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Comparing oral health-related quality of life and satisfaction: root canal therapy vs. extraction for first permanent molars in children – a case–control study

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Abstract

Background This study addresses a literature gap by examining Oral Health Related Quality of Life (OHRQoL) and children-parental satisfaction concerning the management of compromised first permanent molars (FPMs) through root canal therapy (RCT) versus extraction.

Methods Children who extracted or received RCT and their parents were interviewed using a validated questionnaire that includes sociodemographic data, OHIP5-Ar questionnaire and satisfaction question.

Results There were 305 patients with RCT (197 (37.1%)) or extraction (108 (87.8%)). RCT increased the adjusted odds ratio (AOR) of the child's OHRQoL (3.76; $P < 0.001$) and parent-satisfaction at assessment-time (AOR = 1.82; $P = 0.02$). Additionally, increase in the duration between treatment and assessment-time elevated the AOR of patient's OHRQoL (AOR = 1.69; $P = 0.001$). Significantly fewer children reported being uncomfortable with the appearance of their teeth following RCT compared to those who underwent extraction ($P < 0.001$). Although not statistically significant, patients tended to express greater satisfaction with extraction compared to RCT at the assessment-time (AOR: 0.64; $P = 0.081$).

Conclusion While the choice between performing RCT or extraction of compromised FPM in children depends on various factors, both can lead to substantial success in improving the child's OHRQoL and satisfaction. Nevertheless, RCT resulted in fewer concerns about dental appearance.

Keywords Dental, Extraction, Oral health, Permanent molar, Quality of life, Root canal treatment, OHRQoL

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Background

The first permanent molar (FPM) is the first permanent tooth to emerge in the oral cavity, usually appearing between the ages of 6 and 7 [1]. This tooth is vital for preserving normal chewing function and is often regarded as the cornerstone of occlusion [2]. Because it erupts first, the FPM is particularly prone to developing caries [3].

The FPM is commonly affected by environmental and developmental conditions such as dental caries and molar-incisor hypomineralization (MIH) [4]. These conditions can result in significant destruction of the tooth, leading to a questionable long-term prognosis, a situation referred to as compromised FPM [5, 6].

Compromised first permanent molars (FPMs) in children present a clinical challenge often leading to a question whether to preserve, through restorative interventions like root canal treatment (RCT); or extract, to avoid complications [7, 8]. While RCT can save the tooth and maintain its function, the infection may persistent can be more susceptible to fractures. On the other hand, extraction, while providing possibility of being replaced by the second permanent molar, can result in spacing, malocclusion, and complications in the development of the dental arch. Therefore, the decision between RCT and extraction has significant implications for a child's oral health, impacting both their functional abilities and overall well-being [9].

Several factors could influence this clinical decision, including the child's age, behavior, tooth restorability, developmental stage, occlusion and others [8, 10–12]. Balancing the potential benefits of RCT to preserve the natural tooth against the risks of its complexity and potential failure, necessitates careful consideration of extraction as an alternative [8]. While existing literature reports success with both RCT and extraction in managing compromised FPMs, each approach carries its own set of consequences and limitations [7, 8, 13].

There is a lack of conclusive long-term data on the effect of the two main management method for compromised FPM, extractions and RCT, conducted on children. Oral Health-Related Quality of Life (OHRQoL) provides a valuable tool to evaluate the broader effects of dental management on a child's including emotional, social, and psychological well-being, not only the absence of disease [14–18]. Thus, it serves as a method to measure the outcomes of treatment in relation to the individual's psychosocial condition and overall health [19, 20].

Studies reported an improvement in OHRQoL of children after completing their dental treatment [21] in dental setting and under general anesthesia their treatment included all type of restorations, extraction and pulp therapy [21]. While studies have explored OHRQoL outcomes after RCT and extraction of molars in adults [22,

23], limited research exists on its impact in pediatric patients [24, 25] and no study compared RCT to extraction in children FPM.

