Impact of Root Canal Treatment on Oral Health-Related Quality of Life in European Population: A Systematic Review

ABSTRACT:

Background: The current systematic review examines the complex picture of endodontic treatment, including quality of life, patient satisfaction, and caries prevalence, through 24 research studies conducted in various European countries.

Methodology: A thorough and methodical search of the literature was carried out using five major electronic databases' predefined keywords and phrases. In strict compliance with PRISMA guidelines, this study included a variety of designs, mainly randomized and prospective studies. This review examines the challenges of endodontic treatment, examines in detail the characteristics and indications for root canal fillings, and highlights the importance of assessing health-related quality of life (HRQOL) and patient-reported experience measures (PREMs).

Results: In particular, patients who undergo root canal treatment experience a statistically significant improvement in their quality of life compared to patients who choose to have their teeth extracted. Looking at prevalence rates globally reveals interesting regional differences. In particular, European and American populations perform better. These differences are due to factors such as patient compliance, better tools, and trained healthcare providers, which lead to improved HR quality of life.

Conclusion: In conclusion, this systematic review highlights the need for further research to not only reveal the differences in endodontic treatment but also to match patient expectations, thereby promoting continued improvement in treatment outcomes and overall quality of life. The study found that European patients experienced significant improvements in quality of life after root canal treatment. Pain and discomfort decrease, 75% of patients experience less pain and discomfort after treatment. Additionally, the majority of patients report improvements in their lives after treatment. These findings suggest that root canal treatment is an effective way to improve the quality of life of European patients. This study highlights the importance of addressing patients' concerns and fears regarding dental procedures and improving communication and doctor-patient relationships to improve root canal treatment. Overall, this study provides a good insight into the impact of root canal treatment on the quality of life of European patients and has important implications for the development of care strategies for patients in this population.

Keywords: Endodontic treatment, Quality of life, Patient satisfaction, PRISMA guidelines, Randomized studies, Global prevalence rates, Patient compliance.

INTRODUCTION:

The natural tooth is unique and irreplaceable in terms of appearance, sensation, and functionality. Modern endodontics has made significant advancements in technologies, procedures, and materials, providing a wide range of treatment options to help save your natural teeth.[1] Traditionally, the success of root canal treatment has been evaluated based on the improvement of symptoms and the healing of periapical (around the root tip) disease. When examining prognostic factors for root canal treatment, researchers have considered various aspects such as the vitality of pulps in teeth, periapical status, and the number of treatment visits[43-45]. Since much of this data comes from observational studies, there is a potential for clinical and statistical heterogeneity. They found that the differences among the studies, known as statistical heterogeneity, could be attributed to certain aspects of the study characteristics.[2]

The Oral Health Impact Profile (OHIP) is a widely recognized tool developed by Slade and Spencer in 1994. By using the OHIP, researchers and healthcare professionals can gain valuable insights into how oral health affects various aspects of a person's well-being. Assessing the impact of oral problems on a person's quality of life is known as OHRQoL, as is an essential component of health related quality of life.[3] Patient reports of Oral Health-Related Quality of Life (OHRQoL) have become increasingly important in complementing the limited professional evaluation that is solely based on clinical parameters. Evaluating the quality of evidence provided by articles that propose to detect changes in OHRQoL after oral interventions is crucial. By critically assessing the evidence, healthcare professionals can make informed decisions and provide interventions that have a positive impact on patients' quality of life.[4] [5]. The Oral Health Impact Profile (OHIP) is indeed an instrument used to assess the quality of life-related to oral disorders. It was developed in Australia by Slade and Spencer and is based on a generic model of disease and its consequences, derived from the International Classification of Impairments, Disabilities, and Handicaps. The OHIP measures self-reported dysfunction, discomfort, and disability, which are intended to complement the traditional oral epidemiological indicators of clinical disease [6] [7]. These measures utilize scaling methods such as visual analog scales, adjectival scales, or semantic differential scales. Semantic differential scales, introduced by Osgood et al., are particularly useful in obtaining ratings of endodontic treatment (ET). By defining dimensions related to ET, such as cost, pain, and function, on a series of continuous bipolar scales, we can identify factors that may impact patient satisfaction with ET [6][4]

There is considerable agreement among researchers that quality of life is subjective. The "Subjective" definition of QOL explains Quality of life as how individuals perceive their place in life, within the framework of the value system and the culture they inhabit and in consideration of their goals, concerns, standards, and expectations. (The World Health Organization Quality of Life assessment (WHOQOL): position paper from the World Health Organization 1995). Oral health is an integral part of general health and can impact the overall quality of life [8]. Root canal treatment (RCT) involves mechanically cleaning and shaping the root canal system, chemically disinfecting it, followed by filling it with a biocompatible material. The goal of this procedure is to maintain and restore the well-being of the tissues surrounding the tooth's root [9].

There has been a rising interest in examining how health impacts the quality of life. This interest is fueled by the desire to better understand the effect of health problems and how healthcare intervention can impact patient's lives [10]. Endodontics treatment implies a potential impact on the overall quality of life and productivity of the population [11]. An important consideration is whether the root canal treatment can alleviate the burden of oral diseases on patients' lives and improve their quality of life [12]. Recent systematic reviews have shown that the shortage of well-designed trials hinders the ability to provide conclusive evidence [13]. There are notable gaps in the overall evidence regarding the association between oral health conditions and health-related quality of life (HRQoL) [14]. The objective of this review is to elucidate the various ways root canal treatment (RCT) improves the patient's quality of life (QoL). By examining the existing literature, this review aims to provide a deeper understanding of the complex relationship between dental intervention and patient health outcomes.

