completion of RCT in more than three visits has been reported by only a minority of dentists.[21] The advent of advanced automated instruments has enabled the procedure to be performed in a single visit. Consequently, an increasing number of dentists are incorporating single-visit endodontics as a key

aspect of contemporary clinical practice which can help to address the patient's concerns related to treatment time. However, Chandraweera et al. reported the cost (44%) and the treatment failure (15%) were the main discouraging factors for future RCT, which is in contrast to our findings as cost and the possibility of treatment failure each concerned 7.5% of patients.[6]

As this study is totally subjective survey, there is a possibility of response bias. The study represents only the views of patients visiting tertiary care center located at Kavrepalanchok, hence the generalizability of this study is limited as patients in other parts of Nepal may have different perceptions. Also, different forms of anesthesia which may reduce post-operative pain and associated anxiety, single visit root canal treatment and long-term treatment outcome were not considered in this study. Further studies should be undertaken on larger scales to develop more understanding of patients' attitudes at different socioeconomic and community levels toward RCT.

CONCLUSION

The study provided insights into patient's perceptions regarding RCT. Most patients presented with pain for the treatment which suggests the lack of awareness towards oral health highlighting the significance of conducting regular oral health campaigns, which could avoid the more intensive treatment like RCT which is costly as compared to other procedures like restoration. Interestingly, initial reluctant towards the procedure did not affect the patient's satisfaction towards the outcome as the result was 100%.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the study subjects who were willing to participated in the study, the dental surgeons posted in the Department of Conservative Dentistry and Endodontics for distributing and collecting questionnaire.

REFERENCES

1. European Society of Endodontology. Quality guidelines for endodontic treatment: consensus report of the European Society of Endodontology. *Int Endod J.* 2006 Dec;39(12):921-30.
2. American Association of Endodontists. Dispelling Myths of Root Canals Through Education. American Association of Endodontists. Posted 15 Mar 2016. Available from: http://www.aae.org/specialty/dispelling-myths-of-root-canals-through-education-2.
3. Watkins CA, Logan HL, Kirchner HL. Anticipated and experienced pain associated with endodontic therapy. *J Am Dent Assoc.* 2002 Jan;133(1):45-54.
4. Gupta N, Singh N. Anticipated and Experienced Pain Associated with Root Canal Treatment in a Teaching Dental Hospital in India: A Survey. *Indian J Dent Sci.* 2023 Oct 1;15(4):163-7.
5. Pak JG, White SN. Pain prevalence and severity before, during, and after root canal treatment: a systematic review. *J Endod.* 2011 Apr;37(4):429-38. doi: 10.1016/j.joen.2010.12.016. PMID: 21419285.
6. Chandraweera L, Goh K, Lai-Tong J, Newby J, Abbott P. A survey of patients' perceptions about, and their experiences of, root canal treatment. *Aust Endod J.* 2019 Aug;45(2):225-32.
7. Varatharajan PN, Krishnamurthy M, Kumar VN. Patients' Perceptions on Root Canal Treatment and Their Experiences with It: Questionnaire-based Survey. *J Conserv Dent Endod*. 2022 May 24;6(2):78-81.
8. Acharya N , Humagain R , Dahal S , Kafle D . The Need of Endodontic Therapy among Patients Attending Tertiary Care Center in Central Nepal. *Kathmandu Univ Med J (KUMJ)*. 2022 Jul-Sep;20(79):264-7. PMID: 37042363.
9. Sadasiva K, Rayar S, Senthilkumar K, Unnikrishnan M, Jayasimharaj U. Analyzing the Reasons for Patients Opting-out from Root Canal Treatment and Preferring Extraction in South Indian Population-Prospective Study. *Int J Prosthodont Restor Dent*. 2018;8(4):108-13.
10. Janczarek M, Cieszko-Buk M, Bachanek T, Chałas R. Survey-based research on patients' knowledge about endodontic treatment. *Pol J Public Health*. 2014 Nov 7;124(3):134-7.
11. Bansal R, Jain A. An insight into patient's perceptions regarding root canal treatment: A questionnaire-based survey. Journal of family medicine and primary care. 2020 Feb 1;9(2):1020-7.
12. Manasa N, Naik KB, Singh M, Moiz AA, Kudala VR, John NK. Patient's Knowledge and Perception of Endodontics Treatment: An Observational Study. *J Pharm Bioallied Sci.* 2023 Jul;15(Suppl 1):S571-S574.
13. Wigsten E, Jonasson P; EndoReCo; Kvist T. Indications for root canal treatment in a Swedish county dental service: patient- and tooth-specific characteristics. *Int Endod J.* 2019 Feb;52(2):158-68.
14. Kamel AM, Al-Harbi AS, Al-Otaibi FM, Al-Qahtani FA, Al-Garni AM. Dental anxiety at Riyadh Elm university clinics. *Saudi J Oral Sci.* 2019 Jul 1;6(2):101-12.
15. Alroomy R, Kim D, Hochberg R, Chubak J, Rosenberg PA, Malek M. Factors Influencing Pain and Anxiety Before Endodontic Treatment: A Cross-Sectional Study Amongst American Individuals. *Eur Endod J.* 2020; 3: 199-204.
16. Pennington MW, Vernazza CR, Shackley P, Armstrong NT, Whitworth JM, Steele JG. Evaluation of the cost-effectiveness of root canal treatment using conventional approaches versus replacement with an implant. *Int Endod J*. 2009 Oct;42(10):874-83.
17. Segura-Egea JJ, Cisneros-Cabello R, Llamas-Carreras JM, Velasco-Ortega E. Pain associated with root canal treatment. *Int Endod J.* 2009 Jul;42(7):614-20.
18. Trope M, Ray HL Jr. Resistance to fracture of endodontically treated roots. *Oral Surg Oral Med Oral Pathol.* 1992 Jan;73(1):99-102.
19. Hamedy R, Shakiba B, Fayazi S, Pak JG, White SN. Patient-centered endodontic outcomes: a narrative review. *Iran Endod J.* 2013 Fall;8(4):197-204.
20. Montero J, Lorenzo B, Barrios R, Albaladejo A, Mirón Canelo JA, López-Valverde A. Patient-centered Outcomes of Root Canal Treatment: A Cohort Follow-up Study. *J Endod.* 2015 Sep;41(9):1456-61.
21. Gaikwad A, Jain D, Rane P, Bhondwe S, Taur S, Doshi S. Attitude of general dental practitioners toward root canal treatment procedures in India. *J Contemp Dent Pract*. 2013 May 1;14(3):528-31.