Furthermore, patient and parental satisfaction play a crucial role in the success of dental treatments [26, 27]. Understanding their expectations and experiences can help guide future clinical decisions and improve compliance with treatment plans [26, 28]. Previous studies have evaluated parental and child satisfaction with various dental management approaches, including orthodontic treatment, isolation techniques, and dental crowns [26, 27, 29, 30]. A systematic review assessing patient-reported outcomes associated with different restorative techniques in pediatric dentistry revealed decreased satisfaction with more invasive treatments [31]. Additionally, factors influencing patient preferences for dental treatments, such as care provided by pediatric dentists, treatment under general anesthesia, and care in emergency dental clinics, have been explored; reporting an effect of sociodemographic factors and dental treatment setting [32–35]. However, satisfaction levels of children and parents following the treatment of compromised first permanent molars (FPM) in children remain unevaluated.

Up to date, the literature has limited research about the OHRQoL and Pediatric patients' satisfaction following the management of compromised FPMs. Therefore, the aim of this study was to compare the OHRQoL of patients who underwent RCT or extraction of their compromised first permanent molars (FPMs) during childhood (ages 9 to 13). Additionally, the study evaluates both the patients' and their parents' satisfaction following RCT or extraction of the compromised FPMs. The null hypothesis posits that there are no differences in OHRQoL between patients treated with RCT versus those who underwent extraction of their FPMs, nor is there a difference in satisfaction levels of patients and their parents.

Materials and methods

This cross-sectional study was carried out among three referral centers in Jeddah City, Saudi Arabia: King Abdulaziz University Dental Hospital (UDH), King Fahad Armed Forces Hospital (KFAFH), and King Abdulaziz Medical City (KAMC). It was carried out in accordance with the declarations of Helsinki and was approved by the three referral centers' Institutional Review Board (IRB): The Faculty of Dentistry at King Abdulaziz University (172–11–1, 005–01–19), the Research Ethics Committee of King Fahad Armed Forces Hospital (REC 277) and the Ministry of National Guard at King Abdullah International Medical Research Center (SP20/426/J).

Patients with compromised FPM were identified from the Information Technology (IT) Department in the

three referral centers. The inclusion criteria were healthy ASA1 children [36] attending pediatric dental clinics between September 2010 and June 30, 2019 who underwent RCT (with closed root apices) or extraction for their FPM at the age of 9 to 13 years old. Children with medical condition (ASA 2 or more) as well as those receiving other dental treatments such as orthodontic or surgical procedures were excluded from the study. The age of patients was selected to ensure the closure of the root apex (at least 9 years old) and the absence of erupted second molars at the time of treatment (no older than 13 years). Both of these conditions influence the type of treatment and its outcomes [8, 37]. The roots of teeth and the eruption of the 2nd molar were identified in this study through their chronological age and to radiographs (apical and panoramic) preformed at treatment time. All our patients were Saudis.

Sample size calculation for the OHRQoL was performed using G*Power version 3.1.9.6, with a power of 80%, an odds ratio of 2, an α err prob = (α) of 0.05, and a critical z-value of 1.96 [24, 38]. This calculation yielded a total estimated sample size of 92 participants. Additionally, for the satisfaction component, we utilized OpenEpi, Version 3, and analyzed 25% of the sample, where the satisfaction rate was found to be 72%. The calculated sample size required to achieve a power of 80% for this factor was 114 children.

After receiving the list electronic files from the IT department for patients treated with RCT or extraction during the study period, patients were screened according to the inclusion criteria and the filtered list of the potential included participant was formed. Parents of the included patients were contacted via mobile phone by two calibrated dentists. If the patient failed to answer the call, they were sent messages through WhatsApp and multimedia messaging service (MMS) communication to increase the response rate.

After explaining the study in simple terms appropriate to the children's age and maturity level, verbal informed consent was obtained from the parents, and assent was obtained from the children. The research benefits, confidentiality, and methodology were described in detail. Subsequently, the parents were asked to provide consent via a link sent to their WhatsApp.

Parents and their children were interviewed on their mobile phones, and a data collection form was filled immediately by both dentists (see supplementary Table 1). The data collection form included the following:

- Patient's general information which included gender, age, and socio-demographic data including family income (low < 7,000, moderate 7,000 to 10,000, and high > 10,000 Saudi Riyals), and level of parental edu-

cation (low < high school, moderate: high school, and high > high school).

