



Factors Influencing the Utilization of Root Canal Treatment Services in the Taif Region of Saudi Arabia: A Narrative Review

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Abstract

Background: Root canal treatment (RCT) is a key endodontic procedure that preserves natural dentition and prevents tooth loss. Despite its clinical benefits, the utilization of RCT services varies widely across Saudi Arabia. Evidence specific to the Taif region remains limited, although national data suggest disparities related to individual, provider, and system-level factors. Understanding these determinants is essential for improving access to quality endodontic care.

Methods: This narrative review synthesized published evidence on factors influencing the utilization of RCT services in the Taif region. Literature was retrieved from PubMed, Scopus, Google Scholar, and the Saudi Digital Library using specific keywords related to endodontic services. Inclusion criteria encompassed studies examining determinants of dental or RCT utilization within Saudi Arabia. Data were categorized using a multilevel framework comprising individual-, provider-, and system-level factors.

Results: Utilization of RCT services in Taif is shaped by interconnected determinants across all three levels. Individual-level factors include sociodemographic characteristics, oral health status, oral health knowledge and attitudes, perceived needs, perceived barriers, and health-seeking behaviors. Provider-level factors encompass availability and geographic distribution of dental clinics and endodontists, accessibility of public versus private services, treatment affordability, and quality of care. System-level factors relate to health policies and regulations governing provider privileges, workforce distribution, financing limitations, insurance coverage, and the degree of oral health integration within the broader healthcare system. Gaps were identified in local data on RCT outcomes, patient satisfaction, and region-specific access barriers.

Conclusion: Multiple factors influence the utilization of RCT services in the Taif region, including patient characteristics, provider availability, and systemic health policies. Addressing disparities in access, affordability, and awareness is essential to improving endodontic service utilization. Further region-specific research is recommended to guide policy development, enhance service delivery, and ensure equitable access to high-quality RCT care.

Keywords: Root Canal Treatment; Dental Service Utilization; Access to Care; Saudi Arabia; Dental Care Barriers

Introduction

Root canal treatment (RCT) is a fundamental endodontic procedure performed to preserve teeth affected by irreversible pulp inflammation or infection through chemo-mechanical debridement and obturation of the root canal system [1]. It is consistently recognized as an effective and cost-efficient intervention for maintaining natural dentition, preventing tooth loss, and improving oral health-related quality of life [2,3]. Despite its clinical benefits, the utilization of RCT varies substantially across populations and regions, reflecting differences in individual characteristics, provider-related factors, and broader health-system determinants [4-7].

In Saudi Arabia, oral health care is delivered through both public and private sectors, with government dental services provided free of charge to all citizens at primary, secondary, and tertiary levels [8,9]. However, disparities in access, service availability, and patterns of dental service utilization have been documented across the country [5,6,9]. The Taif region, located in western Saudi Arabia, has an estimated population of 1.3 million and includes nine public dental centers (one under construction) and 54 private clinics, collectively offering 362 dental chairs. Despite this infrastructure, evidence suggests that the use of specialized dental services, such as RCT, remains suboptimal.

Although Saudi Arabia operates under centralized governance through the Ministry of Health, regional variations exist in population density, geographic distribution, specialist workforce availability, private sector penetration, and access to tertiary care facilities. Taif represents a mid-sized urban/semi-urban region with mixed public-private infrastructure, differing from major metropolitan centers such as Riyadh and Jeddah, as well as from peripheral regions with limited specialist distribution. These contextual differences may influence patterns of root canal treatment (RCT) utilization and justify region-specific examination [5,10]. Factors influencing such utilization can be categorized into individual-, provider-, and system-level determinants. Individual factors include sociodemographic characteristics, oral health status, oral health knowledge and attitudes, perceived need for care, perceived barriers, and health-seeking behaviors [1,5,9,11-14]. Provider-level determinants encompass availability of qualified clinicians (particularly endodontists), accessibility of services, affordability, and perceived quality of care [8,15,16]. System-level factors include national health policies, workforce regulations,

financing approaches, and integration of oral health into broader healthcare planning [17-19].