8.2% was the worldwide prevalence of root-filled teeth (RFT).55.7% was the global prevalence of people having at least one RFT. In the 20th century, 10.2% was the prevalence of RFT. In the 21st century, the overall RFT prevalence was 7.5%. The frequency of Root canal treatment (RCT) in different countries ranges from 0.7% to 87% and people with at least one RFT showed a range of percentages from 19.9% to 97.3%. 64.5% prevalence of Root-filled teeth with apical periodontitis in adults of Spain. 80% of adults in Ukraine have teeth that are endodontically treated. The prevalence of root-filled teeth in Norway is 1.3%, in Portugal 1.5%, in Finland 21.5%, in Lithuania 8.2%, in Belgium 6.8%, in Denmark 4.8 to12.6%, in France 19.1%, in Lodz 9.7%, in Turkey 3.3 to 5.3%. The highest prevalence of root-filled teeth has been shown in Brazilian people and the

European population which is 12% and 9.3% respectively. 59.6% of people in Europe have at least one RFT. The frequency of root-filled teeth with apical periodontitis in the Greek population was higher as compared to other European countries [15], [16], [17].

METHODOLOGY:

Study design:

This systematic review is reported by using the PRISMA guidelines. population:(all subject is needed for endodontic treatment, especially for root canal treatment, and re-root canal surgery); comparison: between the quality of life before and after the treatment; outcomes: assess the Oral health-related quality of life in patients after treatment. Data collection was conducted among different electronic databases (PubMed, Wiley Online Library, Springer Link, Science Direct, and Google Scholar). This study was conducted by following the methodological guidance for a systematic review of epidemiological studies. This literature search was undertaken with territory limitation (Oral health-related quality of life in European people) .1830 studies were collected and out of these studies, 24 studies met the inclusion criteria and were included in this systematic review.

Inclusion criteria:

The inclusion criteria were as follows: The studies were from European countries, on oral health-related quality of life after root canal treatment, published in the English language, published in a peer-reviewed journal.

Exclusion criteria:

To systematically review the literature and determine the impact of endodontic treatment on oral health-related quality of life (OHRQoL). By evaluating the changes in OHRQoL before and after treatment, the study aimed to provide valuable insights into the impact of endodontic treatment on patients' well-being.

When evaluating the quality of evidence, it is important to use multi-item scales with validated instruments for assessing quality of life. These instruments capture seven important dimensions of oral health: functional limitation, physical pain, psychological discomfort, physical disability, psychological

The exclusion criteria were as follows: The study outside European countries did not provide information about Quality of life, including patients with mixed dentition, that did not contrast their findings with the radio-graphic examination, published in a language other than English.

Data extraction:

All the information related to the literature was extracted according to the article's identification: country, authors, year of publication, study designs, Participants: gender, range, mean age of participants, and sample size, Results: number of people with one or more root canal treatments, no. of teeth, no of root-filled teeth.

The root canal treatment and patient outcome as Quality of life were accessed in all the included studies. The titles and abstracts of identified articles were screened independently.

Results:

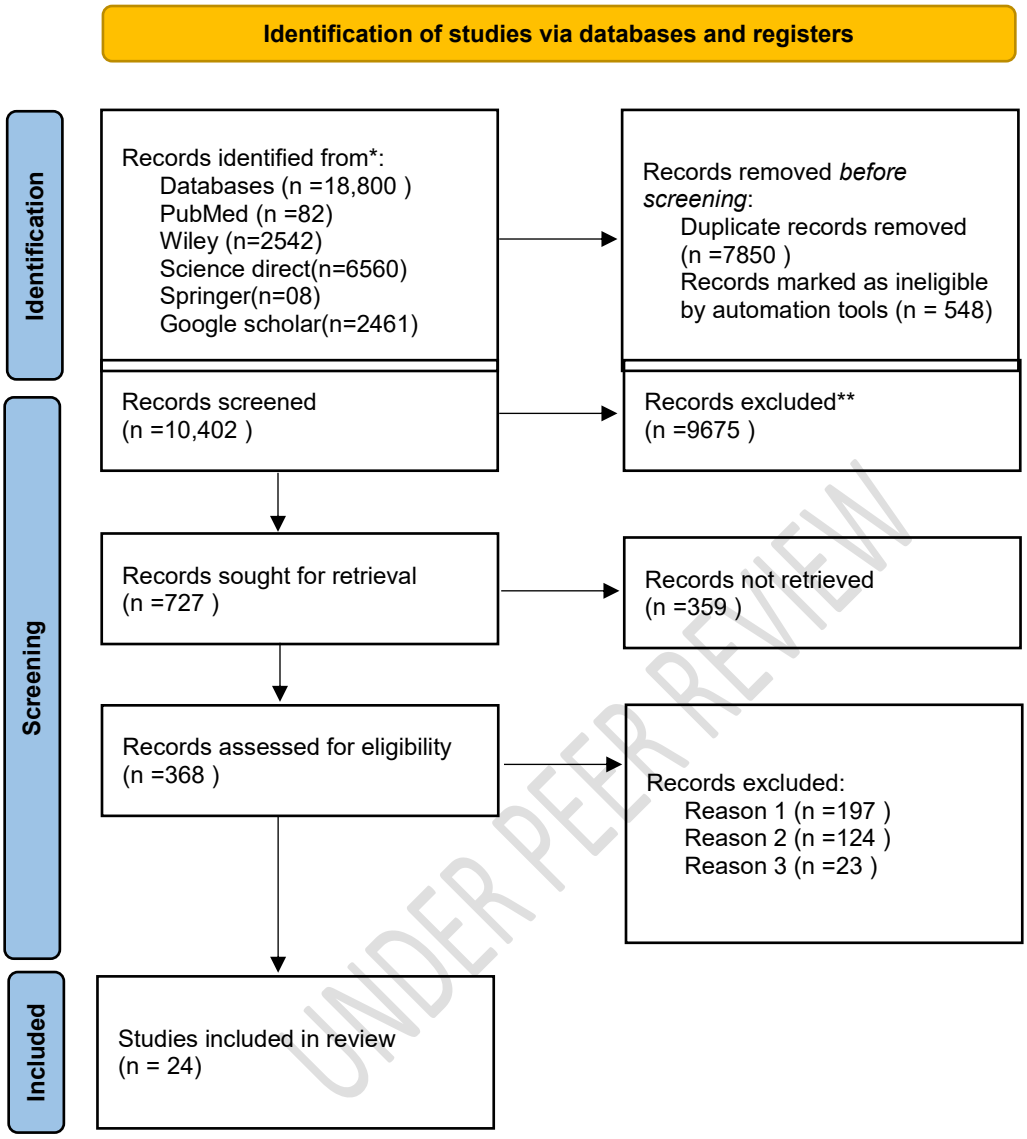
A total of 18,800 articles were found from different databases. Among 10,402 studies were screened after removal of duplicates out of which 9650 studies were excluded, that were not matched by the keywords. Among these shortlisted studies 727 studies, 359 studies were found proceeding (abstract) only when the full-text articles were searched for as presented in Figure 1. They were published in a special edition as the abstract was not available as full text. After the execution of these studies, a total of 368 were assessed for eligibility criteria.