- Information about the provided treatment including type of treatment, date of the treatment and site of treatment (UDH, KFAFH, KAMC).
- Five-Item Oral Health Impact Profile (OHIP-5) to assess the patients' OHRQoL and lastly yes/no questions to patients and parents to assess their satisfaction of FPM RCT/Extraction at treatment time as well as at the current assessment time. OHIP-5 is a short and psychometrically reliable tools for assessing oral health-related quality of life in school-aged children with Cronbach's alpha of 0.75 [39, 40]. The Five-Item Oral Health Impact Profile in Arabic language (OHIP5-Ar) [41] is the Arabic validated version of OHIP-5 with Cronbach's alpha of 0.75 [34]. It comprises five health-related problems answered by a 5-point adjectival scale ranging from 0 (never), 1 (hardly ever), 2 (occasionally), 3 (fairly often), to 4 (very often) [21]. Subsequently, "optimal OHRQoL" was scored if sum of the OHIP5-Ar scores was "0" and "less than optimal OHRQoL" if the sum was more than zero in all the OHIP5-Ar questions. Patients and their parents were further enquired on their treatment satisfaction at treatment and assessment time with yes/no questions. The reason of dis-satisfaction listed were pain, discomfort, accessibility-difficulties and further treatment is needed. Selecting more than one reason was allowed.

The questionnaire was initially written in English and then translated into Arabic, which is the primary language of the participants. Before starting the study, a panel of seven experts in pediatric dentistry and endodontics evaluated the content validity of the questionnaire in both languages. The Content Validity Index (CVI) was 0.93, and reliability was assessed using Cronbach's alpha, yielding a score of 0.885. The questionnaire has also been previously validated in both Arabic and English [41–43]. Any incomplete questionnaires were excluded from the research.

Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) ver. 22 (IBM Corp., Armonk, NY, USA) for Mac OSX software. Only complete questionnaires were included. Descriptive frequencies and Chi-square test were conducted. Logistic Regression analysis and Adjusted Odds Ratio (AOR) were performed to assess the relationship between OHRQoL optimal score and patient/parents' satisfactions (dependent factors) and type of FPM management, child's gender, family income, number of teeth and duration between treatment and assessment time (independent factors). The statistical significance was set at $P \leq 0.05$.

Clinical trial number

Not applicable.

Results

Across the three referral centers, a total of 482 out of 811 children (59.4%) and 123 out of 192 children (64.1%), aged 18 years or younger, who received either RCT or extractions on their FPM, respectively, agreed to participate. Of these, 197 (37.1%) RCTs and 108 (87.8%) extractions, in children aged 9 to 13 years old or younger, were included in our study (Fig. 1). Females were 196 (64.3%) while males were 109 (35.7%), among which, 149 (48.9%) patients received their treatment 5 to 6 years ago. The number of patients treated in each referral center were 140 (45.9%), 93 (30.5%) and 72 (23.6%) at UDH, KFAFH and KAMC. Among children aged 11 to 13 years, 168 (85.3%) underwent RCT compared to 43 (39.8%) who had extractions, showing a statistically significant difference of $P < 0.001$. Furthermore, in the RCT group, 154 (78.2%) had one FPM treated per child, whereas in the extraction group, 61 (56.5%) had a similar experience, with a statistically significant difference of $P < 0.001$ (Table 1).

Regarding OHRQoL, 130 (66%) children in the RCT group reported optimal OHRQoL compared to 36 (33.3%) in the extraction group, showing a statistically significant difference of $P < 0.001$. Among the five questions in the OHIP5-Ar questionnaire, the primary OHRQoL difference between the RCT group (162 (82.2%)) and the extraction group (63 or (58.3%)) was

observed in children reporting never experiencing discomfort about teeth appearance ($P < 0.001$) (Table 2).

The relationship between the type of management and both optimal OHRQoL and patient-parent preferences was evaluated. Patients who underwent RCT reported significantly better OHRQoL compared to those who had extractions ($P < 0.001$). However, other factors, such as sociodemographic variables and the number of affected teeth at the time of assessment, were not significantly associated with OHRQoL ($P > 0.05$). Refer to Supplementary Table 1 for details.

