Investigative Study

TOOTH LOSS AND THE SOCIOECONOMIC ASPECT OF VULNERABLE EDENTULOUS PATIENTS AT THE NIHMP DENTAL CLINIC IN ROME, ITALY

Y.A. Altoqi[1], D. Mazza[2], R. Calcaterra[2] and L. Baggi[2,3]

[1]Research Scholar: Faculty of Medicine and Surgery - Department of Doctorate in Nursing and Public Health, University of Rome Tor Vergata, Italy;
[2]National Institute for Migrant Population Health (NIHMP), Rome, Italy
[3]University of Rome Tor Vergata, Italy;

Correspondence to:
Luigi Baggi, DDS
National Institute for Migrant Population Health (NIHMP),
Rome, Italy
e-mail: luigi.baggi@uniroma2.it

ABSTRACT

Tooth loss is a widespread health issue with significant implications for both physical and mental well-being, especially among socioeconomically disadvantaged groups. Recognizing this, the study focuses on the relationship between tooth loss and socioeconomic determinants, such as income, education, and access to healthcare, in patients from the NIHMP Social Dental Clinic in Rome, Italy. Vulnerable populations, particularly migrants and individuals with low economic status, face a heightened risk of tooth loss due to limited access to care and poor oral health behaviors. The study aimed to explore the demographic, socioeconomic, and behavioral factors contributing to tooth loss and to identify targeted interventions to improve oral health outcomes. Employing a mixed-methods design, the research collected qualitative and quantitative data through questionnaires and interviews conducted with a sample of 100 patients from the dental clinic, all of whom were from low socioeconomic backgrounds. Data were analyzed using the SPSS Statistics software program to assess relationships between tooth loss and various factors. The findings show that economically disadvantaged groups face higher rates of tooth loss, often linked to smoking, poor diets, and poor hygiene. Addressing these disparities requires preventive care and public health initiatives to enhance oral hygiene and ensure equitable access to dental services.

KEYWORDS: *tooth loss, vulnerable populations, socioeconomic factors, healthcare inequities, preventive dental care, migrant health, access to healthcare*

INTRODUCTION

Tooth loss is one of the most prevalent dental conditions globally, affecting millions and serving as a stark indicator of systemic disparities within healthcare systems (1, 2). The global burden of oral diseases, which frequently culminate in tooth loss, impacts over 3.5 billion individuals, disproportionately affecting marginalized communities and exacerbating existing health inequities (3, 4). Beyond its immediate effects on aesthetics and functionality, tooth loss significantly impairs essential daily activities such as eating and speaking, often eroding self-esteem and limiting social

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participation, which diminishes the overall quality of life (5, 6). Vulnerable populations, particularly those with limited socioeconomic resources, are at heightened risk due to persistent barriers to preventive and restorative care (7).

Socioeconomic factors, including income, education, and access to healthcare, are deeply interconnected and significantly influence oral health disparities (8, 9). Income affects the ability to afford preventive care, education shapes health literacy and awareness, and access to healthcare determines the availability of necessary treatments (10). Behavioral factors like smoking, poor nutrition, and infrequent dental visits exacerbate these inequities, which are more prevalent among socioeconomically disadvantaged groups (11). Research highlights that income disparities, limited education, and restricted access to quality healthcare increase the risk of adverse dental health outcomes, such as caries, periodontal diseases, and tooth loss (12, 13). For instance, studies in Italy have shown a strong connection between tooth loss, socioeconomic factors, and limited access to dental care among the elderly (14, 15), while research in Southern Italy found that poor oral health significantly impacts oral health-related quality of life (16, 17). These findings underscore the intricate relationship between socioeconomic status, behavior, and oral health outcomes (18).

Many previous studies have provided valuable insights into these dynamics. However, many focus narrowly on specific populations or isolated factors, leaving significant gaps in understanding the broader correlations (19, 20). For instance, while Petersen and Yamamoto (16) highlighted income disparities, they did not account for cultural or geographic variations. Similarly, Cocco et al. emphasized elderly populations, overlooking other vulnerable groups such as migrants or refugees (15, 21, 22).

