Original Article

"Risk assessment for periodontal disease associated tooth loss among rural and urban population of 35-44, 45-54, 55-64 and 65-74 years age groups of Barabanki district, Uttar Pradesh, India: An epidemiological study

ABSTRACT

Aim: The aim of the study was to assess the risk for periodontal disease-associated tooth loss among rural and urban population of Barabanki district, Uttar Pradesh, India.

Materials and Methods: A cross-sectional study was done on 1200 urban and rural adults (632 males and 568 females) aged 35–74 years. Data were collected, followed by clinical examination for missing teeth. One-way analysis of variance with Bonferroni *post hoc* test, Chi-square test, and Student's *t*-test were used for statistical analysis. Statistical significance was set at $P \leq 0.05$.

Results: The mean number of periodontal disease-associated tooth loss in the study population was 4.2 ± 7.4. A significant association was found between the place of residence and tooth loss (3.5 ± 6.8 urban; 4.7 ± 7.8 rural), with rural adults showing greater tooth loss compared to urban adults ($P < 0.01$). Tooth loss increased significantly with age, ranging from mean number of 1.2 teeth in 35–44 years old to 11.5 teeth among 65–74 years old ($P < 0.001$). Gender showed a significant difference ($P < 0.01$) in tooth loss between males (4.7 ± 7.7) and females (3.6 ± 6.9). A significant association for tooth loss was also found with respect to the level of education and socioeconomic status ($P < 0.001$). A decrease in the mean number of missing teeth with increasing education and better socioeconomic status was observed, which was statistically significant ($P < 0.001$).

Conclusion: The insights gained illustrate that tooth loss was 57% in rural and urban Barabanki district population, and the significant risks identified were age, illiterate, marital status, and low socioeconomic status.

Keywords: Periodontal disease, risk assessment, tooth loss

INTRODUCTION

One of the most important oral health indicators is the ability to retain more number of teeth throughout life. Oral health goals recommended by the World Health Organization for the year 2020 have stated that there should be an increase in the number of individuals with functional dentition (21 or more natural teeth) at ages 35–44 and 65–74 years.[1] Tooth loss is the result of complex interaction of factors, of which the clinical condition of the tooth such as caries, periodontal disease, or trauma may only be the triggering factors, rather than the one single reason for loss of tooth. It is said to vary by age, gender, race, education, income, and geographic region.[2]

Tooth loss impairs the quality of life, often substantially, and affects the well-being of the person. Missing teeth can

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interfere with chewing ability, diction, and esthetics. Low self-esteem related to tooth loss can hinder an individual's ability to socialize, hamper the performance of work and daily activities, and lead to absence from work.[3] Hence, preservation of natural dentition should be the ultimate goal of the dental profession. This study aims to assess the risk assessment for periodontal disease-associated tooth loss among rural and urban population in Barabanki district, Uttar Pradesh, India.

MATERIALS AND METHODS

A cross-sectional study was done to assess the risk for periodontal disease-associated tooth loss during January 2018–February 2019 in villages and cities of Barabanki district, Uttar Pradesh, India. The protocol of the study was approved by the local authorities at village level and higher authorities at city level of Barabanki district, Uttar Pradesh, India. This study was got ethical clearance from the institutional ethical committee and also done in accordance with the Declaration of Helsinki of 1975, as revised in 2013 for human subjects. Appropriate verbal and written informed consent was obtained from the participants. For Ethical Clearance was obtained with Ref no 0626/C.D.C. & H./2021-22 dated 20.07.2022.

Selection of urban area

In the first stage, Barabanki city was divided geographically into five areas, i.e., northeast, northwest, southeast, southwest, and central. Approximately seven wards came under each of these geographic areas. In the second stage, one ward was randomly selected from each geographic area. A list of all the blocks from the five selected wards was obtained from census enumeration area data. In the third stage, three blocks were selected randomly from each ward. In the fourth stage, a door-to-door survey was conducted and around twenty individuals, aged 35–74 years, were interviewed and examined from each block.