In addition, there was no significant difference observed in patients' or parents' satisfaction between treating compromised FPM with RCT and extraction at both treatment and assessment times (Supplementary Table 2&3). Other factors that showed significant relationship with patients' or parents' satisfaction at treatment time were paternal education and family income (Parental's satisfaction: father education $P = 0.017$, family income $P = 0.002$; and Patient's satisfaction: father education $P = 0.025$, family income $P = 0.004$). See supplementary Table 2. However, a difference was noted in parents' satisfaction at the assessment time, revealing a statistically significant preference for RCT over extraction ($P = 0.024$) (Supplementary Table 3).

The main reason for parental dissatisfaction at assessment time was accessibility (42.2%). Significantly more parents expressed dissatisfaction due to the necessity of additional treatment after extraction (22.2%) compared

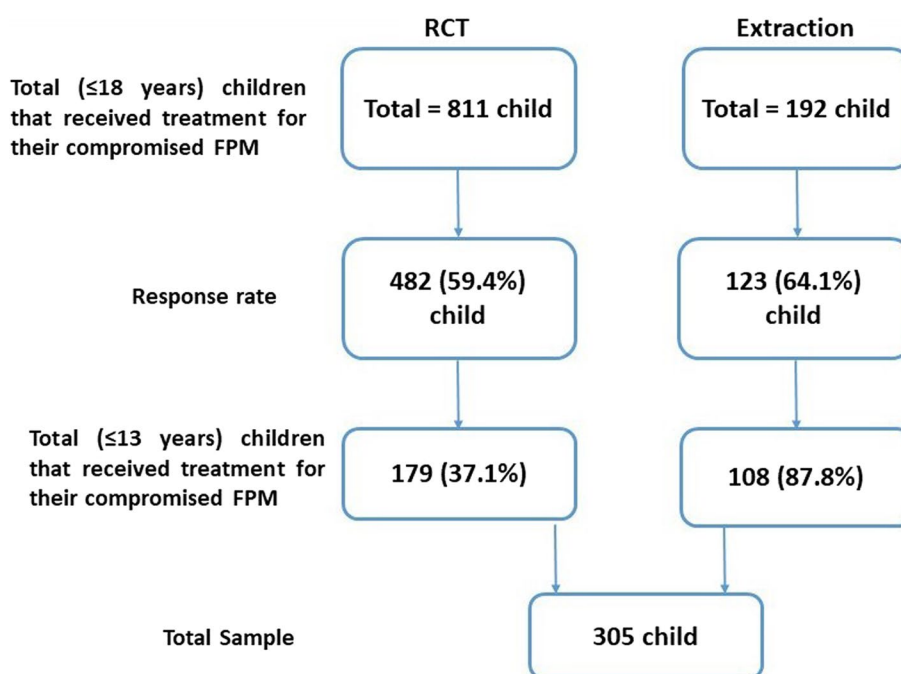


Fig. 1 Flow diagram for sample recruitment

Table 1 Distribution of patients according to demographic data, healthcare center, and number of treated teeth per patient ($N = 305$)

Demographic data		RCT N (%)	Extraction N (%)	P value	Total N (%)
Age at treatment time	9–10	29 (14.7)	65 (60.2)	< 0.001*	94 (30.8)
	11–13	168 (85.3)	43 (39.8)		211 (69.2)
Years between treatment and assessment time	1–2	18 (9.1)	6 (5.6)	0.070	24 (7.9)
	3–4	76 (38.6)	56 (51.9)		132 (43.3)
	5–6	103 (52.3)	46 (42.6)		149 (48.9)
Healthcare Center	UDH	107 (54.3)	33 (30.6)	< 0.001*	140 (45.9)
	KFAFH	49 (24.9)	44 (40.7)		93 (30.5)
	KAMC	41 (20.8)	31 (28.7)		72 (23.6)
Gender	Males	70 (35.5)	39 (36.1)	0.920	109 (35.7)
	Females	127 (64.5)	69 (63.9)		196 (64.3)
Family income	Low	39 (19.8)	21 (19.4)	0.467	60 (19.7)
	Moderate	127 (64.5)	64 (59.3)		191 (62.6)
	High	31 (15.7)	23 (21.3)		54 (17.7)
Father's education level	Low	23 (11.7)	6 (5.6)	< 0.001*	29 (9.5)
	Moderate	35 (17.8)	63 (58.3)		98 (32.1)
	High	139 (70.6)	39 (36.1)		178 (58.4)
Mother's education level	Low	74 (37.6)	15 (13.9)	< 0.001*	89 (29.2)
	Moderate	53 (26.9)	51 (47.2)		104 (34.1)
	High	70 (35.5)	42 (38.9)		112 (36.7)
Number of affected teeth	> One tooth	43 (21.8)	47 (43.5)	< 0.001*	90 (29.5)
	One tooth	154 (78.2)	61 (56.5)		215 (70.5)
Total		197 (100.0)	123 (100.0)		320 (100.0)