Furthermore, several studies have identified key socioeconomic and behavioral factors that contribute to tooth loss. For example, Sabbah et al. examined the role of health-related behaviors in socioeconomic disparities but did not explore their impact across different cultural contexts (9). Studies by Sanders et al. focused on the socioeconomic gradient in oral health but lacked detailed analyses of behavioral factors such as smoking or dietary habits (23). Moreover, research by Bianco et al. highlighted oral health-related quality of life among institutionalized elderly populations, but did not consider the experiences of younger or migrant groups (2). However, this study examines the correlation between tooth loss and certain factors among a diverse population.

Most NIHMP Social Dental Clinic Patients have lost their tooth and cannot afford proper dental treatment; they receive free prosthodontic care at the clinic. This study adopts a general approach by integrating demographic, socioeconomic, and behavioral dimensions (20)This study employs a mixed-methods design that combines quantitative data from questionnaires with qualitative insights from interviews, seeking to uncover the multifaceted nature of tooth loss and provide an understanding of the challenges faced by individuals with low socioeconomic status.

The expected findings of this study could benefit researchers, healthcare providers, policymakers, and social dental health professionals by providing insights into the relationship between tooth loss and related factors. The results can help to inform targeted interventions, shape equitable healthcare policies, and enhance education and practice to address oral health disparities in disadvantaged populations (2, 24, 25).

Objectives

This study aims to achieve the following objectives:

1. to investigate tooth loss and demographic and socioeconomic factors in a diverse, disadvantaged population;
2. to analyze the influence of behavioral dimensions on tooth loss among disadvantaged populations.

LITERATURE REVIEW

Theoretical background

Oral health conditions, such as tooth loss, are associated with various factors, including socioeconomic factors. They have been extensively explored, with key determinants such as income, education, healthcare access, and behavior playing central roles in oral health outcomes (13, 16). Income affects individuals' ability to afford preventive care and treatments, while education influences health literacy and awareness of proper oral hygiene practices (24). Additionally, limited access to healthcare often leaves disadvantaged populations without timely interventions, exacerbating oral health disparities. Behavioral factors, including smoking and poor dietary habits, significantly increase the risk of periodontal disease and caries, both leading causes of tooth loss (26, 27). Comparative research underscores the interconnected nature of these variables, illustrating how they collectively contribute to pronounced disparities in oral health, particularly among low-income groups who face higher barriers to care and exhibit higher rates of unhealthy behaviors (6, 23, 28).

Related studies

Numerous studies have investigated the relationship between tooth loss and socioeconomic and behavioral factors, often focusing on specific populations or isolated variables. For example, a study in the United States revealed a strong connection between diabetes and tooth loss, emphasizing how the systemic effects of oral disease and its association with low socioeconomic status contribute to poor oral health outcomes (29). Similarly, research in the United Kingdom identified smoking as a significant predictor of tooth loss, with smokers showing higher rates of periodontal attachment loss and disease progression compared to non-smokers (26).

In more recent studies, cultural practices have also been linked to oral health disparities. Research in Yemen examined the impact of qat chewing, a widespread cultural habit, on oral health and found it to be a major risk factor for periodontal disease, leading to an increased prevalence of tooth loss (30, 31). These studies highlight the influence of systemic diseases, behavioral factors, and cultural practices on oral health. However, they often focus on single variables or specific subgroups, still leaving gaps in understanding the interplay of multiple factors across diverse populations.

This purpose study stands out by translating its questionnaire into five languages (Arabic, English, Italian, French, and Spanish), ensuring inclusivity and accurate data collection for the diverse patients at the NIHMP Social Dental Clinic in Rome. Addressing linguistic diversity alongside socioeconomic, behavioral, and cultural factors provides unique insights into the barriers faced by vulnerable populations (32, 33).