Selection of rural area

In the first stage, Barabanki district was divided geographically into four areas – northeast, northwest, southeast, and southwest. In the second stage, from each of the geographical areas, four villages were randomly selected. In the third stage, each village was divided into two halves. In the fourth stage, from each half of the village, around twenty individuals, aged 35–74 years, were interviewed and examined during the door-to-door survey.

Sampling design and study population

A total of 1290 individuals were approached to participate in the study, but 90 declined citing a variety of reasons (response rate 93%). Study sample of 1200, aged 35–74 (mean age of 50.9 ± 10.78 years) adults were recruited by random sampling procedure. They included 565 (47.1%) individuals from urban and 635 (52.9%) individuals from rural areas. Of these, 632 (52.7%) were males and 568 (47.3%) were females.

Methodology (data collection)

A specially designed pro forma was prepared to obtain data regarding the participant's place of residence, age, sex, marital status, education level, and socioeconomic status. Standard epidemiological methods were followed for participant selection, recruitment, and data collection by conducting interviews and oral examinations. Oral examination was done according to the Australian National Survey of Adult Oral Health in the year 2006.[4]

Data regarding the participant's place of residence, age, sex, marital status, education level, and socioeconomic status were recorded. The oral examination was done following the interview at the participant's houses and places of work. The participants were informed that the examinations were being carried out by a registered dentist. They were requested to sit on a chair in upright position in the front porch under natural light or inside of their house under artificial light (if participant requested to be examined inside the house). Female participants were examined in the presence of another family member. Sterilized or disposable instruments were used. Instruments coming in contact with blood or saliva were washed with commercial cleansing agents and placed in a separate bag. Used, contaminated, and dirty instruments were autoclaved on a daily basis.

During the examination, the examiner was gloved and used a face mask and protective eyewear glass. The armamentarium for examination consisted of disposable gloves, gauze pieces, cotton rolls, tweezers, periodontal probes, and disposable syringes. On an average, twenty participants were interviewed and examined per day. A single investigator who was trained and calibrated performed all oral examinations ($\kappa = 0.90$).

Examination criteria

Participants included were those who did not have any contraindication for periodontal examination. Tooth was considered as missing, if patient gave history of tooth loss due to periodontal disease. Supernumerary tooth, congenitally missing or traumatic missing, and tooth loss due to orthodontic treatment were excluded. Individuals who reported medical conditions that contraindicated periodontal examination were excluded from the study. The contraindications for periodontal probing were the presence of any of the following conditions: heart disease (congenital

heart disease, infective endocarditis, and rheumatic heart disease), blood coagulation disorders, uncontrolled diabetes, kidney disorders requiring renal dialysis, transplanted organs, and joint replacement in the past 3 months. The safety protocol was followed to ensure the safety of the investigator and assistant.[5] The investigator was always accompanied by an assistant. Both assessed the safety of surroundings on the previous day before the start of the survey. Local leaders were informed about the areas being covered on the following days, and mobile phone numbers of leaders were noted. Mobile phones were used for communication. The investigator and assistant listened and observed carefully for signs of potential risk to safety. If there were high-intensity sounds such as cry, yell, and scream inside the houses, such houses were not approached. People appearing under the influence of alcohol or addiction were not approached.

The study population was categorized into four age groups: 35–44, 45–54, 55–64, and 65–74 years. Socioeconomic status based on per capita income was classified according to BG Prasad's[6] rural socioeconomic status scale classification using the All India Consumer Price Index for October 2005 as Social Class I (≥Rs 2001), Social Class II (Rs 1001–2000), Social Class III (Rs 601–1000), Social Class IV (Rs 301–600), and Social Class V (≤Rs 300).[7]