RCT Root Canal Treatment, UDH University Dental Hospital, KFAFH King Fahad Armed Forces Hospital, KAMC King Abdulaziz Medical Center

* Significant at $P \leq 0.05$

Table 2 Frequency of optimal OHRQoL Questions according to OHIP5-Ar scores ($N = 305$)

Question	Mean \pm SD ^R	Optimal OHRQoL	RCT N (%)	Mean \pm SD	Extraction N (%)	P value ^q	Total N (%)
Difficulty in chewing any food	0.71 \pm 1.15	Yes	135 (68.5)	0.66 \pm 1.10	72 (66.7)	0.739	207 (67.9)
		No	62 (31.5)				98 (32.1)
Painful aching in teeth	0.68 \pm 1.11	Yes	136 (69)	0.70 \pm 1.17	73 (67.6)	0.795	209 (68.35)
		No	61 (31)				96 (31.5)
Uncomfortable of their teeth appearance	0.38 \pm 0.87	Yes	162 (82.2)	1.01 \pm 1.37	63 (58.3)	< 0.001*	225 (73.8)
		No	35 (17.8)				80 (26.2)
Less flavor of food	0.08 \pm 0.43	Yes	198 (95.9)	0.10 \pm 0.49	103 (95.4)	0.814	292 (95.7)
		No	8 (4.1)				13 (4.3)
Difficulty in doing usual jobs	0.40 \pm 0.79	Yes	149 (75.6)	0.71 \pm 1.22	75 (69.4)	0.242	224 (73.4)
		No	48 (24.4)				81 (26.6)
Total OHRQoL score	2.24 \pm 3.79 ^T	Yes	130 (66)	3.16 \pm 3.68	36 (33.3)	< 0.001*	166 (54.4)
		No	67 (34)				139 (45.6)

RCT Root canal treatment, OHIP5-Ar 5-Item Oral Health Impact Profile in Arabic language, OHRQoL Oral Health Related Quality of Life. R 5-point adjectival scale ranging from 0 (never), 1 (hardly ever), 2 (occasionally), 3 (fairly often), to 4 (very often). ^T total score "25"

"Zero"= never; and More than zero is combination of (hardly ever, occasionally, fairly often and very often) experienced any of the oral health related problem

SD Stander of deviation

^q Chi square

* Significant at $P \leq 0.05$

to parents whose children underwent RCT (17.5%), with a statistically significant difference ($P=0.024$) (Table 3).

Logistic regression analysis found statistically significant relationship between the dependent variables (OHRQoL and parent satisfaction at assessment time) and the type of management ($P<0.001$, $P=0.021$, respectively). Treating compromised FPM with RCT increased the AOR of the child's OHRQoL (AOR:3.76; $P<0.001$) and parent satisfaction at assessment time compared to extraction (AOR=1.82; $P=0.021$). Additionally, an increase in the duration between treatment and assessment time increased the AOR of patient's OHRQoL (AOR=1.69; $P=0.007$), which indicate increase experience of the oral health related problem (Table 4).

Discussion

This study aimed to evaluate and compare the outcome of invasive treatment options (extraction), with tooth-preserving approaches (RCT), conducted on compromised FPM among children through measuring the patients' OHRQoL, as well as their satisfaction. Children in the RCT group exhibited significantly more optimal OHRQoL and parental satisfaction at assessment time compared to those in the extraction group.

