ORIGINAL ARTICLE

Causes of Tooth Loss in Patients Attending a Dental School's Clinics in Riyadh: A Retrospective Study

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Abstract

Background: Tooth loss is a significant global health concern affecting quality of life, including pain, altered eating habits, and reduced self-esteem. Understanding the primary causes of tooth loss is essential for targeted preventive strategies. **Objectives:** This study aimed to examine the causes and patterns of tooth loss among patients attending private university (REU) dental clinics over 4 years (2021–2024). **Methods:** A retrospective analysis was conducted using patient records from the Dento Plus system at REU dental hospital in Riyadh, Saudi Arabia. Demographic data, medical and dental history, reasons for extraction, and tooth numbers were collected. Descriptive statistics and frequency distributions were calculated, and chi-square tests were applied to assess associations between tooth loss and variables, such as age and gender. **Results:** A total of 1,844 tooth extractions were analyzed. Most patients were aged 35–54 years (46.0%). Lower molars (31.5%) and upper molars (28.0%) were the most frequently extracted teeth. The leading cause of extraction was dental caries (53.3%), followed by periodontal disease (22.0%) and failed root canal treatment (12.9%). Less common reasons included orthodontics (6.3%), prosthodontics (3.7%), trauma (0.9%), and other causes (0.9%). Statistically significant associations were found between reason for extraction and gender ($\chi^2 = 57.284$, df = 6, $P < 0.001$) as well as age group ($\chi^2 = 302.643$, df = 12, $P < 0.001$). **Conclusion:** Dental caries and periodontal disease were the primary causes of tooth loss, predominantly affecting lower and upper molars. These findings emphasize the need for public health initiatives focused on oral health education, preventive care, and management of systemic conditions to reduce tooth loss and its impact on quality of life.

Key words: Prevalence, socioeconomic conditions, systemic conditions, tooth loss

INTRODUCTION

Tooth loss is an increasingly prevalent health condition that has a significant impact on the quality of life of people worldwide through various negative consequences, such as pain, alteration in food consumption, speaking challenges, and reduced self-esteem.[1] Studies conducted in different regions globally have indicated that dental caries and periodontal diseases are the leading causes of tooth loss.[2-4]

Systemic diseases do play a very significant role in oral health, which cannot be neglected. The conditions that are associated with greater incidences of tooth loss include smoking, diabetes, hypertension, and rheumatoid arthritis.[5,6] Such diseases not only make the management of oral health complex but also facilitate the progression of periodontal disease. More tooth loss can emanate from this fact.[5] Therefore, the relationship between systemic and oral health should be understood to implement adequate care in both fields.

Besides the factors of morbidity, socioeconomic conditions weigh heavily in oral health. There are fewer dental care

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Received: 18-11-2025
Revised: 20-12-2025
Accepted: 28-12-2025

facilities and less access where there is a low-income population; therefore, a greater number of untreated dental conditions prevail. Studies revealed that lower-income people have more tendency toward tooth loss due to the economic barriers that prevent them from accessing all the required dental treatments.[7,8] This difference brings into focus the right of every stratum to fair access to dental care. The demographic characteristics of people who suffer from tooth loss should also be taken into account.[9] Some research indicates that age, gender, and nationality may influence not only the prevalence but also the reasons for tooth loss. Older people generally take more time to heal, thus making them more prone to periodontal disease. This is the major reason for tooth loss among this age group. Furthermore, it is important to note that oral health practices and access to care between different genders might vary. Studies have indicated that males generally have a greater mean number of tooth loss than females.[10]

Tooth loss varies greatly between populations and regions within the same country, by socioeconomic, cultural habits, and healthcare accessibility factors. In Saudi Arabia, this is considered mainly an issue of public health. The factors that have been found to impart great influence on the number of teeth lost include age, educational attainment, and income level of an individual.[11]

Complex factors of tooth loss necessitate an in-depth discussion of its etiology and effects. This study advances present perspectives by examining the primary and ancillary factors that account for tooth loss among patients based in Riyadh, Saudi Arabia. The factors that majorly contribute to tooth loss have been sought so as to appropriately design public health strategies, enhance dental care services, and improve oral health outcomes at community levels. As inferred from global trends, addressing the contributing factors of tooth loss is imperative toward better oral health and improved general well-being. Therefore, this retrospective study attempted to determine the reasons for tooth loss among patients who attended university dental clinics over a span of 4 years. This makes it very instrumental in assessing how efficient oral hygiene measures are and the accessibility of dental care services within this region.