Statistical analysis

The recorded data were compiled and entered in a spreadsheet computer program and then exported to data editor page of SPSS version 11.5 (SPSS Inc., Chicago, IL, USA). The variables were assessed for normality using the Kolmogorov–Smirnov test. Descriptive statistics included computation of percentage, mean, and standard deviation of the number of missing teeth for the various categories of the risk. Chi-square test, Student's *t*-test, and one-way analysis of variance with Bonferroni *post hoc* test were used to assess bivariate relationships. Multivariate analysis was used to assess the relative importance of independent variables and to identify the main variable influencing tooth loss. All the risk were dichotomized and employed as independent variables in multiple logistic regression estimating values of odds ratio (OR) and the respective 95% confidence interval (CI). Goodness of fit was assessed by means of Hosmer and Lemeshow test. Statistical significance was set at $P \leq 0.05$.

RESULTS

The percentage of periodontal disease-associated tooth loss among rural and urban adult population of Barabanki district, Uttar Pradesh, India, was 57%, in which 5.2% were complete edentulous and 51.8% were partially edentulous. In rural population, 5.7% were complete edentulous and 52.6% were partially edentulous. In urban population, 4.8% were complete edentulous and 51% were partially edentulous [Table 1].

The mean number of periodontal disease-associated tooth loss in the study population was 4.2 ± 7.4. A significant association was found between the place of residence and tooth loss (3.5 ± 6.8 urban; 4.7 ± 7.8 rural), with rural adults showing greater tooth loss compared to urban adults ($P < 0.01$). Tooth loss increased significantly with age, ranging from mean number of 1.2 teeth in 35–44 years old to 11.5 teeth among 65–74 years old ($P < 0.001$). Gender showed a significant difference ($P < 0.01$) in tooth loss between males (4.7 ± 7.7) and females (3.6 ± 6.9). A significant association for tooth loss was also found with respect to the level of education and socioeconomic status ($P < 0.001$). A decrease in the mean number of missing teeth with increasing education and better socioeconomic status was observed, which was statistically significant ($P < 0.001$) [Table 2]. Socioeconomic status was the main variable influencing tooth loss with 95% CI (1.334–2.581) and OR of 1.855, followed by age with 95% CI (0.913–1.54) and OR of 1.186 [Table 3].

DISCUSSION

Loss of tooth reflects a major public health problem in many countries. The prevalence of tooth loss among the adult population of Barabanki district, India, was 57%. The mean number of missing teeth (4.2) was higher in comparison with Haitian immigrants (2.64) of New York City.[8] Complete edentulousness was more prevalent among rural adults who are in conformity with few other studies.[9,10]

The difference in tooth loss between rural and urban adults might be explained by the fact that meeting dental care needs is more challenging to the people living in rural areas compared to their urban counterparts. Availability, accessibility, acceptability, and affordability of dental services might be the potential barriers for rural people to seek timely advice and treatment. In India, there is a gross disparity in oral health-care provision between urban and rural areas.[11] Furthermore, the attitude of the rural people is generally such that they elect to have their symptomatic teeth extracted rather than conserving those.[10]

A directly proportional relationship was observed between age and tooth loss, which was lower than that found in the National Oral Health Survey of India.[12] Greater tooth loss among the older age groups may be due to the cumulative

Table 1: Periodontal disease-associated tooth loss according to the place of residence and sex among the rural and urban population

Variables	Sex	No tooth loss, *n* (%)	Completely edentulous, *n* (%)	Partially edentulous, *n* (%)	χ^2, *P*
Urban (*n*=565)	Male	119 (40.8)	15 (5.1)	158 (54.1)	20.794, 0.05*
	Female	131 (48)	12 (4.4)	130 (47.6)	
	Total	250 (44.2)	27 (4.8)	288 (51)	
χ^2, *P*	10.774, 0.224				
Rural (*n*=635)	Male	126 (37.1)	23 (6.8)	191 (56.2)	
	Female	139 (47.1)	13 (4.4)	143 (48.5)	
	Total	265 (41.7)	36 (5.7)	334 (52.6)	
χ^2, *P*	19.556, 0.028*				
Overall (*n*=1200)	Male	245 (38.8)	38 (6.0)	349 (55.2)	
	Female	270 (47.5)	25 (4.4)	273 (48.1)	
	Total	515 (43)	63 (5.2)	622 (51.8)	
χ^2, *P*	25.476, 0.007*				