Previous research has reported a 20% clinical-radiographic failure rate of RCT [7], and adverse consequences of extraction of FPM [8] among children, which undoubtedly will impact the OHRQoL of individuals. The OHRQoL encompasses aspects that directly evaluate the success or failure of RCT, such as the ability to maintain proper function (e.g., difficulty chewing food) and the presence of pain, subjectively. Thus, by studying OHRQoL, we are assessing the treatment outcomes subjectively through children and their parents, which

will certainly give an indication of the treatment failure/success [18]. Previous research highlighted the importance of OHRQoL on treatment decision [18]. Valuating OHRQoL enables a transition from conventional medical and dental metrics to a more holistic approach that emphasizes a person's social, emotional, and physical experiences when establishing treatment goals and outcomes [18, 44]. In addition, since parental satisfaction is a key factor in treatment acceptance, presenting RCT as a superior option for OHRQoL improvement can help address concerns about the procedure and improve compliance [26, 45, 46]. Therefore, the improvement in OHRQoL and parental satisfaction with RCT impacts the decision-making for treatment options of prioritizing the treatments of preserving the FPM.

Researchers recommend standardizing the assessment tools used to evaluate perceived oral health [39]. The OHIP-5 was suggested as a shorter, validated alternative to the OHIP-14, making it an easier and more valuable instrument [39, 47]. While it has primarily been used for adults, this study serves as a good example of its application in adolescents. Other studies have also successfully utilized it with children [40, 48].

Considering that this study focused on evaluating RCT, children younger than 9 years were excluded to ensure that the FPM had closed root [49, 50]. Consequently, due to the recommendation for extraction in younger age groups [8, 51] and our inclusion criteria of children aged 9 and above, the number of FPM extractions found in this study was lower than those that underwent RCT. Moreover, the preference for extraction in younger age groups might explain why most recruited children in the younger age group (9 to 10 years) received extractions, while those in the older age group (11 to 13 years) received RCT. This suggests that pediatric dentists are adhering to recommendations from previous studies and the concept of spontaneous closure of the second permanent molar, which is expected to occur more frequently in younger children, allowing for its eruption in place of the FPM. Thus, indicating that dentists were aware of the recommended preferable extraction time, which was not always the case in previous studies [3, 52–54]. Among this study's population, more than half of the patients were female. This could be because females were suggested to be more prone to caries due to the earlier eruption of the FPM [50].

Patients receiving RCT reported significantly better OHRQoL compared to those in the extraction group, consistent with a previous study conducted on adults [55]. Additionally, a study on primary molars reported a negative impact of extractions on children's quality of life [56]. However, none of these studies were conducted on young FPM among children. The main OHRQoL item

Table 3 Reason of parents dis-satisfaction of at assessment time ($N=102$)

Reasons		Type of management			P value
		RCT N (%)	Extraction N (%)	Total	
Pain	Yes	15 (26.3)	15 (33.3)	30 (29.4)	0.440
	No	42 (73.7)	30 (66.7)	72 (70.6)	
Discomfort	Yes	15 (26.3)	5 (11.1)	20 (19.6)	0.055
	No	42 (73.7)	40 (88.9)	82 (80.4)	
Accessibility	Yes	28 (49.1)	15 (33.3)	43 (42.2)	0.109
	No	29 (50.9)	30 (66.7)	59 (57.8)	
Further treatment needed	Yes	10 (17.5)	10 (22.2)	20 (19.6)	0.024*
	No	47 (82.5)	35 (77.8)	82 (80.4)	
Total		57 (100)	45 (100)	102 (100)	

RCT Root Canal Treatment

* Significant at $P\leq0.05$

Table 4 Regression analysis for the oral health related quality of life (OHRQoL) and patients or parents' satisfaction (dependent variable) in relation to the type of FPM management, child's gender, family income, number of affected teeth and duration between treatment and assessment time