MATERIALS AND METHODS

This retrospective study took place at the dental hospitals of a private university (REU) in Riyadh, Saudi Arabia. It documented the primary and secondary causes of tooth loss among patients who visited the dental clinics from January 2021 to December 2024.

Study location

The present study utilized patients' records obtained from the university hospitals located in the central and eastern region of Riyadh city, Saudi Arabia. These centers were selected because of their high patient volume and availability of dental specialists treating patients requiring extractions.

Criteria

Inclusion criteria

The inclusion criteria required that patients have a documented history of dental extractions during the study period.

- Patients aged ≥18 years.
- Patients with complete medical and dental records, including pre- and post-extraction.
- Radiographs.
- Patients with documented reasons for extraction.

Exclusion criteria

1. Third molar extractions.
2. Unclear cause of extraction.
3. Retained primary teeth.
4. Impacted teeth.
5. Supernumerary teeth.
6. Cases missing complete medical or dental records were excluded.

Data collection

Patient records were retrieved using the DentoPlus system to collect demographic (sex, age, and nationality), medical and dental history (systemic conditions and medications), reason for extraction (primary and secondary reasons), and specific tooth or teeth extracted.

Study variables

The reasons for tooth extraction were categorized into primary and secondary.

Causes

Primary causes

- Dental caries.
- Periodontal disease.
- Tooth infections (e.g., failed root canal treatment).
- Orthodontic reasons (e.g., creating space).
- Prosthetic reasons (e.g., hindrance to prosthetic treatment).
- Trauma (e.g., avulsions or fractures).
- Other causes (e.g., supra-eruption, cysts, and tumors).

Secondary causes

- Reasons contributing to the extraction if the primary cause was not definitive. Each extracted tooth was recorded by its number for analysis of tooth distribution.

Ethical approval

The Institutional Review Board (IRB) of Riyadh Elm University approved this study. All patient data were anonymized to ensure confidentiality of the data.

Statistical analysis

The following statistical descriptive statistics of frequency distribution and percentages were calculated for the categorical variables. The chi-square test was employed to explore the relationship between various variables linked to tooth loss. Statistical significance was set at $P < 0.05$. All data analyses were performed using IBM SPSS Statistics for Windows (version 25, Armonk, NY, USA).

RESULTS

In total, 1,844 tooth extractions were analyzed in this study. The majority of patients who underwent extractions were aged 35–54 years (46.0%), followed by those aged 18–34 years (30.3%) and ≥55 years (23.8%). Females constituted a slightly higher proportion (51.1%) than males (48.9%). Most participants were Saudi nationals (92.6%). Regarding tooth type, lower molars (31.5%) and upper molars (28.0%) were the most frequently extracted teeth, whereas lower canines (1.5%) and incisors (2.4%) were the least frequently extracted teeth [Table 1]. The predominant reason for extraction was dental caries (53.3%), followed by periodontal disease (22.0%) and failed root canal treatment (12.9%). Extractions for orthodontics(6.3%), prosthodontics (3.7%), trauma (0.9%), and other reasons (0.9%) were less common [Figure 1].

When stratified by gender, the proportion of extractions due to dental caries was 51.5% among males and 54.9% among females; periodontal disease represented 21.4% and 22.6% among males and females, respectively. Orthodontic (7.4% vs. 5.3%) and prosthodontic (6.9% vs. 0.7%) indications were more frequent in men. The association between the reason for extraction and gender was statistically significant (χ^2=57.284, df = 6, $P < 0.001$). By nationality, the distribution of reasons for extraction was comparable between Saudi and non-Saudi participants (dental caries: 53.6% vs. 48.9%; periodontal disease: 21.7% vs. 25.5%; failed root canal treatment: 12.7% vs. 15.3%; orthodontic reasons: 6.4% vs. 5.1%). There was no significant association between nationality and extraction reason (χ^2= 6.358, df = 6, $P = 0.384$) [Table 1].