Test applied: Chi-square test, *$P \leq 0.05$ is statistically significant

Table 2: Periodontal disease-associated tooth loss in relation to residence, age, sex, marital status, education, and socioeconomic status among the rural and urban population

	Urban (*n*=565)			Rural (*n*=635)			Overall (*n*=1200)		
	n (%)	Mean (SD)	*P*	*n* (%)	Mean (SD)	*P*	*n* (%)	Mean (SD)	*P*
Residence	565 (47.1)	3.5 (6.8)	-	635 (52.9)	4.7 (7.8)	-	1200 (100)	4.2 (7.4)	t=2.80, <0.01*
Age (years)									
35-44	187 (33.1)	1.0 (2.0)[a]	*F*=42.5, <0.01*	177 (27.9)	1.4 (3.1)[a]	*F*=66.9, <0.001*	364 (30.3)	1.2 (2.6)[a]	*F*=114.0, <0.001*
45-54	187 (33.1)	2.6 (5.1)[a]		189 (29.8)	2.6 (5.0)[a]		376 (31.3)	2.6 (5.0)[b]	
55-64	130 (23.0)	5.2 (7.9)[b]		148 (23.3)	5.6 (7.9)[b]		278 (23.2)	5.4 (7.9)[c]	
65-74	61 (10.8)	10.7 (11.3)[c]		121 (19)	12.0 (10.8)[c]		182 (15.2)	11.5 (10.9)[d]	
Sex									
Male	292 (51.7)	3.9 (7.0)	*t*=1.12 0.26	340 (53.5)	5.5 (8.2)	*t*=2.48, <0.05*	632 (52.7)	4.7 (7.7)	*t*=2.67, <0.01*
Female	273 (48.3)	3.2 (6.5)		295 (46.5)	3.9 (7.2)		568 (47.3)	3.6 (6.9)	
Marital status									
Married	516 (91.3)	3.3 (6.4)[a]	*F*=8.45, <0.001*	586 (92.3)	4.2 (7.3)[a]	*F*=28.3, <0.001*	1102 (91.8)	3.8 (6.9)[a]	*F*=36.3, <0.001*
Unmarried	23 (4.1)	3.7 (8.3)[a]		12 (1.9)	1.9 (2.6)[a]		35 (2.9)	3.1 (6.9)[a]	
Widow/widower	26 (4.6)	8.8 (10.1)[b]		37 (5.8)	13.6 (10.4)[b]		63 (5.3)	11.7 (10.5)[b]	
Education level									
No education	61 (10.8)	5.5 (8.9)[a,b]	*F*=11.3, <0.001*	242 (38.1)	5.0 (8.2)[a]	*F*=3.76, <0.05*	303 (25.2)	5.1 (8.3)[a]	*F*=15.3, <0.001*
Primary	119 (21.1)	5.9 (8.6)[a]		206 (32.4)	5.8 (8.5)[a]		325 (27.1)	5.8 (8.5)[a]	
Secondary	180 (31.9)	3.2 (6.4)[b,c]		143 (22.6)	3.0 (6.1)[b,c]		323 (26.9)	3.1 (6.3)[b]	
Graduation and above	205 (36.2)	1.9 (4.2)[c]		44 (6.9)	4.1 (6.5)[a,c]		249 (20.8)	2.3 (4.8)[b]	
Socioeconomic status									
I	229 (40.5)	2.5 (5.4)[a]	*F*=2.95, <0.05*	33 (5.2)	1.8 (2.7)[a]	*F*=2.55, <0.05*	262 (21.8)	2.4 (5.2)[a]	*F*=7.13, <0.001*
II	128 (22.7)	4.4 (7.9)[b]		73 (11.5)	4.1 (8.0)[b]		201 (16.8)	4.3 (7.9)[b]	
III	107 (18.9)	4.0 (7.2)[b,c]		91 (14.3)	3.9 (6.6)[b]		198 (16.5)	3.9 (6.9)[b]	
IV	60 (10.6)	3.6 (6.1)[c]		163 (25.7)	4.6 (7.4)[b]		223 (18.6)	4.3 (7.1)[b]	
V	41 (7.3)	5.5 (8.5)[d]		275 (43.3)	5.7 (8.6)[c]		316 (26.3)	5.6 (8.6)[c]	