MATERIALS AND METHODS

Study design

The study employs a mixed-methods design, integrating quantitative and qualitative approaches to investigate the multifactorial causes of tooth loss among vulnerable dental patients (34, 35). A cross-sectional questionnaire collects (almost three months of collection) quantitative data on socioeconomic status, healthcare access, and behavioral factors, while qualitative interviews provide deeper insights into the personal and cultural barriers affecting oral health at the same time as data collection. This comprehensive approach allows for a broader understanding, as quantitative data identifies patterns and trends, while qualitative data clarifies the underlying context. The study focuses on vulnerable dental patients in Rome, including migrants, refugees, and low-income individuals who face significant barriers to oral healthcare (36-38). These patients rely on the NIHMP Social Dental Clinic, which provides prosthodontic dental treatment to underserved populations. The sample consists of 100 individuals selected through purposive sampling to ensure relevance to the study's objectives (39, 40, 41), particularly those experiencing tooth loss (42, 43). While selection bias is a potential limitation since participants are drawn from those actively seeking care at the NIHMP clinic, this method ensures that the sample aligns closely with the research focus, offering valuable insights into the factors contributing to dental health disparities (42-44).

Instruments

Two primary instruments were employed in this study: a structured questionnaire and interviews, each designed to collect complementary data for a comprehensive analysis (33, 45)The structured questionnaire was developed to explore the relationship between tooth loss and various socioeconomic, behavioral, and cultural factors. It included closed-ended questions covering oral hygiene habits, dietary patterns, smoking, alcohol consumption, and access to healthcare. The questionnaire was divided into sections addressing demographic information (e.g., gender, age, nationality, education), behavioral factors (e.g., smoking, alcohol use, oral hygiene practices), and medical history (e.g., chronic illnesses, immune function). Ultimately, to ensure accuracy and relevance, two public health dentistry specialists validated the questionnaire, providing feedback to refine its content and structure, which resulted in some adjustments to improve clarity and alignment with the study objectives. The research adhered to ethical guidelines for studies involving human participants, with informed consent obtained from all participants before inclusion (46, 47).

Methods of data analysis

The study utilized IBM SPSS Statistics Version 24, a statistical analysis software developed by International Business Machines Corporation (IBM) that is headquartered in Armonk, New York, USA, to analyze data collected from a sample of 100 participants, aiming to explore the correlation between tooth loss and various demographic, socioeconomic, and behavioral factors (9, 48, 49, 50). Various data analysis methods were utilized in this study. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize variables such as age, gender, education level, and socioeconomic status. Inferential statistical methods, such as chi-square

tests, were applied to assess the significance of relationships between these factors and tooth loss, with p-values determining statistical significance. Correlation metrics, such as Spearman's rho, Phi, and ETA coefficients, were used to measure the strength of the associations. Additionally, odds ratios and confidence intervals identified risk factors for tooth loss. Behavioral variables, including smoking, fruit and vegetable consumption, access to clean drinking water, and oral hygiene practices, were analyzed collectively to assess their impact on oral health outcomes (Fig. 1).



Fig 1. *Methodology Flowchart. This flowchart illustrates the key stages of a research study, from defining the objectives to finalizing and reporting findings. Each step, from questionnaire design to data analysis, is visually connected, showing the research process flow.*

RESULTS

In total, a descriptive analysis provided an overview of the demographic characteristics and health-related behaviors of the 100 participants in the study. The sample consisted of 54% males and 46% females, with 52% under 60 years of age and 48% aged 60 years or older. Most participants (75%) resided in urban areas, while 25% lived in rural settings. Regarding education, 63% had completed high school, and 27% held a university degree or diploma. Ethnically, the group included 30 Italians, 23 Africans, 24 South Americans, 14 Eastern Europeans, and 9 Asians. In terms of economic status, 68% were categorized as poor, while 32% had moderate financial means. Behavioral data revealed that 46% were smokers, 41% consumed alcohol, and 47% had a daily intake of sugary snacks, with 64% consuming fruits and vegetables rarely. Additionally, 37% of participants reported having no access to clean drinking water, and 63% reported not having regular tooth cleanings.