Variable		AOR	P value	95% CI
OHRQoL				
Family income	Low	1.24	0.590	0.566–2.725
	Moderate	1.5	0.221	0.784–2.859
	High	1		
Gender	Male	1.19	0.511	0.714–1.976
	Female	1		
Number of affected teeth	> One tooth	0.92	0.771	0.536–1.587
	One tooth	1		
Type of management	RCT	3.76	< 0.001*	2.244–6.306
	Extraction	1		
Duration between treatment and assessment time		1.69	0.007*	1.150–2.469
Child's satisfaction at treatment time				
Family income	Low	0.47	0.062	0.209–1.039
	Moderate	1.24	0.548	0.613–2.518
	High	1		
Gender	Male	0.6	0.055	0.350–1.011
	Female	1		
Number of affected teeth	> One tooth	0.92	0.773	0.515–1.638
	One tooth	1		
Type of management	RCT	1.07	0.800	0.616–1.873
	Extraction	1		
Duration between treatment and assessment time		1	0.991	0.661–1.505
Parent's satisfaction at treatment time				
Family income	Low	0.58	0.198	0.252–1.331
	Moderate	1.78	0.132	0.840–3.788
	High	1		
Gender	Male	0.57	0.058	0.317–1.019
	Female	1		
Number of affected teeth	More than one tooth	1.35	0.372	0.699–2.610
	One tooth	1		
Type of management	RCT	1.27	0.436	0.693–2.342
	Extraction	1		
Duration between treatment and assessment time		0.68	0.110	0.422–1.092
Child's satisfaction at assessment time				
Family income	Low	0.85	0.703	0.379–1.924
	Moderate	0.83	0.591	0.424–1.632
	High	1		
Gender	Male	1.08	0.762	0.649–1.806
	Female	1		
Number of affected teeth	> One tooth	0.98	0.941	0.563–1.703
	One tooth	1		
Type of management	RCT	0.62	0.087	0.363–1.071
	Extraction	1		
Duration between treatment and assessment time		0.95	0.806	0.648–1.402
Parent's satisfaction at assessment time				
Family income	Low	1.02	0.961	0.465–2.235
	Moderate	1.06	0.851	0.558–2.028
	High	1		

Table 4 (continued)

Variable		AOR	P value	95% CI
Gender	Male	1.26	0.369	0.759–2.105
	Female	1		
Number of affected teeth	> One tooth	1.17	0.570	0.679–2.021
	One tooth	1		
Type of management	RCT	1.82	0.021*	1.093–3.026
	Extraction	1		
Duration between treatment and assessment time		0.98	0.921	0.668–1.441

AOR Adjusted Odds Ratio, R² for OHRQoL = 15% and satisfaction = 6%

RCT Root Canal Treatment, UDH University Dental Hospital, KFAFH King Fahad Armed Forces Hospital, KAMC King Abdulaziz Medical Center, OHRQoL Oral Health Related Quality of Life

* Significant at $P \leq 0.05$

affected mentioned in this study was discomfort with appearance which was similar to the previous adults' study [55].

Patients' and parents' satisfaction were also assessed. Involvement of parents in children satisfactory research is important due to the presence of dentist-patient and parent/caregiver relationships [57]. Patients and parents reported high satisfaction at both treatment time and assessment time for RCT and extraction groups, except for parents at assessment time in the extraction group. This follows previous studies conducted on adults reporting high patients' satisfaction following RCT and extraction [7, 41, 49, 58–60]. However, none of the previous studies included children or parents, thus comparing results was not possible. In addition, studies which reported parents' satisfaction did not include children [33, 34, 61–64]. This highlights the novelty of this study which evaluated both patients' and parents' satisfaction in both RCT and extraction groups.

When assessing variables related to patient and parent satisfaction, families with low income and lower paternal education reported significantly less satisfaction compared to those with higher income and education. However, this relationship was only observed at the time of treatment and showed no statistically significant results in the logistic regression analysis. Nevertheless, education and family income exhibited contradictions and varying associations in previous literature [65]. Studies with similar findings suggested that patients from lower-income backgrounds may face unique challenges and specific needs, such as limited access to treatment. Other factors such as physicians not allowing parents to fully express their concerns during their child's health visit, as well as the findings from examinations, may contribute to the reported dissatisfaction at the time of treatment [66–68]. While financial issues were mentioned, they are unlikely to explain the dissatisfaction among our

participants, as all included centers in this study provide services free of charge.