Among them a total of 24 studies were selected as they meet the inclusion criteria and others were excluded due to reason1: studies other than the European population, reason:studies don't specify both objectives (RCT, OHRQoL), reason conducted other than English language. these 24 studies were evaluated for the present systematic review. the titles and abstracts, 24 articles were included in the full-text analysis, ranging from 2001 to 2024. These articles are from Spain (Southwest corner of Europe), the UK (Northwestern Europe), Canada (North America), Italy (South central Europe), the USA (North America), Germany, (Western region of central Europe), Sweden (North Europe), Brazil (South America), China (East Asia) region of Europe as presented in table 2.

the study design included the studies was Longitudinal retrospective observational, Model structure study, University-based qualitative research, Cross-sectional studies, Observational studies, Cohort studies, Random studies, and Prospective studies. we apply the points AXIS 20 tool to verify the quality of all the included studies. The AXIS tool is a critical appraisal tool that addresses issues in cross-sectional studies and reports on quality as well as the risk of bias in cross-sectional studies. The table 1 represents the results of the quality assessment of the included studies using AXIS 20.

The objective of the included studies is justified, the studies included have a defined sample size and study design, and no conflicts of interest were observed in any study that was included in this systematic review.

Figure-1: PRISMA flow diagram for systematic review



The PRISMA 2020 statement: an updated guideline for reporting systematic reviews.
For more information, visit: http://www.prisma-statement.org/

Table 1: ZEE tool for cross-sectional studies assessment (Appraisal tool)

	1 [21]	2 [2]	3 [25]	4 [37]	5 [38]	6 [39]	7 [36]	8 [40]	9 [35]	10 [1]	11 [8]	12 [14]	13 [13]	14 [30]	15 [4]	16 [22]	17 [10]	18 [5]	19 [19]	20 [6]	21 [11]	22 [41]	23 [12]	24 [42]
Were the aims/objectives of the study clear?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Was the study design appropriate for the stated aim(s)?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Was the sample size justified?	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Was the target/reference population clearly defined?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Were measures undertaken to address and categorise non-responders?	×	×	✓	×	✓	×	✓	✓	✓	×	×	×	×	×	✓	×	×	×	✓	×	×	×	×	×
Were the risk factor and outcome variables measured appropriate to the aims of the study?	×	✓	✓	×	✓	×	✓	✓	✓	✓	✓	✓	×	✓	✓	×	✓	✓	✓	✓	✓	✓	×	✓
Were the risk factor and outcome variables measured correctly using instruments/measurements that had been trialled, piloted or published previously?	×	×	✓	×	✓	×	×	×	✓	✓	×	✓	×	×	✓	×	✓	✓	×	✓	✓	✓	✓	✓
Is it clear what was used to determined statistical significance and/or precision estimates? (e.g. p-values, confidence intervals)	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Were the methods (including statistical methods) sufficiently described to enable them to be repeated?	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	✓	✓	×	×	✓	✓	✓	✓	✓	✓
Were the basic data adequately described?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Does the response rate raise concerns about non-response bias?	×	×	✓	✓	×	×	×	✓	×	×	×	×	×	×	✓	✓	×	×	×	×	×	×	×	×
If appropriate, was information about non-responders described?	×	×	✓	×	✓	✓	✓	×	×	×	×	×	×	×	✓	×	×	×	✓	×	×	×	×	×
Were the results internally consistent?	×	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓
Were the results presented for all the analyses described in the methods?	×	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	×	✓	×	✓	✓	✓	✓	✓	✓

Were the authors' discussions and conclusions justified by the results?	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓
Were the limitations of the study discussed?	×	×	×	×	×	×	×	✓	×	×	×	×	×	×	×	×	✓	×	✓	×	✓	×	×	×
Were there any funding sources or conflicts of interest that may affect the authors' interpretation of the results?	×	×	✓	×	×	×	×	✓	×	×	×	×	×	×	✓	×	×	×	✓	×	×	×	×	×
Was ethical approval or consent of participants attained?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 2: Study characteristics of the included studies:

Study no	Authors	Year	Country	Study Design	Number of teeth	Sample size	Gender	Age	Type of evidence	Intervention	Was a pre-intervention QoL reported?	The time point of post-intervention QoL measurement	Key outcome
1	Isabel Lopez-valverde,Fabio Vignoletti,Gianfranco vignollet Conchita Martin,Mariano Sanz [21]	2022	Italy,Spain	longitudinal retrospective observational	598	312	♂=54.2 % ♀=45.8 %	>18	Radio graphic data	non-surgical endodontic therapy	yes	5 years of follow up	High longevity in symptom-less function and high success rates of ETT
2	Y-L.Ng, V.Mann, K. Gulabivala [2]	2007	London	prospective study	1 RCT 759 teeth 2 RCT 858 teeth	572 642	♂=441 ,♀=318 ♂=552, ♀=306	not specified	Radio-graphic data	endodontic treatment	yes	2-4 years follow up	Primary and secondary root canal treatment yield 95% 4-year tooth survival.
3	Javier Montero, Beatriz Lorenzo, Rocio Barrios, Alberto Albaladejo, Jose Antonio Lopez-Valverde [25]	2015	Spain	cohort study	250	250	♂=57.6 % ♀=42.2 %	35 - 65yr	visual analog scale questionnaire validation	root canal treatment	yes	7 days	study aimed to assess the impact of pulpal pathology in terms of oral health
4	Jenny Abanto, Georgios Tsakos, Isabel Cristina Olegário, Saul Martins Paiva, Fausto Medeiros Mendes, Thiago Machado Ardenghi, Marcelo Bönecker [37]	2024	Brazil	Randomized clinical trial	100	50 in tooth extraction 50 in pulpectomy	♂=55 ♀=45	3-5 yr	Radio-graphic	Pulpectomy and dental extraction	yes	4,8,12 months	the impact of root canal treatment on the quality of life was apparent, and higher anxiety levels reported as compared to tooth extraction
5	Professor Ceci Nunes,Carvalho, Professor Meire, Coelho Ferreira [38]	2009	Brazil	randomized	58	pro taper=58	♂48.3 % ♀=51.7 %	18-66 yr	visual analog scale, oral health impact Pofile OHIP 14 questionnaire	root canal treatment performed by proper next or reciprocal	yes	after 7 days	the two canal preparation systems exerted a similar impact on quality of life
6	Abanto J, Tsakos G, Paiva SM, Carvalho TS, Raggio DP, Bönecker M [39]	2013	spain Ireland London	two-arm, randomized controlled	175	50 in pulpectomy 50 in tooth	♀=55 ♂=45	3-5 yr	The Brazilian version of Early Childhood	pulpectomy and tooth extraction	yes	4,8,12 months	pulpectomy resulted in improved oral health-related quality of life and low anxiety as compared to tooth extraction

			Brazil			extraction			Oral Health Impact Scale				
7	Stefania Multari , Mario Alovisi, Elio Berutti, Stefano Corbella , Silvio Taschieri , Giorgia Carpegna , Nicola Scotti , Allegra Comba and Damiano Pasqualini [36]	2020	Italy	Cross sectional study	58	58	♂=22 ♀=36	30 to 60 years	periapical radiography	Root canal treatment	yes	7 days	Root canal treatment improve quality of life
8	Natalie N. Dugas, Herenia P. Lawrence, Paul Teplitsky, and Shimon Friedman [40]	2002	Canada	cross-sectional	150 teeth	119	♂=48.2 %♀=51 .8%	25 to 40 years	Oral Health Impact Profile	The questionnaire that measured changes in QOL	yes	2 years	QOL was improved after endodontic treatment. Satisfaction was significantly better when EDT was provided by endodontists
9	Di Filippo G, Sidhu SK, Chong BS [35]	2014	UK London	Observational study	115 teeth	136	♀=53.7 % ♂=46.3 %	16-65 yr	radio-graphic data	root canal	yes	3 months	High apical periodontitis prevalence in root-filled teeth indicates poor technical quality.
10	Andre Luis Faria-e-Silv [1]	2020	Brazil	randomized controlled	120 teeth	120	♂=30% ♀=70%	34 yr	Oral Health Impact Profile	manual and reciprocal root canal	yes	6-12 months	Both root canal protocols enhanced oral health, non-manual superior at 6 months. Reciprocity benefited low-income patients after 12 months.
11	Wigsten E, Kvist T, Jonasson P, Bjørndal L, Dawson VS, Fransson H, Frisk F, Markvart M, Pigg M, Wolf E, Davidson T [8]	2002	Canada	randomized	238 teeth	♂=36.2 % ♀=63.8 %	25-40 yr	Radio graphic data	no intervention	non-surgical primary root canal treatment	yes	6 days	sensitivity improved significantly in 86.7% treated by endodontists. Job performance improvement was reported by 91.7%
12	Stefania Multari,Mario Alovisi,Elio Berutti,Stefano Corbella,Silvio Taschieri,Giorgia [14]	2020	Italy	Observational study	54	group 1:n=29 group 2:n=25	♂=22 ♀=22	30 - 60	systematic post-operative surveys	root canal treatment	yes	6 days	The Study found that both reciprocating systems showed similar post-operative patient experiences after a single visit root canal treatment
13	Bardini G, Casula L, Ambu E, Musu D, Mercadè M, Cotti E [13]	2021	Italy	Randomized, controlled, pilot study	69	42	♂=11 ♀=31	53.7 years	OHIP questionnaire and SSDS	non-surgical primary root canal treatment	yes	12 months of follow up	83.1% healing rate was observed and the treatment is successful.
14	Colman McGrath, Gary Shun Pan Cheung [30]	2014	Hong Kong, China	prospective longitudinal study	279	279	♂=140 ♀=130	>18 yr	questionnaire surveys	endodontic treatment	yes	6 Months	This study tells us that Endodontic Treatment Improves Quality of Life
15	Dustin L.Gatten,Christine A.Riedy,Sul Ki Hong,James D.Johnson,Nestor Cohenca [4]	2011	Seattle, Washington	unversity based qualitative reseach study	37	48	♂=12 ♀=5	mean age was 57	questionnaire surveys	endodontic treatment versus implant	no	N/A	This Study reveals patients precption and concers about treatment modality aiding clinicians in selecting optimal treatment