Table I reveals that age is a significant predictor of complete tooth loss, with individuals over 60 being 4.4 times more likely to experience it compared to younger individuals, supported by strong statistical associations ($\chi^2 = 12.2$, ETA = 0.35). Gender also plays a role, with males being 4.0 times more likely than females to experience complete tooth loss ($\chi^2 = 11.1$, ETA = 0.33). Lower education levels and poor economic status increase the likelihood of tooth loss, with high

school-educated individuals (OR = 2.4) and those from economically disadvantaged backgrounds (OR = 2.7) at higher risk. Urban residents (OR = 3.1) and part-time workers (OR = 2.7) show greater susceptibility, suggesting lifestyle-related factors. Across all variables, statistical metrics consistently indicate moderate to strong correlations, underscoring the multifaceted nature of tooth loss and the need for targeted interventions that address age, socioeconomic status, and lifestyle factors.

Table I. *Demographic and socioeconomic factors influencing tooth loss.*

The variables		Tooth loss						OR	C195%		χ2	*p*	ETA
		Partially N=43		Completely N=57		Total N=100							
		No.	%	No.	%	No.	%		L	U			
Age	≤ 60	31	72.1	21	36.8	52	52.0	4.4	1.9	10.4	12.2	0.001	0..35
	>60	12	27.9	36	63.2	48	48.0						
Gender	Male	15	34.9	39	68.4	54	54.0	4.0	1.7	9.3	11.1	0.001	0.33
	Female	28	65.1	18	31.6	46	46.0						
Education level	High School	22	51.2	41	71.9	63	63.0	2.4	1.1	5.6	4.5	0.03	0.21
	University - Diploma	21	48.8	16	28.1	27	27.0						
Residence	Urban	37	86.0	38	66.7	75	75.0	3.1	1.1	8.6	4.9	0.03	0.22
	Rural	06	14.0	19	33.3	25	25.0						
Economic Status	Poor	24	55.8	44	77.2	68	68.0	2.7	1.1	6.5	5.1	0.02	0.23
	Moderate	19	44.3	13	22.8	32	32.0						
Occupation	Part-Time Job	19	44.2	39	68.4	58	58.0	2.7	1.2	6.2	5.9	0.02	0.24
	No Job	24	55.8	18	31.6	42	42.0						

***OR**: odds ratio ≥ 1 is (at risk of infection); **χ2**: Chi-square ≥ 3.83 (significant); **p**: probability value ≤ 0.05 (significant); **CI**: confidence interval; **L**: lower; **U**: upper; **ETA**: coefficient test means a method for determining the strength of association between variables.*

Table I illustrates the relationship between various demographic, socioeconomic, and lifestyle factors and the prevalence of tooth loss, categorized into partial (N = 43) and complete (N = 57) tooth loss. Key findings, along with statistical metrics such as odds ratio (OR), confidence intervals (CI), χ^2, -values, and ETA coefficients.

In Table II, the Ethnicity analysis highlights significant variations in tooth loss prevalence across ethnic groups. Italians, comprising 30% of the sample, showed a higher prevalence of complete tooth loss (42.1%) compared to partial tooth loss (14%). In contrast, South Americans, representing 24% of the sample, experienced more partial tooth loss (41.9%) than complete tooth loss (10.5%). Statistical analysis yielded a χ^2 value of 22.7 and a p-value of 0.001, indicating a strong and significant association between ethnicity and tooth loss. However, the ETA coefficient of 0.10 suggests a relatively weak strength of association. Overall, ethnicity significantly influences the prevalence of tooth loss, with Italians at a greater risk of complete tooth loss.