In the current study, the reason for parental dissatisfaction at assessment time was accessibility. Early extractions of FPM in most cases require further orthodontic treatment for alignment and space closure [53]. In addition, RCT for young patients further needs final restoration and crowns [69]. Studies have shown the presence of barriers and long waiting lists to reach orthodontic and dental treatment [70].

The study is considered novel in its conception. Almost half of the patients received their treatment 5 to 6 years ago, which allowed for longer evaluation time. In addition, the included centers which treat patients from different backgrounds. These centers also have an enormous number of patients seeking treatments with diverse backgrounds, levels of education, and nationalities. UDH is an educational hospital with a broadly heterogeneous population which allows treatment for all nationalities by undergraduate students, interns, postgraduate students, general dentists, and consultants [71]. While KFAFH and KAMC is for military personnel and their families and permits the treatment of Saudis [45, 46, 65–67, 72, 73]. In addition, the distribution of the sample was according to their socioeconomic status is similar to the total population. More than half of the involved patients belong to families with moderate income and high parental education which is consistent with other studies conducted in Jeddah, Saudi Arabia; improving the research generalizability [74–80]. However, there are some limitations in this study. One of the main limitations is the design of the study being not possible to match and was performed from secondary data. Secondary data could present certain limitations. One limitation is the reliance on pre-existing datasets, which may not have been designed to address the specific research questions of this study. The data often lacks the flexibility to adapt or expand

variables based on the depth of analysis. These factors should be considered when interpreting the results of this study.

Furthermore, several factors that could have affected the OHRQoL in the extraction group, such the presence of treatment complications, and the severity of caries, were not addressed in this study. Additionally, the stage of development of the second permanent molar were not evaluated due to our inclusion criteria focusing on FPM with closed root apices, specifying children at least 9 years of age [49].

Although this study found that both treatments can achieve significant success in improving OHRQoL and overall satisfaction, it recommends RCT over extraction whenever possible for children above 9 years old. Accessibility for completing treatment is important for parental satisfaction. Further studies including more specific risk factors and confounders related to the success of the FPM management selected are needed.

Conclusion

This study provides valuable new insights into the OHRQoL of children, offering guidance for the clinical selection of treatment methods for compromised FPM while considering patient and parental satisfaction. Although the decision between RCT and extraction depends on various factors, including the child's age and clinical status, both treatments can achieve significant success in improving OHRQoL and overall satisfaction. Nevertheless, RCT showed significantly more favorable OHRQoL of life in the age group 9 to 13 years old and is more favored by parents, especially when considering esthetics.

Abbreviations

OHRQoL	Oral Health Related Quality of Life
FPMs	First permanent molars
RCT	Root canal therapy
AOR	Adjusted odds ratio
MIH	Molar-incisor hypomineralization
UDH	King Abdulaziz University Dental Hospital
KFAFH	King Fahad Armed Forces Hospital
KAMC	King Abdulaziz Medical City
CVI	Content validity index
SPSS	Statistical Package for the Social Sciences

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12903-025-05646-7>.

Supplementary Material 1.

Supplementary Material 2.

Authors' contributions

HJS: Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, software, supervision, validation, visualization, writing – original draft and writing – review & editing;

WD: Conceptualization, data curation, funding acquisition, investigation, methodology, resources, validation, visualization and writing – review & editing; AAS, JT, MIA, RZ, AB: Investigation and writing – review & editing; NB: Conceptualization, funding acquisition, investigation, methodology, project administration, supervision and writing – review & editing.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study is in accordance with the declarations of Helsinki. It was approved by the three referral centers' Institutional Review Board (IRB): The Faculty of Dentistry at King Abdulaziz University (172–11–19, 005–01–19), the Research Ethics Committee of King Fahad Armed Forces Hospital (REC 277) and the Ministry of National Guard at King Abdullah International Medical Research Center (SP20/426/J). After explaining the study in simple terms appropriate to the children's age and maturity level, verbal informed consent was obtained from the parents, and assent was obtained from the children. The research benefits, confidentiality, and methodology were described in detail. Subsequently, the parents were asked to provide consent via a link sent to their WhatsApp.

Competing interests

The authors declare no competing interests.

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