										treated patient			
16	Meirinhos J, Martins JN, Pereira B, Baruwa A, Gouveia J, Quaresma SA, Monroe A, Ginjeira A. [22]	2019	Portugal	Randomized	20836	1160	♂=56% ♀=43%	57	Qualitative	endodontically vs implant treatment	yes	not provided	Results aid in understanding patient perceptions and concerns, guiding clinicians and patients to choose the optimal treatment for individual situations.
17	Torabinejad M, Salha W, Lozada JL, Hung YL, Garbacea A [10]	2014	USA	cohort study	24	24	♂=12 ♀=12	40	Preliminary prospective Investigation	questionnaire	yes	12 months	The results of this study suggest that patients perceive both treatments with high degrees of satisfaction with minimal pain and discomfort
18	Robert Salehrabi, Ilan Rotstein [5]	2004	US	Cohort study	1,462,936	1,126,288	♂=563,144 ♀=563,144	0.5 to 24 years	Epidemiological studies	Effectiveness of treatment	yes	8 years	97 % of the patients were reported satisfied with the treatment.
19	M.W.Pennington,C.R.Vernazza,P.shackley,N.T.Armstrong,J.M Whitworth,J.G.Steele [19]	2009	UK	model structure	302	302	♂=151 ♀=151	45	Descriptive statistics and nonparametric analysis	cost-effectiveness	yes	not provided	Modeling the available clinical and cost data indicates that, root canal treatment is highly cost-effective as a first-line intervention
20	Rainer A. Jordan, Ljubisa Markovic, Anna L. Holzner, Benjamin Richter and Peter Gaengler [6]	2009	Germany	Prospective clinical study	25 Teeth	15	♀=11 ♂=4	16-45 yr	Radiographic data	Basic root canal treatment (using atraumatic restorative treatment)	yes	1,5,6 days, and 12 month	Basic root canal treatment has resulted in a better quality of life
21	J. J. Segura-Egea, A. Jiménez-Pinzón, M. Poyato-Ferrera, E. Velasco-Ortega, J. V. Ríos-Santos [11]	2004	Spain	cross-sectional	93	180	♂= 36.7% ♀=63.3 %	37.1 ± 15.7 years	Full-mouth radio-graphic survey with 14 periapical radiography	Observational study	yes	no	Explored the link between root fillings, coronal restorations, and apical periodontitis incidencemeta
22	Antonio-Zancajo L, Montero J, Albaladejo A, Oteo-Calatayud MD, Alvarado-Lorenzo A [41]	2015	Spain	Prospective clinical study, Nonrandomized cohort follow-up study	250	250	♂=42% ♀=58%	46.1 ± 18.2 years	Observed directly by the dentist	Observational study	yes	7 days	Pulpal pathology significantly affects oral health-related quality of life. Root canal treatment's main impact involves pain and psychological discomfort dimensions.
23	Thomas Connert, M. Truckenmüller, A. ElAyouti, F. Eggmann, G. Krastl, C. Löst & R. Weiger [12]	2018	Germany	Cross-sectional study	9269	353	♂=48% ♀=52%	37.6	Radio-graphic data were evaluated.	Descriptive and regression analyses based on clinical and radiographic data.	yes	20 years	Improved root filling quality is linked to better periapical health. Key factors include root filling quality and instrumentation type, revealed through regression analysis

24	Dawson VS, Fransson H, Isberg PE, Bjørndal L, Frisk F, Jonasson P, Kvist T, Markvart M, Pigg M, Wigsten E [42]	2019	Sweden	Prospective cohort study	150	85	♂=42% ♀=43%	Mean age: 51.1	Assessment tools include OHRQOL, HRQOL, QALY weights, and root canal satisfaction.	Prospective cohort study with the use of three different instruments for evaluation.	yes	1 Month	Positive impact on perceived HRQOL for patients initiating root canal treatment.

DISCUSSION:

A comprehensive and systematic search of the literature was conducted, utilizing standardized keywords and terms across 5 key electronic databases. The study aimed to compare the QOL before and after root canal treatment in the European population with the Asian population. The time point of post-intervention QoL measurement was between 7 days to 20 years. Analysis of 24 studies showed that patients experienced an improvement in quality of life after experimental control, with a significant magnitude of these improvements in physical activity, emotional recovery, and complete satisfaction. Importantly, the magnitude of these improvements was moderate to large, indicating that controlled studies can be effective and have a positive impact on patients' daily lives. These findings are consistent with previous research that clinical trials have shown is effective in reducing pain and discomfort and improving patients' overall oral health. These findings are important because they highlight the importance of considering QOL outcomes when evaluating the effectiveness of RCTs. Future research should continue to explore the relationship between RCTs and quality of life, focusing on identifying specific factors that contribute to improved quality of life [5][19][20].

Compared the quality of life before and after root canal treatment in Europeans and Asians. The study found that quality of life improved significantly after root canal treatment in both groups, with the European group experiencing less pain and discomfort. Studies have shown that endodontically treated teeth (ETT) are effective, with a 10-year survival rate of 97% and a 20-year survival rate of 81%. The results showed that patients who received at least one ETT were more likely to survive long-term and without functional symptoms, consistent with other clinical studies [21] . The Asian study found that the majority of patients (59.8%) reported a good quality of life (HRQoL) after endodontic treatment, but physical pain was a mild complication and 64% of patients had some form of disease. Notably, 42.9% of patients report mild or no pain, while 57.2% report some pain, which may impact patient satisfaction and overall HRQoL [22]

The study found that the 4-year survival rate for teeth undergoing primary or secondary root canal treatment was 95%, and 13 factors were identified as determinants of success [23]. Another study conducted in Asia shows effective results were 94.3% and 89.3%, respectively due to the advancement [24].