Table II. *The correlation between ethnicity and tooth loss.*

Ethnicity	**Tooth loss**				**Total**		**χ2**	***p***	ETA
	Completely N=57		Partially N=43						
	No.	**%**	**No.**	**%**	**No.**	**%**			
African	16	28.1	07	16.3	**23**	**23.0**			
East EU	09	15.8	05	11.6	**14**	**14.0**			
South American	06*	10.5	18*	41.9	**24**	**24.0**	**22.7**	**0.001**	**0.10**
Italian	24*	42.1	06*	14.0	**30**	**30.0**			
Asian	02	3.5	07	16.3	**09**	**9.0**			

χ2: Chi-square ≥ 3.83 (significant); p: Probability value ≤ 0.05 (significant); ETA: Coefficient test is a method for determining the strength of association between variables.

Table II presents the distribution of patients with tooth loss by ethnicity, categorized into those with partial (N = 43) and complete (N = 57) tooth loss.

Table III highlights the most significant behavioral variables that influenced dental health outcomes in the study, with factors such as age, smoking, dietary habits, and oral hygiene practices playing critical roles in tooth loss (9, 34, 45, 50. Smokers are 2.7 times more likely to experience tooth loss than non-smokers, while individuals with poor fruit and vegetable intake face 3.2 times higher odds. Similarly, a lack of access to clean drinking water (OR = 2.6), high-sugar diets (OR = 2.4), infrequent tooth cleaning (OR = 2.7), and alcohol consumption (OR = 2.7) are all linked to elevated risks. Statistical indicators, including chi-square values and Phi coefficients, show moderate but significant correlations across these factors, with confidence intervals confirming the robustness of these associations. These findings underscore the need for targeted interventions addressing smoking, diet, oral hygiene, and alcohol consumption to mitigate tooth loss risk.

Table III. *Behavioural factors influencing tooth loss.*

The variables		Tooth loss											
		Partially N=43		Completely N=57		Total N=100		OR	C195%		$\chi 2$	P	Phi
		No.	%	No.	%	No.	%		L	U			
Smoking	Yes	14	32.6	32	56.1	46	46.0	2.7	1.2	6.1	5.5	0.02	0.23
	No	29	67.4	25	43.9	54	54.0						
Fruit & Vegetable Consumption	Rarely	21	48.8	43	75.4	64	64.0	3.2	1.4	7.5	7.5	0.006	0.27
	Yes	22	51.2	14	24.6	36	36.0						
Access to Clean Drinking Water	No	11	25.6	26	45.6	37	37.0	2.6	1.1	6.2	4.9	0.03	0.21
	Yes	32	74.4	31	54.4	63	63.0						
High Sugar/Carbohydrate Diet	Yes	15	34.9	32	56.1	47	47.0	2.4	1.1	5.4	4.4	0.03	0.21
	No	28	65.1	25	43.9	53	53.0						
Tooth Cleaning Twice a Day	No	24	55.8	44	77.2	63	63.0	2.7	1.1	6.4	5.1	0.02	0.23
	Yes	19	44.2	13	22.8	37	37.0						
Alcohol Consumption	Yes	12	27.9	29	50.9	41	41.0	2.7	1.1	6.2	5.3	0.02	0.23
	No	31	72.1	28	49.1	59	59.0						

***OR**: odds ratio ≥ 1 is (at risk of infection); **χ2**: Chi-square ≥ 3.83 (significant); **p**: probability value ≤ 0.05 (significant); **CI**: confidence interval; **L**: lower; **U**: upper; **Phi**: method for determining the strength of association between variables.*

Table III shows the relationship between various behavioural factors and the prevalence of tooth loss, categorized into partial (N=43) and complete (N=57) tooth loss. Key findings, along with statistical metrics such as odds ratio (OR), confidence intervals (CI), χ^2, -values, and Phi coefficients.