Marked differences were observed between the age groups. In those aged 18–34 years, dental caries accounted for 59.5% of extractions and orthodontic reasons for 17.2%, whereas periodontal disease was less common (11.3%). Among those aged 35–54 years, dental caries was the most common diagnosis (56.1%), followed by periodontal disease (23.2%)

Table 1: Study characteristics (n=1844)

Variables	*n*	%
Age (years)		
18–34	558	30.2
35–54	848	46.0
≥55	438	23.8
Gender		
Male	901	48.9
Female	943	51.1
Nationality		
Saudi	1707	92.6
Non-Saudi	137	7.4
Tooth type		
Upper incisors	76	4.1
Lower incisors	44	2.4
Upper canine	58	3.1
Lower canine	28	1.5
Upper premolars	348	18.9
Lower premolars	193	10.5
Upper molars	517	28.0
Lower molars	580	31.5
Main reasons for the extraction		
Dental caries	982	53.3
Periodontal disease	406	22.0
Failed root canal treatments	238	12.9
Orthodontic reason	117	6.3
Prosthodontic reason	69	3.7
Trauma	16	0.9
Other reasons	16	0.9

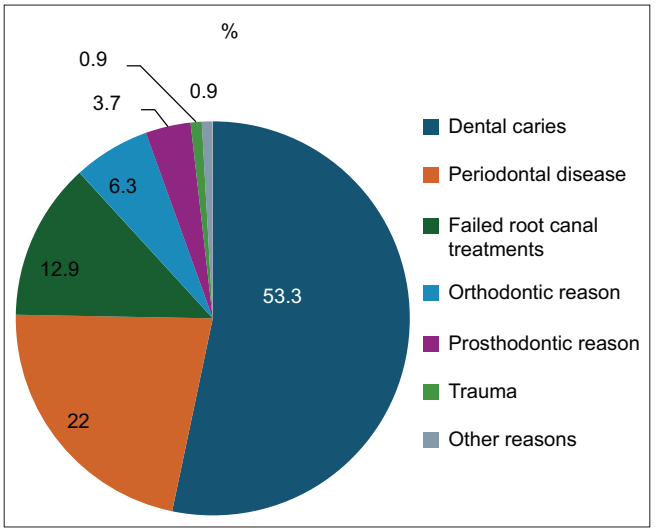

Figure 1: Observed reasons for teeth extraction (n = 1844)

and failed root canal treatment (15.4%). In the 55–84-year group, periodontal disease increased substantially (33.3%),

while dental caries decreased (39.7%), and prosthodontic indications increased (9.6%). The association between age group and reason for extraction was significant (χ^2= 302.643, df = 12, $P < 0.001$). Overall, extractions were concentrated in molar teeth and were most commonly indicated for dental caries, with statistically significant variations by sex and age but not by nationality [Table 2].

Dental caries was the most frequent indication overall (53.3%), predominantly affecting molars (712/1,097; 64.9%) and, to a lesser extent, premolars (241/541; 44.5%), with comparatively lower proportions in incisors (14.2%) and canines (14.0%). Periodontal disease accounted for 22.0% of extractions overall and was notably concentrated in the anterior teeth, comprising over half of the extractions among incisors (62/120; 51.7%) and canines (45/86; 52.3%), versus 16.4% in molars. Failed root canal treatment represented 12.9% of extractions, with similar proportions in molars (13.7%) and premolars (13.3%), and lower rates in incisors (7.5%) and canines (8.1%). Orthodontic indications constituted 6.3% overall and were predominantly observed in premolars (87/541; 16.1%), with minimal contributions from molars (1.5%) and anterior teeth (incisors 4.2%, canines 10.5%). Prosthodontic reasons accounted for 3.7% of extractions, and were more common among anterior teeth (incisors, 19.2%; canines, 14.0%) than posterior teeth (premolars, 3.3%; molars, 1.5%). Trauma and other reasons were infrequent (0.9% overall), with low and relatively uniform distributions across tooth types [Figure 2].