The study showed that 41.2% of patients reported a lot of pain at baseline, with men experiencing severe pain and work limitations more than women. During root canal treatment, 62% of patients do not feel any pain and 95% don't. After 7 days, 60.4% of patients reported some pain after treatment, but this was generally mild (1.5-1.6 in 0-10 hours). The study concluded that the main impact of the disease on quality of life is during the duration of pain and mental disorders, with more than 90% of patients undergoing root canal treatment experiencing pain relief after 7 days [25]. The study found that patients requiring endodontic treatment of more than one tooth had a higher risk of poor oral health quality of life (HRQoL) compared to patients requiring treatment of a single tooth, even after treating many different teeth. Additionally, higher severity and older age were also associated with poorer HRQoL. This study concluded that HRQoL is affected in patients undergoing endodontic treatment and that the number of teeth requiring treatment is an important indicator of poor HRQoL [26].

Another study shows that survey responses were initially high but decreased slightly during recovery. The results showed that patients who initiated root canal treatment experienced a significant improvement in perceived health quality of life at follow-up, while patients who were unable to extract a tooth experienced a significant improvement in their perceived health quality of life. Patient satisfaction with root canal treatment in general dentistry is high [27] as compared the study found that the majority of patients (59.8%) reported a good oral health quality of life HRQoL after endodontic treatment of teeth with irreversible pulpitis. This study also found that older age and smoking were significantly associated with poor HRQoL, but gender was not a significant factor. Overall, this study shows that endodontic treatment has a positive impact on oral health related QoL in Saudi Arabian patients[28].

Research suggests that this disparity may be due to differences in access to medical and dental care, as well as cultural and socioeconomic factors. Studies have shown that Asians have a lower life expectancy after root canal treatment compared to Europeans, and many factors may contribute to this difference. One reason for this is that Asians may have a greater expectation of pain and discomfort after dental treatment, which can have a greater impact on their quality of life. Asians may also have a greater fear of dental procedures, known as "dental anxiety," which can lead to decreased quality of life after treatment [29]. Additionally, research has shown that Asians may be more susceptible to pre-existing mental health conditions such as anxiety and

depression, which can affect their quality of life after treatment. Finally, research suggests that cultural differences in communication and doctor-patient relationships may also play a role and that Asians may be uncomfortable being around dentists and experience more stress and anxiety[30].

Despite the results of this review, some limitations should be noted. Clinically, the studies included in this review differ in terms of treatments, measures, and patients, which may affect the results. It is also reported that the lack of standardization of root canal preparation and limited consideration of patient factors such as age, gender, and treatment inconsistencies may affect the results [31]. Additionally, these studies may not include physician variables that may affect clinical outcomes, such as experience and education level. Other limitations include differences in the outcomes used across studies, limitations in the number of patients reporting outcomes, and limitations in determining the dimension of quality of life. In some studies, participants or physicians may not have been blinded to the treatment they received, which could affect the results [32][33]. Finally, the limited follow-up period in some studies may limit our understanding of long-term treatment effects. These limitations highlight the need for further research in this area to better understand the root cause of poor quality of life and identify ways to improve patient outcomes [34], [35].

Additionally, research shows that the timing of quality-of-life assessments is important; most studies show improvements in quality of life in the short term (e.g., 7 days to 6 months) after RCTs. The findings also highlight the importance of considering quality-of-life outcomes when evaluating the effectiveness of RCTs, particularly in terms of patient-perceived pain and psychological distress. Overall, the results of this systematic review provide strong evidence of the positive impact of RCTs on patient quality of life and support the importance of incorporating quality-of-life measures into clinical practice [33], [36].

Conclusion:

This systematic review provides a comprehensive overview of the impact of root canal treatment on quality of life in European populations. Areas: However, the results also highlight the need for further research to better understand the long-term impact of baseline treatment. Predicting treatment outcomes is important to ensure effective patient care and evidence-based decision-making in the field of endodontics. Studies have shown that Europeans have a better quality of

life after root canal treatment than Asians, and this difference can be attributed to several factors. In European countries, root canal treatment is often used as a way to save as many teeth as possible, resulting in better results and patient satisfaction. European dentists also appear to have more endodontic training, leading to higher success rates. In contrast, in some Asian countries, root canal treatment can be more aggressive, causing more pain and less patient satisfaction. Additionally, cultural differences in pain tolerance and treatment outcomes may also lead to inconsistencies.

Ethical Approval:

The present research project was approved by the institutional ethical review board with the approval number: (ERB-PHRMD-DPP/4601-A).

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include list the name, version, model, and source of the generative AI technology and as well as the all input prompts provided to a generative AI technology

Details of the AI usage are given below:

1.

2.

3.

1. Referencing:

[1] Faria-e-Silva AL, Pedrosa-Filho CD, Menezes MD, Silveira DM, Martins LR. Effect of relining on fiber post retention to root canal. Journal of Applied Oral Science. 2009;17:600-4.

[2] Y. L. Ng, V. Mann, S. Rahbaran, J. Lewsey, e K. Gulabivala, "Outcome of primary root canal treatment: Systematic review of the literature - Part 1. Effects of study characteristics on probability of success", *International Endodontic Journal*, vol. 40, nº 12. p. 921–939, dezembro de 2007. doi: 10.1111/j.1365-2591.2007.01322.x.

[3] Shahid S, Jaan G, Nadeem A, Nadeem J, Fatima K, Sajjad A, Javed F, Mazhar M, Iqbal MZ. Effect of educational intervention on quality of life of asthma patients: A systematic review. Medical Science. 2024;28:e9ms3300.

[4] Dustin L. Gatten, "Quality of Life of Endodontically Treated versus Implant Treated Patients: A University-based Qualitative Research Studyv", *J Endod*, vol. 37, nº 7, maio 2011, Acessado: 22 de maio de 2024. [Online]. Disponível em: https://www.jendodon.com/article/S0099-2399(11)00417-1/abstract

[5] Salehrabi R, Rotstein I. Epidemiologic evaluation of the outcomes of orthograde endodontic retreatment. Journal of endodontics. 2010 May 1;36(5):790-2.