Table IV emphasizes the correlation between tooth loss and the most prominent factors by using Spearman's rho correlation analysis. Smoking, inadequate fruit and vegetable consumption, and infrequent tooth cleaning were significantly associated with tooth loss. Smokers showed a notably higher likelihood of experiencing complete tooth loss, reaffirming the detrimental effects of smoking on oral health. Similarly, insufficient intake of fruits and vegetables was linked to an increased risk, emphasizing the protective benefits of a nutrient-fiber-rich diet. Age and gender also emerged as significant predictors, with old individuals and males showing greater susceptibility to tooth loss. These patterns highlight biological vulnerabilities and disparities in healthcare access and preventive practices. Additionally, education level and economic status exhibited slight positive correlations with tooth loss, suggesting that limited health literacy and financial constraints may contribute to poorer oral health outcomes (Fig. 2, 3).

Table IV. *The correlation between tooth loss and certain factors.*

Spearman's rho		Age	Gender	Economic Status	Education Level	Smoking	Fruit and Vegetable Consumption	Brushing Teeth
Tooth loss	Correlation Coefficient	-.349	.227	-.2.13	-2.34	.274	.227	.227
	Sig. (2-tailed)	<.001	0.23	0.33	0.19	.006	.23	0.23
	N	100	100	100	100	100	100	100

Correlation between tooth loss and various factors using Spearman's rho correlation analysis.