Previous studies in Saudi Arabia have primarily focused on specific geographic areas or selected population groups such as dental students, smokers, pregnant women, or patients with special healthcare needs [9,11-14]. Consequently, the broader determinants influencing the utilization of RCT services among the general population remain inadequately explored. Moreover, findings from earlier studies highlight persistent barriers such as a lack of awareness, high cost, long waiting times, limited service availability, and sociocultural factors [8]. These challenges may further contribute to delayed presentation and increased need for emergency dental treatment, including RCT.

Given the rising burden of dental caries and endodontic disease in Saudi Arabia—as reported in national and regional studies—the need to understand service utilization patterns is increasingly recognized as a public health priority [20-22]. Understanding the interplay of individual, provider, and system factors is essential for designing targeted interventions to improve access, strengthen service delivery, and enhance the quality of RCT care in the Taif region.

Therefore, this literature review aims to identify and critically examine the main determinants that influence the utilization of RCT services in the Taif region of Saudi Arabia. By synthesizing available evidence, the review seeks to provide a comprehensive understanding of current challenges and inform future policy and practice recommendations to improve access to endodontic care.

Methodology of the Narrative Review

This narrative review synthesized evidence on factors influencing the utilization of root canal treatment (RCT) services in the Taif region of Saudi Arabia. The review followed established guidelines for narrative synthesis in health research [23,24], focusing on breadth and conceptual integration rather than meta-analysis.

Search strategy

A literature search was conducted in the following electronic databases.

PubMed, Scopus, Google Scholar, and Saudi Digital Library

Search terms included combinations of:

- “root canal treatment,” “endodontic services,”
- “dental service utilization,” “oral health behavior,”
- “Saudi Arabia,” “Taif,”
- “barriers,” “access,” “determinants,” using Boolean operators (AND/OR).

Inclusion Criteria: Studies were included if they,

- Examined RCT utilization or factors affecting dental service use in Saudi Arabia.
- Reported data from the general population or specific subgroups relevant to RCT demand.
- Were published in English.
- Included observational studies, national reports, review articles, or health system analyses.

Exclusion Criteria: Studies were excluded if they,

- Focused purely on laboratory or in-vitro outcomes of endodontic procedures.
- Reported clinical trials on instrumentation or obturation techniques without relevance to service utilization.
- Discussed populations outside Saudi Arabia without health system comparability.

Data Extraction and Synthesis: Evidence was charted according to three pre-defined domains widely used in health-services research [25],

- Individual-level factors
- Provider-level factors
- System-level and policy factors

Findings from included studies were summarized narratively, emphasizing contextual relevance to the Taif region. Where data gaps were identified, supportive evidence from other Saudi regions was incorporated due to comparable health system structures [5,10].

Factors Influencing the Utilization of RCT Services:

Individual-Level Factors

- **Sociodemographic Characteristics:** Multiple sociodemographic variables have been associated with dental service utilization, including age, sex, education, income, and

occupation [1,9]. Evidence from Saudi Arabia indicates that: Older individuals, Women, those with higher income, and Individuals with greater educational attainment tend to use dental services, including RCT, more frequently [2,14]. These associations mirror global trends and may reflect differences in health awareness, perceived need, and affordability [26]. However, variations across regions and cultural contexts can affect generalizability.

- **Oral Health Status:** Oral health status is a strong determinant of RCT need and utilization. People with High caries experience, Poor oral hygiene, Untreated dental decay, Pulpal infection or exposure, or Prior dental trauma are more likely to require RCT [20,21]. High caries burden remains prevalent in several regions of Saudi Arabia, highlighting a consistent driver of endodontic demand [20,21].
- **Knowledge, Attitudes, and Perceptions:** Adequate knowledge and positive attitudes toward RCT increase the likelihood of seeking timely dental care. Misconceptions—such as the belief that extraction is easier or more affordable may reduce RCT utilization [5,6,9]. Studies in Saudi Arabia demonstrate that individuals with higher education or income exhibit better awareness of dental diseases and treatment options, contributing to higher utilization rates [5,6,9].
- **Perceived Needs and Perceived Barriers:** Perceived need is influenced by subjective oral symptoms, awareness of treatment benefits, and personal valuation of dental health [5,6,9]. Perceived barriers include: Cost, Fear and anxiety, Waiting times, Distance to clinics, Lack of trust or dissatisfaction with dental care [7,8,11]. Perceived need may not always match objective clinical need. Patients who do not experience pain often underestimate the urgency of RCT, while those with strong perceived barriers may delay treatment even when symptomatic.
- **Health-Seeking Behaviors:** Health-seeking behavior encompasses actions taken in response to oral health problems. These behaviors vary widely and may include: Use of home remedies or self-medication, seeking advice from non-dental sources, visiting general dentists instead of specialists, and Avoidance or postponement of dental visits [8,27,28].