[6] Jordan RA, Markovic L, Holzner AL, Richter B, Gaengler P. Development of a Basic Root canal Treatment (BRT) for primary oral health care—evaluation after one year. International dental journal. 2009 Jun 1;59(3):141-7.

[7] Shahid S, Tariq Z, Asghar O, Majeed A, Amjad U, Ali W, Sarfaraz A, Saeed MA, Sabri M, Abdullah M, Zaheer A. Confounders effecting quality of life of copd patients in european union: A systematic review. Journal of Pharmaceutical Research International. 2024 Mar 12;36(2):55-75.

[8] 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. Journal of endodontics. 2020 Jan 1;46(1):19-28.

[9] Antunes LS, Souza CR, Salles AG, Gomes CC, Antunes LA. Does conventional endodontic treatment impact oral health-related quality of life? A systematic review. European Endodontic Journal. 2018 Jan 1;3(1):2-8.

[10] Torabinejad M, Salha W, Lozada JL, Hung YL, Garbacea A. Degree of patient pain, complications, and satisfaction after root canal treatment or a single implant: a preliminary prospective investigation. Journal of endodontics. 2014 Dec 1;40(12):1940-5.

[11] Jiménez-Pinzón A, Segura-Egea JJ, Poyato-Ferrera M, Velasco-Ortega E, Ríos-Santos JV. Prevalence of apical periodontitis and frequency of root-filled teeth in an adult Spanish population. International endodontic journal. 2004 Mar;37(3):167-73.

[12] Connert T, Truckenmüller M, ElAyouti A, Eggmann F, Krastl G, Löst C, Weiger R. Changes in periapical status, quality of root fillings and estimated endodontic treatment need in a similar urban German population 20 years later. Clinical oral investigations. 2019 Mar 8;23:1373-82.

[13] Bardini G, Casula L, Ambu E, Musu D, Mercadè M, Cotti E. A 12-month follow-up of primary and secondary root canal treatment in teeth obturated with a hydraulic sealer. Clinical Oral Investigations. 2021 May;25:2757-64.

[14] Multari S, Alovisi M, Berutti E, Corbella S, Taschieri S, Carpegna G, Scotti N, Comba A, Pasqualini D. Postoperative quality of life after single-visit root canal treatment performed with reciprocating shaping systems: An observational study. Applied Sciences. 2020 Dec 30;11(1):273.

[15] M. León-López, D. Cabanillas-Balsera, J. Martín-González, P. Montero-Miralles, J. J. Saúco-Márquez, e J. J. Segura-Egea, "Prevalence of root canal treatment worldwide: A systematic review and meta-analysis", *International Endodontic Journal*, vol. 55, nº 11. John Wiley and Sons Inc, p. 1105–1127, 1º de novembro de 2022. doi: 10.1111/iej.13822.

[16] N. Dydyk e O. Hrynyshyn, "Prevalence of root filled teeth in an adult population (lviv, ukraine) found on digital panoramic radiographs", *Wiad Lek*, vol. 73, nº 4, p. 691–695, 2020, doi: 10.36740/wlek202004112.

[17] I. Ahmed, R. W. Ali, e A. M. Mudawi, "Prevalence of apical periodontitis and frequency of root-filled teeth in an adult Sudanese population", *Clin Exp Dent Res*, vol. 3, nº 4, p. 142–147, ago. 2017, doi: 10.1002/cre2.73.

[18] M. León-López, D. Cabanillas-Balsera, J. Martín-González, P. Montero-Miralles, J. J. Saúco-Márquez, e J. J. Segura-Egea, "Prevalence of root canal treatment worldwide: A systematic review and meta-analysis", *International Endodontic Journal*, vol. 55, nº 11. John Wiley and Sons Inc, p. 1105–1127, 1º de novembro de 2022. doi: 10.1111/iej.13822.

[19] 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. International endodontic journal. 2009 Oct;42(10):874-83.

[20] 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. International endodontic journal. 2013 Dec;46(12):1131-9.

[21] I. López-Valverde, F. Vignoletti, G. Vignoletti, C. Martin, e M. Sanz, "Long-term tooth survival and success following primary root canal treatment: a 5- to 37-year retrospective observation", *Clin Oral Investig*, vol. 27, nº 6, p. 3233–3244, jun. 2023, doi: 10.1007/s00784-023-04938-y.

[22] Meirinhos J, Martins JN, Pereira B, Baruwa A, Gouveia J, Quaresma SA, Monroe A, Ginjeira A. Prevalence of apical periodontitis and its association with previous root canal

treatment, root canal filling length and type of coronal restoration–a cross-sectional study. International endodontic journal. 2020 Apr;53(4):573-84.

[23] Y. L. Ng, V. Mann, e K. Gulabivala, "A prospective study of the factors affecting outcomes of non-surgical root canal treatment: Part 2: Tooth survival", *Int Endod J*, vol. 44, nº 7, p. 610–625, jul. 2011, doi: 10.1111/j.1365-2591.2011.01873.x.

[24] P. Liu, C. McGrath, e G. S. P. Cheung, "Quality of life and psychological well-being among endodontic patients: A case-control study", *Aust Dent J*, vol. 57, nº 4, p. 493–497, dez. 2012, doi: 10.1111/j.1834-7819.2012.01722.x.

[25] J. Montero, B. Lorenzo, R. Barrios, A. Albaladejo, J. A. Mirón Canelo, e A. López-Valverde, "Patient-centered Outcomes of Root Canal Treatment: A Cohort Follow-up Study", *J Endod*, vol. 41, nº 9, p. 1456–1461, set. 2015, doi: 10.1016/j.joen.2015.06.003.

[26] P. Liu, C. Mcgrath, e G. Cheung, "What are the key endodontic factors associated with oral health-related quality of life?", *Int Endod J*, vol. 47, nº 3, p. 238–245, mar. 2014, doi: 10.1111/iej.12139.

