

## Effect of tobacco use on tooth loss among patients visiting the out-patient dental department of a tertiary care hospital in Pakistan

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### Abstract

**Objectives:** To determine the factors influencing tooth loss and to assess the strength of association between the factors and the loss.

**Methods:** The unmatched case-control study was conducted at the Pakistan Institute of Medical Sciences, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, from March to April 2016, and comprised data of patients who visited the outpatient dental department. Face-to-face interviews and clinical examination were done. Data was analysed using SPSS 20.

**Results:** Of the 376 subjects, there were 188(50%) in each of the two groups. The mean age among the cases was 37.01±12.077 years and among the controls it was 28.06±9.591 years. Tobacco consumption and age >35 were significant predictors of tooth loss (p<0.05 each). Tobacco users with high duration and frequency had a significant value for increased chances of tooth loss (p<0.001). Both the smokers and smokeless tobacco users had more chances of tooth loss (p<0.001).

**Conclusion:** There was negative implications of smoking on oral health which increased the chance of tooth loss.

**Keywords:** Tobacco, Smoking, Smokeless, Pakistan, Tooth decay, Tooth loss, Oral health, Age, Education. (JPMA 68: 841; 2018)

### Introduction

Poor oral health has implications on general well-being and quality of life. Oral health is affected by conditions including periodontal disease, tooth decay, dental cavities, and tooth loss. According to the Global Burden of Disease Study, poor oral health affected 3.9 billion people globally and severe periodontitis was regarded as the 6th most prevalent health problem affecting 11% of the global population.<sup>1</sup> World Health Organisation (WHO) estimates that dental cavities are found among 60-90% schoolchildren and universally are present among adults globally.<sup>2</sup>

Tooth loss is the outcome of dental cavities and periodontal disease, affecting the psychological well-being and social functioning of individuals due to symptoms like discomfort, pain and issues like aesthetic concerns.<sup>2,3</sup> Tooth loss had a 2% global prevalence in 2010, and furthermore, it leads to significant economic burden due to the high cost of the treatment.<sup>1</sup> Tooth loss is found more among the elderly as 30% of the world populations are edentulous at the age of 65 and

above.<sup>2</sup> However, there are many risk factors, including improper oral hygiene, and especially unhealthy lifestyles, including unbalanced diet, smoking, and alcohol use, that contribute to periodontal disease that increases vulnerability to tooth loss even in younger age groups.<sup>4-8</sup>

Social determinants of tooth loss have been documented in high-income countries but it needs to be explored in other settings.<sup>9</sup> Inequitable distribution of resources in low-income countries reduces accessibility to education and healthcare that limits the opportunity for the poor communities, thus predisposing individuals to unhealthy and unhygienic lifestyles and practices.<sup>9,10</sup> Disparities and compromised health status have been documented among marginalised population due to lack of awareness, poverty and low education status.<sup>11</sup>

Tobacco use is a leading cause of morbidity and mortality as it causes approximately 6 million deaths per year. It serves as a major a risk factor for multiple health conditions, including chronic diseases like cardiovascular and chronic respiratory diseases, cancers of lungs and oral cavity.<sup>6,12</sup> Tobacco use in some form is prevalent among one-third of the world's adult population with a major proportion residing in low and middle-income countries (LMICs) and alarmingly adolescent start tobacco use as early as the age of 10 years.<sup>2,3,13</sup> By the year 2025, it is

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estimated that 7 out of 10 deaths will be due to tobacco use.<sup>12,14</sup> Deleterious effects of tobacco use on oral cavity cannot be undermined.<sup>15,16</sup>

Periodontitis and dental caries have been strongly associated with smoking tobacco, which can lead to premature tooth loss due to poor periodontal health.<sup>16-20</sup> A study conducted in Brazil concluded that tooth loss can occur as a co-morbidity with other chronic diseases, while a study conducted in Pakistan showed that tooth loss was associated significantly with patients suffering from chronic heart disease independent of factors like gender, age, smoking and diabetes etc.<sup>21-23</sup>