In Taif, studies show that although parents recognize the importance of dental visits for children, knowledge of optimal timing and preventive strategies remains limited [28]. This

suggests opportunities for targeted educational interventions. The main individual-level determinants influencing the utilization of root canal treatment services identified in the reviewed literature are summarized in Table 1.

Factor Category	Specific Factors	Key Evidence/Findings	Supporting References
Individual-Level Factors	Sociodemographic characteristics	Older adults, females, individuals with higher education and income, and white-collar workers are more likely to utilize RCT services.	[1,2,9,14,26]
	Oral health status	Caries, poor oral hygiene, untreated decay, pulp infection, and trauma increase RCT need.	[21,22]
	Knowledge and attitudes	Better oral health knowledge increases service use; misconceptions reduce acceptance of RCT.	[5,6,9]
	Perceived needs	Subjective perception strongly influences care-seeking behavior.	[5,6,9]
	Perceived barriers	Fear, cost, distance, waiting times, and dissatisfaction reduce utilization.	[7,8,10]
	Health-seeking behavior	Self-medication, delayed visits, limited awareness of preventive visits.	[8,27,28]

Table 1: Summary of Evidence on Individual-Level Factors Influencing the Utilization of Root Canal Treatment (RCT) Services.

Provider-level factors

Availability and distribution of RCT services

Availability depends on: Number and distribution of dental clinics, Capacity of public versus private sectors, Number and qualifications of endodontists. The Taif region has 16 public and 54 private dental clinics with 362 dental chairs, but the distribution is uneven, and endodontist availability (0.14 per 10,000) remains below the national average. This may hinder equitable access to RCT services. Compared to highly urbanized metropolitan centers such as Riyadh, where tertiary hospitals and specialist services are concentrated, mid-sized regions operate with more limited referral infrastructure and specialist density [8,13,19]. This distribution pattern may increase reliance on general dentists for less complex RCT cases and extend referral pathways for molar endodontic treatment.

Accessibility

Accessibility encompasses: Physical distance and transportation, Clinic working hours, Waiting times, and Appointment systems [5]. In Taif, public RCT services are available only at MOH clinics and the university dental hospital, as military hospitals are restricted

to personnel. This restricts access for many patients who cannot afford the fees at private clinics.

Affordability

Despite free public services, affordability remains a barrier due to: Limited availability of free RCT appointments, Costs in private clinics, and Lack of insurance coverage for many residents [4,8]. Emerging financial tools such as buy-now-pay-later (BNPL) systems (e.g., Tabby, Tamara) may facilitate treatment acceptance by lowering upfront costs [29]. In metropolitan regions such as Riyadh, employer-based private insurance and corporate-linked healthcare coverage are more prevalent, contributing to higher private-sector utilization rates [6,19]. In contrast, semi-urban and non-metropolitan regions demonstrate greater reliance on public services and higher out-of-pocket expenditure in private settings due to lower insurance penetration [6,13,14]. Consequently, treatment costs may disproportionately influence acceptance of procedures such as root canal treatment. Under Vision 2030, ongoing expansion of insurance-based models and privatization reforms aim to reduce regional disparities in financing and improve equitable access to dental care [19].

Quality of care

Quality is influenced by: Technical competence of practitioners, Adherence to clinical guidelines, Availability of modern equipment (e.g., rotary files, apex locators), and Infection control protocols [1,16]. Although high-quality RCT care is available in specialized

settings, there is limited evidence on patient satisfaction and treatment outcomes specifically in Taif, representing an important research gap. The main provider-level determinants influencing the utilization of root canal treatment services identified in the reviewed literature are summarized in Table 2.