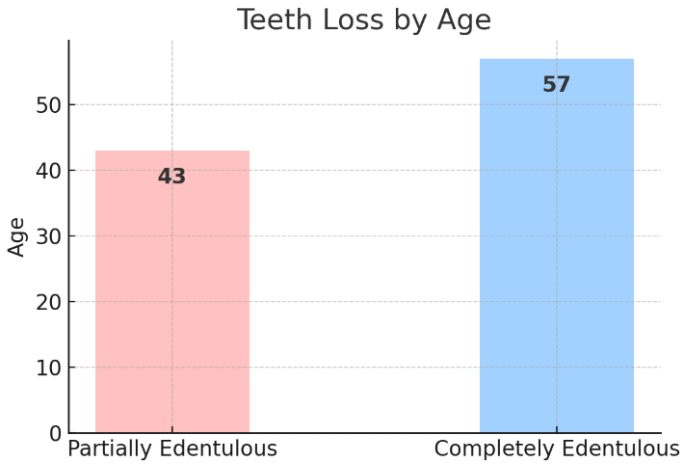


Fig. 2. *A bar chart of tooth loss and patients' age.*

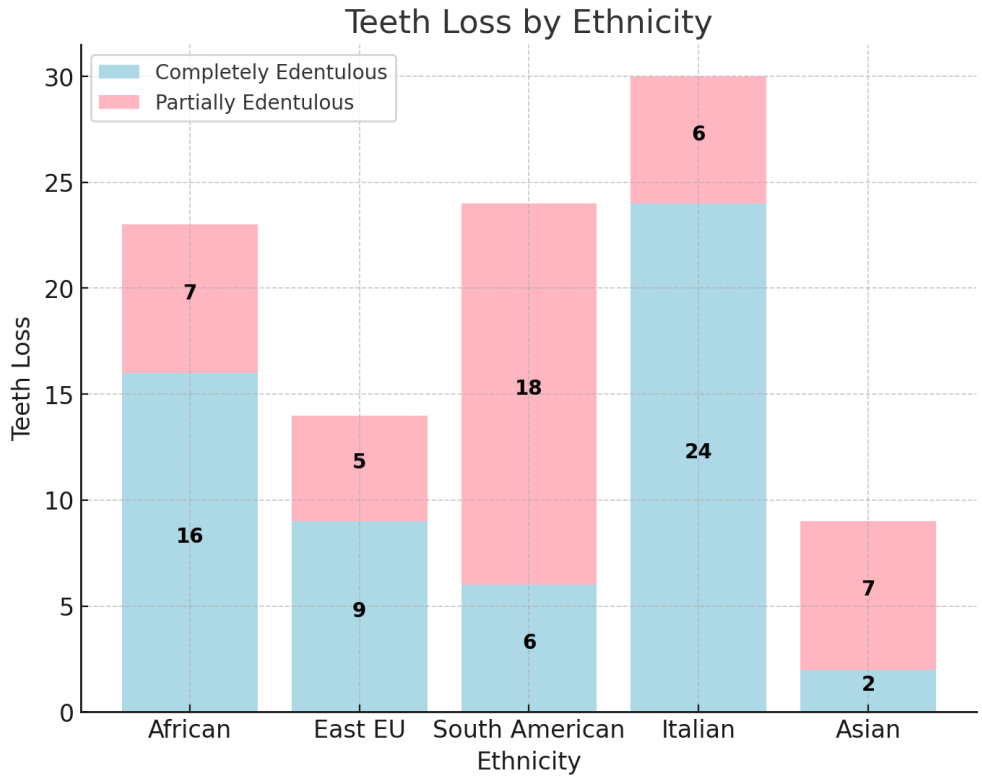


Fig 3. *Bar chart of the relationship between tooth loss and ethnicity.*

DISCUSSION

The findings of this study provide valuable insights into the multifaceted relationship between socioeconomic factors, behavioral variables, demographic factors, and tooth loss, contributing to the understanding of oral health disparities among vulnerable populations (51-53).

The results indicate that older individuals are most affected by tooth loss. Additionally, lower levels of education were associated with higher rates of tooth loss, and Italians were the largest ethnic group impacted. These findings are consistent with a study by Petersen et al., which reported that age, socioeconomic status, and education are significant predictors of oral health outcomes (16). Petersen's study supports the idea that older adults and those with less education are more likely to experience tooth loss due to reduced access to dental care and poorer oral health behaviors.

In contrast, a study by Kassebaum et al. found that age alone is not a definitive predictor of tooth loss (54). Their analysis showed that younger individuals with unhealthy dietary habits and inadequate oral hygiene also experienced significant tooth loss, suggesting that lifestyle factors may outweigh demographic influences. This contrast underscores the multifactorial nature of oral health and the varying contributions of age and behavior (55).

Behavioral habits, such as inadequate oral hygiene and high sugar consumption, were prominent in the study population. These behaviors likely contributed to the high rates of tooth extractions. The strong association between oral hygiene practices and tooth loss aligns with the findings of Watt and Sheiham (56), who emphasized that consistent brushing, flossing, and professional dental care are critical in preventing tooth loss. However, a contrasting study by Díaz-García highlighted that even individuals with adequate oral hygiene can experience tooth loss if other factors, such as genetic predisposition or systemic diseases, are present.

Lower education levels, urban residency, and poor economic status, as noted by Park (57), were also associated with greater tooth loss, contrasting with Bernabe et al., while Locker emphasized the role of systemic health conditions over socioeconomic factors (6).

Additionally, ethnic disparities, such as higher tooth loss among Italians and South Americans, aligned with Garcia's focus on cultural and healthcare access disparities (58), while the Japanese exhibit lower rates of tooth loss, likely due to better access to preventive dental care (59). Thus, lower tooth loss rates likely reflect better access to preventative dental care and a stronger cultural emphasis on oral health maintenance.

CONCLUSIONS

This study underscores the multifactorial nature of tooth loss, revealing its strong connection to socioeconomic factors like education, income, and healthcare access, as well as behavioral patterns such as smoking, poor diet, and inadequate oral hygiene. Vulnerable populations, particularly those with limited resources and access to preventive care, face an elevated risk of tooth loss. These findings highlight the link between tooth loss among 100 patients and emphasize the necessity of broader future investigations to expand the results. Interventions by healthcare professionals, the implementation of subsidized dental care and public health reforms by policymakers, and the allocation of resources for affordable dental services by hospital administrators are crucial steps in improving access to oral healthcare and reducing disparities in dental outcomes. Furthermore, academic researchers can benefit from this study by gaining a deeper understanding of oral health disparities, while community organizations can play a pivotal role in promoting oral health education and removing barriers to oral care. Addressing these challenges holistically through collaborative efforts across sectors is essential for achieving equitable and sustainable improvements in oral health outcomes.

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