Overall, these results reveal a distinct and clinically consistent pattern: Caries-related tooth loss is most common in the back teeth, periodontal-related loss is primarily found in the front teeth, endodontic failures are mainly seen in the posterior teeth, and orthodontic extractions are predominantly in the premolars. This highly significant correlation ($P < 0.001$) highlights the notable differences in extraction reasons based on tooth type [Table 3].

DISCUSSION

These results are in agreement with previous studies on the etiology and patterns of tooth loss in different populations from various parts of the world. Present study results indicated that dental caries and periodontal disease are more prevalent as the leading causes of tooth loss, with some noted differences in prevalence by age, secondary contributing factors, and demographic characteristics. The discussion covers the pertinent literature and, as a result, its implications for clinical practice and public health.

Dental caries was the main primary reason for tooth loss, particularly in younger adults. It matched studies carried out in Libya, which also recorded dental caries as the main reason for tooth extraction among patients.[2] Again, Torres *et al.* indicated that caries were the most important factor of tooth loss among adolescents in São Paulo, Brazil, therefore considering the high prevalence of untreated dental caries around the globe as a big oral health issue.[12]

Periodontitis was found to be the second major cause of tooth loss in this study, with increased prevalence among older adults. This finding corroborates other previous studies, which indicated that periodontal disease was the main source of tooth loss among older populations.[3,13] Usually, periodontitis has associations with systemic conditions, such as diabetes and cardiovascular diseases apart from behavioral factors, such as smoking and not maintaining good oral hygiene. The fact that periodontal disease progresses more in older adults highlights an exigent need for early intervention and regular periodontal maintenance, as well as public health initiatives toward the modifiable risk factors.[7] A similar pattern was recorded by a study carried out in Sudan and Iran, where periodontal complications and recurring infections weighed heavily on the cumulative burden of tooth loss.[9,14] These results infer that even though it is mostly through caries that initiation of tooth loss takes place, it is through secondary

Table 2: Association between reasons for extraction and demographic variables

Reason for extraction	Gender				Nationality				Age					
	Male		Female		Saudi		Non-Saudi		18–34		35–54		55–84	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Dental caries	464	51.5	518	54.9	915	53.6	67	48.9	332	59.5	476	56.1	174	39.7
Periodontal disease	193	21.4	213	22.6	371	21.7	35	25.5	63	11.3	197	23.2	146	33.3
Failed root canal treatments	101	11.2	137	14.5	217	12.7	21	15.3	58	10.4	131	15.4	49	11.2
Orthodontic reason	67	7.4	50	5.3	110	6.4	7	5.1	96	17.2	1	0.1	20	4.6
Prosthodontic reason	62	6.9	7	0.7	66	3.9	3	2.2	1	0.2	26	3.1	42	9.6
Trauma	5	0.6	11	1.2	13	0.8	3	2.2	5	0.9	8	0.9	3	0.7
Other reasons	9	1.0	7	0.7	15	0.9	1	0.7	3	0.5	9	1.1	4	0.9
Chi-square	57.284				6.358				302.643					
Df	6				6				12					
P	<0.001				0.384				<0.001					

Table 3: Association between reason for extraction and tooth type

Reason for extraction	Tooth type								Total	
	Incisors		Canine		Premolars		Molars			
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Dental caries	17	14.2	12	14.0	241	44.5	712	64.9	982	53.3
Periodontal disease	62	51.7	45	52.3	119	22.0	180	16.4	406	22.0
Failed root canal treatments	9	7.5	7	8.1	72	13.3	150	13.7	238	12.9
Orthodontic reason	5	4.2	9	10.5	87	16.1	16	1.5	117	6.3
Prosthodontic reason	23	19.2	12	14.0	18	3.3	16	1.5	69	3.7
Trauma	3	2.5	0	0.0	1	0.2	12	1.1	16	0.9
Other reasons	1	0.8	1	1.2	3	0.6	11	1.0	16	0.9
P	<0.001									