Factor Category	Specific Factors	Key Evidence/Findings	Supporting References
Provider-Level Factors	Availability of services	Uneven distribution of clinics; limited number of endodontists in Taif.	[1]
	Accessibility	Public RCT services limited; transport and scheduling barriers.	[5,8]
	Affordability	Private RCT costly; limited insurance; BNPL options emerging.	[4,8,29]
	Quality of care	Dependent on clinician skill, equipment, guidelines; limited data for Taif.	[1,16, 17]

Table 2: Summary of Evidence on Provider-Level Factors Influencing the Utilization of Root Canal Treatment (RCT) Services.

System-level factors

Health policies and regulation

Health policies govern provider privileges, training requirements, and allocation of resources [17-19]. Newly graduated dentists in Saudi Arabia may perform RCT on anterior and premolar teeth, but require certification to treat molars. In Taif, this process is supervised by an MOH committee of senior consultants.

Workforce planning and training

The number of trained endodontists, continuing professional development opportunities, and distribution of specialists significantly influence service availability. Under Vision 2030, initiatives aim to expand dental services and enhance training pathways [19].

Financing and insurance coverage

The Saudi health system is transforming with increased privatization and insurance coverage. Gaps in dental insurance coverage remain a significant barrier, particularly for procedures such as RCT that are cost-intensive and time-consuming [8].

Integration of oral health into general healthcare

Integrated care models may enhance referral pathways, patient education, and preventive strategies, thereby reducing late presentations requiring complex RCT. Studies show that coordinated care improves outcomes and utilization in similar healthcare systems [29]. The main system-level determinants and cross-cutting contextual insights influencing the utilization of root canal treatment services identified in the reviewed literature are summarized in Table 3.

Factor Category	Specific Factors	Key Evidence/Findings	Supporting References
System-Level Factors	Health policies and regulations	MOH privileging requirements; regulatory oversight affects service distribution.	[17-19]
	Workforce planning	Specialist shortages; Vision 2030 aims expansion.	[19]
	Financing and insurance	Limited dental insurance; high out-of-pocket cost.	[7,10]
	Integration of care	Limited integration with general healthcare; integrated models improve outcomes.	[30]
Cross-Cutting Insights	National disease burden	High caries prevalence increases RCT needs.	[22]
	Service utilization inequalities	Socioeconomic disparities affect access nationwide.	[6,13,14]

Table 3: Summary of Evidence on System-Level Factors and Cross-Cutting Insights Influencing the Utilization of Root Canal Treatment (RCT) Services.

A contextual comparison between the Taif region and other Saudi regions in factors influencing root canal treatment utilization is presented in Table 4.

Domain	Taif Region	Major Metropolitan Regions (e.g., Riyadh, Jeddah)	Peripheral/Rural Regions	Potential Impact on RCT Utilization
Population Density and Urbanization	Moderate urban–semi-urban mix; seasonal population fluctuations	Highly urbanized, dense populations [6,14]	Lower density, dispersed communities [13]	Urban density associated with higher dental service utilization rates [6,14]
Specialist Endodontist Availability	Limited concentration of specialists; lower per-capita specialist distribution (MOH data context)	Higher concentration of specialists in tertiary hospitals [8,19]	Often dependent on general dentists; specialist scarcity [13]	Specialist availability influences access to complex molar RCT
Private Sector Penetration	Moderate private clinic presence; mix of public and private care	Strong private sector expansion and insurance-linked care [6,19]	Limited private sector availability [13]	Greater private penetration may increase service choice but raise cost barriers
Public Dental Infrastructure	Public MOH clinics and university dental hospital; limited tertiary referral depth	Multiple tertiary referral hospitals and academic centers [8,19]	Primary care-based services with referral dependency [8]	Availability of tertiary centers reduces referral delays for complex RCT
Waiting Time (Public Sector)	Capacity constraints may prolong appointments (inferred from MOH service demand patterns) [8]	Higher facility capacity may reduce delays [8]	Referral-based systems may extend waiting periods [13]	Longer waiting times may delay RCT initiation
Insurance Coverage and Affordability	Mixed insurance penetration; significant out-of-pocket payment in private clinics [6]	Higher employer-based insurance coverage in metropolitan workforce [6,19]	Lower private insurance penetration; reliance on public services [13]	Insurance coverage influences treatment acceptance and affordability [6]
Access Barriers (Transportation and Distance)	Some mountainous and semi-rural access zones	Advanced urban infrastructure and transport networks [14]	Geographic distance major barrier to dental access [13,14]	Physical accessibility influences care-seeking behavior
Service Utilization Inequality	Socioeconomic gradients present, similar to national trends [6]	Documented socioeconomic inequality in dental utilization [6,14]	Higher inequality in underserved regions [13]	Income and education strongly influence dental service utilization [6,13,14]