Student's *t*-test and one-way ANOVA with Bonferroni *post hoc* test. Values with the same letter superscripted do not vary significantly. *$P \leq 0.05$ is statistically significant. SD: Standard deviation

effect of dental diseases and lack of oral health-care measures. It has also been reported that age alone is not responsible for the deterioration of oral health.[2,3]

In the present study, females had fewer missing teeth than males. Although similar observation was found in other studies,[9,13] few studies have shown females.[11,14] Females are generally more concerned about their oral health and are more likely to choose the preservation of their teeth rather than extraction. Females are more conscious for looking beautiful. They are fear from losing teeth and thinking that if teeth are lost, they are looking old. The negative impact of bleeding gums and halitosis that might affect their personality and socialization encourages the women to maintain good

Table 3: Estimates of multiple logistic regressions for variables affecting tooth loss

Variables	Category	OR	95% CI
Place of residence	Urban	0.831	0.426-1.619
	Rural		
Age in years	≤55	1.186*	0.913-1.541
	>55		
Sex	Male	1.123	0.854-1.475
	Female		
Marital status	Married	0.876*	0.56-1.368
	Unmarried		
Education	Illiterate	1.065*	0.781-1.453
	Literate		
Socioeconomic status (monthly income in rupees)	>Rs. 10,001	1.855*	1.334-2.581
	≤Rs. 10,000		

*Indicates statistical significance at $P<0.05$. OR: Odds ratio, CI: Confidence interval

oral hygiene. Females are also found to brush their teeth more regularly and utilize dental services more frequently than men, which might have resulted in less tooth loss among them.[15,16]

People who were married and living together with their spouse had fewer missing teeth. Marital status may be an independent factor for better oral health and better care-seeking behavior and consequently less tooth loss, because marital relation by its very nature acts as an incentive for seeking oral health care out of partner's encouragement. Loneliness and depression due to loss of spouse may lead to neglect of personal and oral hygiene.

The level of education was found to be associated with tooth loss. In this study, people with higher levels of education had experienced less tooth loss. This result extends the finding of previous researches documenting that lower literacy level is associated with higher number of missing teeth.[11] Well-educated people are more knowledgeable, understand the importance of maintaining a healthy oral cavity, can be motivated easily, and generally comply with the instructions given to them by the dentist to maintain good oral hygiene. They are also likely to visit the dentist regularly for checkups and utilize more preventive services.

Higher social class people showed less prevalence of tooth loss which was similarly reported in other studies also.[8,9,16] People of lower social classes tend to place very little value for health in general and oral health in particular. They give little or no importance for the preservation of their teeth for the entire lifetime and prefer extraction over restoration.[9]

Tooth loss may be considered as the ultimate barometer of failure or success of dentistry and dental health programs. The risks assessed in this study reflect aspects of a complex process whose outcome is the loss of one or more teeth, i.e., they document the characteristics of the individual losing tooth, rather than the characteristics of the tooth that was lost.

CONCLUSION

The findings of this study provide an insight into the prevalence of periodontal disease-associated tooth loss which was observed to be higher among rural than urban adults in Barabanki district, Uttar Pradesh, India. The associated sociodemographic risk responsible for increased tooth loss included age, male, illiterate, and low socioeconomic status groups. This epidemiological data confirm the need for community-based oral health promotion and disease prevention programs designed to reduce the risk for tooth loss in this and similar population groups.

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Conflicts of interest

There are no conflicts of interest.

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