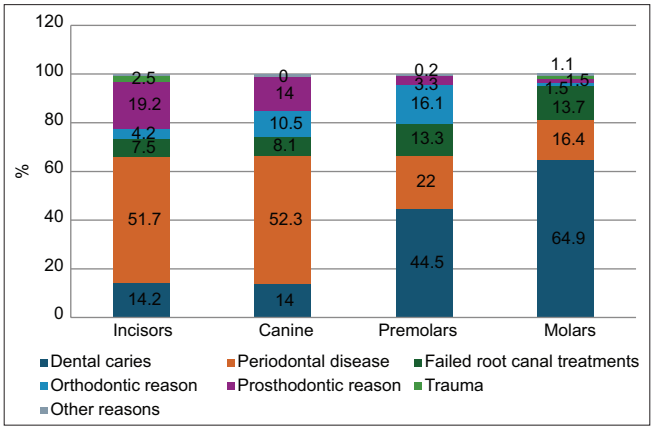

Figure 2: Reasons for extraction of different tooth types

periodontal complications that the process gets further impetus to accelerate the extraction of teeth, particularly among the aged population.

Orthodontic extractions made up 6.3% of the primary reasons for tooth loss, a finding that goes hand in hand with results from Kenya, where orthodontic needs were a relatively common cause of extractions.[10] There is an increasing awareness about dental esthetics and functional alignment, and it reflects among younger patient pools. Patterns found in this study are consistent with global trends of tooth loss, such as Peltzer *et al.* who indicated that caries and periodontal disease were the primary reasons for tooth extraction in diverse populations from countries as different as Ghana, India, and South Africa.[15] Cultural and socioeconomic factors may influence prevalence rates in different regions, however. For example, more trauma-related tooth loss has been reported in Kenya due to less access to restorative care.[10] This study also echoes the results of research carried out in Libya, where diet and access to dental care emerged as leading determinants of tooth loss.[2] In Saudi Arabia, high consumption of sugar, limited oral health literacy, and socioeconomic factors were most probably the reason for explaining such a high prevalence rate of caries and periodontal disease that leads to tooth loss.[11]

Implications for clinical practice and public health

These findings underscore the vital importance of adopting preventive strategies against the etiological factors of tooth loss. The public health programs should emphasize: Preventing dental caries through early detection and management that may include fluoride application, dietary counseling, as well as patient education on how to perform oral hygiene. Managing periodontal disease by regular periodontal maintenance in older adults and patients with systemic conditions. Thus, preventing the progression of the periodontal disease and consequent tooth loss. Improving dental care access to preventive and restorative services in greater populations who are underserved reduces the burden from untreated caries and periodontal diseases.

It also underscores the importance of molar preservation since these were the ones most frequently extracted. The functional and esthetic implications that missing molars may have on an individual's quality of life were articulated in several studies.[12,15] Therefore, there is a need for dental professionals to be proactive in oral health education and prevention as a means of preserving permanent teeth and preventing tooth loss. In addition, dentists should be more focused on restorative and periodontal treatments to preserve teeth whenever feasible.

Limitations of the study

Though this study has provided very useful information, certain limitations need to be highlighted. Being a retrospective study, it was not possible to establish causal relationships between the risk factors and tooth loss. Missing data, especially concerning age and nationality, might have injected some bias into our analysis. The fact that this study was carried out in one institution also limits how much its results can be applied to other areas and health care systems. Future studies are to overcome these limitations through prospective designs and wider population samples. The study of the effect of systemic conditions, and behavioral factors,

and the role of socioeconomic status in tooth loss would also take us further in understanding this problem.

CONCLUSION

Dental caries and periodontal disease were the major causes of tooth extraction, where lower and upper molars are mostly extracted. Such findings stress the need for specific public health interventions intended to better the knowledge of oral health among the population and access to preventive service together with other systemic health issues that would ultimately reduce the impact of tooth loss in the population.

ACKNOWLEDGMENT

The authors would like to thank the Research and Innovation Center of Riyadh Elm University for providing the necessary help and support.

REGISTRATION

This study was registered at the Research and Innovation Center of Riyadh Elm University, Riyadh, Saudi Arabia ("FUGRP/2024/377/1168/1041").

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Source of Support: Nil. **Conflicts of Interest:** None declared.