Table 4: Comparison of Taif and Other Saudi Regions in Factors Influencing RCT Utilization.

As shown in Table 4, while regulatory frameworks are centrally governed, operational realities differ across regions. Taif demonstrates intermediate characteristics between highly urbanized centers and peripheral regions. These contextual factors may influence RCT utilization through variations in specialist availability, waiting times, and affordability structures.

Limitations

This narrative review has several limitations. First, lack of region-specific data: Although regional comparisons are based on available national reports rather than primary Taif-specific epidemiological surveys, the tabulated analysis provides a structured justification for regional contextualization. Second, the narrative review design is a narrative rather than a systematic review; the methodology does not include a formal quality appraisal or quantitative synthesis, which may introduce selection bias and limit reproducibility. Third, Heterogeneity of included studies, the reviewed literature varied in study design, population characteristics, and outcome measures, making direct comparison difficult and reducing the strength of generalized conclusions. In addition, limited data on RCT-specific outcomes. Few studies in Saudi Arabia report treatment success rates, patient satisfaction, or post-treatment complications specifically related to RCT, leaving gaps in understanding quality-of-care factors. Moreover, the underrepresentation of certain population groups, vulnerable populations such as low-income patients, rural residents, people with disabilities, and older adults, remains insufficiently studied in the context of RCT utilization. Finally, Potential publication bias, Reliance on published English-language studies may exclude relevant findings from local reports, theses, or non-English publications.

Future Research Scope

Future research should aim to address the gaps identified in existing evidence. Region-specific empirical studies in the Taif region to quantify utilization rates, access barriers, service quality, and patient-reported experiences with RCT. Prospective or mixed-methods studies to explore interactions between individual, provider, and system-level determinants, allowing for more nuanced and causal interpretations. Population-based epidemiological surveys assessing endodontic treatment needs, particularly among underserved groups (e.g., rural residents, low-income families, elderly populations). Interventional studies

assessing strategies to improve awareness, reduce waiting times, increase affordability, and enhance early detection of endodontic disease.

Conclusions

In conclusion, Utilization of RCT services in the Taif region is shaped by interrelated individual, provider, and system-level factors. Individual determinants include sociodemographic variables, oral health status, knowledge, attitudes, perceived needs, and health-seeking behaviors. Provider-level barriers include limited distribution of specialists, restricted access to public RCT services, affordability issues, and variable quality of care. System-level issues relate to policies on provider privileges, workforce distribution, limited insurance coverage, and insufficient integration of oral health into general healthcare pathways. Evidence specific to Taif remains limited, underscoring the need for region-specific research, especially on patient satisfaction and treatment outcomes.

Recommendations

Enhance public awareness through targeted education campaigns addressing misconceptions about RCT and promoting early dental visits. Improve geographic distribution of endodontic services across Taif through strategic workforce planning. Strengthen accessibility by expanding RCT capacity in public clinics and optimizing appointment systems. Increase affordability via insurance expansion, subsidized services, or interest-free installment payment options. Ensure high-quality care by promoting evidence-based practice, training programs, and clinical audits. Support system-level reforms under Vision 2030, focusing on oral health integration and improved inter-professional collaboration. Prioritize research on RCT outcomes, patient satisfaction, and barriers specific to the Taif population to guide policy and resource allocation.

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