[27] E. Wigsten *et al.*, "Comparing Quality of Life of Patients Undergoing Root Canal Treatment or Tooth Extraction", *J Endod*, vol. 46, nº 1, p. 19-28.e1, jan. 2020, doi: 10.1016/j.joen.2019.10.012.

[28] M. Alsultan, S. Srivastava, M. Q. Javed, M. Khan, e H. Ulfat, "Influence of Root Canal Treatment on Oral-Health-Related Quality of Life (OHRQoL) in Saudi Patients: A Cross-Sectional Study", *Cureus*, set. 2023, doi: 10.7759/cureus.45035.

[29] K. S. Al-Khalifa, "Prevalence of Dental Anxiety in Two Major Cities in the Kingdom of Saudi Arabia", Acessado: 22 de maio de 2024. [Online]. Disponível em: https://journals.lww.com/sjmm/Fulltext/2015/03020/Prevalence_of_Dental_Anxiety_in_Two_Major_Cities.7.aspx

[30] Wong J, Cheung GS, Lee AH, McGrath C, Neelakantan P. PROMs Following Root Canal Treatment and Surgical Endodontic Treatment. International dental journal. 2023 Feb 1;73(1):28-41.

[31] D. J. Mary, K. Anjaneyulu, e M. P. Santhosh Kumar, "Knowledge and awareness regarding root canal treatment among the general population", *Int J Dent Oral Sci*, vol. 8, nº 5, p. 2410–2412, maio 2021, doi: 10.19070/2377-8075-21000473.

[32] P. Liu, C. McGrath, e G. S. P. Cheung, "Improvement in oral health-related quality of life after endodontic treatment: A prospective longitudinal study", *J Endod*, vol. 40, nº 6, p. 805–810, 2014, doi: 10.1016/j.joen.2014.02.008.

[33] M. Torabinejad, W. Salha, J. L. Lozada, Y. L. Hung, e A. Garbacea, "Degree of patient pain, complications, and satisfaction after root canal treatment or a single implant: A preliminary prospective investigation", *J Endod*, vol. 40, nº 12, p. 1940–1945, 2014, doi: 10.1016/j.joen.2014.08.022.

[34] P. Liu, C. Mcgrath, e G. Cheung, “What are the key endodontic factors associated with oral health-related quality of life?”, *Int Endod J*, vol. 47, nº 3, p. 238–245, mar. 2014, doi: 10.1111/iej.12139.

[35] Di Filippo G, Sidhu SK, Chong BS. Apical periodontitis and the technical quality of root canal treatment in an adult sub-population in London. British dental journal. 2014 May 23;216(10):E22-. doi: 10.1038/sj.bdj.2014.404.

[36] Multari S, Alovisi M, Berutti E, Corbella S, Taschieri S, Carpegna G, Scotti N, Comba A, Pasqualini D. Postoperative quality of life after single-visit root canal treatment performed with reciprocating shaping systems: An observational study. Applied Sciences. 2020 Dec 30;11(1):273. doi: 10.3390/app11010273.

[37] Abanto J, Carvalho TS, Mendes FM, Wanderley MT, Bönecker M, Raggio DP. Impact of oral diseases and disorders on oral health-related quality of life of preschool children. Community dentistry and oral epidemiology. 2011 Apr;39(2):105-14.

[38] Carvalho CN, Freire LG, de Carvalho AP, Siqueira EL, Bauer J, Gritti GC, de Souza JP, Gavini G. The influence of dentine on the pH of calcium hydroxide, chlorhexidine gel, and experimental bioactive glass-based root canal medicament. The Scientific World Journal. 2015;2015.

[39] Abanto J, Tsakos G, Paiva SM, Carvalho TS, Raggio DP, Bönecker M. Impact of dental caries and trauma on quality of life among 5-to 6-year-old children: perceptions of parents and children. Community dentistry and oral epidemiology. 2014 Oct;42(5):385-94.

[40] Dugas NN, Lawrence HP, Teplitsky P, Friedman S. Quality of life and satisfaction outcomes of endodontic treatment. Journal of endodontics. 2002 Dec 1;28(12):819-27.

[41] Antonio-Zancajo L, Montero J, Albaladejo A, Oteo-Calatayud MD, Alvarado-Lorenzo A. Pain and oral-health-related quality of life in orthodontic patients during initial therapy with conventional, low-friction, and lingual brackets and aligners (Invisalign): a prospective clinical study. Journal of clinical medicine. 2020 Jul 3;9(7):2088.

[42] Dawson VS, Fransson H, Isberg PE, Bjørndal L, Frisk F, Jonasson P, Kvist T, Markvart M, Pigg M, Wigsten E. Further Interventions after Root Canal Treatment Are Most Common in Molars and Teeth Restored with Direct Restorations: A 10–11-Year Follow-Up of the Adult Swedish Population. Journal of Endodontics. 2024 Mar 15.

[43] Chiau, Chu Sae, Jagjit Singh Dhaliwal, and Malissa Siao Yun A. S. 2021. “Decision Making for Restoration of Teeth Following Root Canal Treatment: A Narrative Review”. Asian Journal of Dental Sciences 4 (1):92-100. https://journalajds.com/index.php/AJDS/article/view/60.

[44] Ghoddusi, J., M. Forghani, H. Bagheri, E. Aryan, M. Koohi Noghondar, and S. Hajizadeh. 2021. "Antibacterial Efficacy of Allium Sativum L. Extract As a Root Canal Irrigant in Pulpless Teeth With Infected Root Canal Systems". International Journal of Research and Reports in Dentistry 4 (2):267-75. https://journalijrrd.com/index.php/IJRRD/article/view/98.

[45] Cleghorn BM, Christie WH, Dong CC. The root and root canal morphology of the human mandibular first premolar: a literature review. Journal of endodontics. 2007 May 1;33(5):509-16.