It has also been concluded that the negative effects of smoking on oral health can last up to 30 years, although its risk decreases after avoiding and quitting cigarette smoking, which can lead to long-term retention of teeth.<sup>24</sup> A review in 2011 concluded that it is highly likely that smoking and tooth loss have a causal association but recommended further studies in different populations to confirm this association.<sup>25</sup> Recent studies conducted in Japan, Italy and Iran have all demonstrated a strong correlation between smoking tobacco and dental caries.<sup>25-28</sup> A study conducted in India in 2012 demonstrated greater tooth loss in patients using tobacco than non-users of tobacco.<sup>19</sup>

Similarly, as with smoking, oral smokeless tobacco use has been strongly associated with oral cancer.<sup>29</sup> Asian countries, including both India and Pakistan, particularly have a high prevalence of oral cancers due to various forms of smokeless chewing tobacco revealed in a systemic meta-analysis review of smokeless tobacco and oral cancer in South Asia.<sup>10,30</sup> However, the role of oral smokeless tobacco in periodontal disease and its relationship to tooth loss is not well-documented.

The national prevalence of smoking is 21.6% in Pakistan.<sup>31,32</sup> Approximately, 90% of all untreated oral diseases among the Pakistani population are due to lack of awareness. Oral hygiene is not a priority among masses in Pakistan.<sup>31-33</sup> Most of the visits to the dentist take place after experiencing dental pain and tooth extraction forms 90% of all the treatments provided in public practice.<sup>34</sup> There is not sufficient information available to estimate the incidence of tooth loss and its association with smoking among the Pakistani patients.

The current study was planned to determine the factors influencing tooth loss and assess the strength of association of these factors with tooth loss among a cross-

section of Pakistani population.

## **Subjects and Methods**

The unmatched case-control study was conducted at the Pakistan Institute of Medical Sciences (PIMS), Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, from March to April 2016, and comprised data of patients who visited the outpatient dental department. The department caters to all dental problems, and receives patients from diverse backgrounds and from a huge geographical catchment area, including Khyber Pakhtunkhwa, Gilgit-Baltistan, Kashmir and Islamabad along with the suburbs. Permission was obtained from the institutional committee and from the ethical review board of the Health Service Academy, Islamabad.

In the absence of an estimate related to Pakistan, an earlier study conducted in only the city of Lahore with 67% of the healthy participants having at least one tooth missing was used to determine the sample size.<sup>22</sup> An Odds ratio of 2 was used.

Patients of either gender aged at least 14 years, and presenting with no history of any systemic disease or congenital tooth loss were included. Those with history of tooth loss due to any reason other than periodontal disease and dental caries were excluded. Patients suffering from congenitally missing tooth or teeth were also excluded along with patients with cessation of tobacco use for one year and more.

Consecutive patients who fulfilled the inclusion criteria were selected. Subjects with tooth loss and/ or having indication for tooth extraction and fulfilling the inclusion criteria were marked as cases. An equal number of subjects without tooth loss and with no indication for tooth extraction and fulfilling the inclusion criteria were selected as controls.

Data was collected after seeking informed written consent. Information regarding socio-demographic background, education status, income, tobacco use, oral hygiene practices, diet and nutrition, routine dental visits and alcohol consumption was obtained through administration of a face-to-face structured questionnaire. Clinical examination was conducted to assess oral hygiene status, the number of teeth lost and the number of teeth indicated for extraction (except for third molars). Data were processed and analysed using SPSS 20. Frequencies, percentages, mean, standard deviation and range were used for the analysis of socio-demographic background variables. Pearson's chi-square analysis was performed for testing associations.

Association was determined between tooth loss and variables including socio-demographic factor, oral hygiene practices, and health-seeking behaviours, lifestyle practices including diet and tobacco use. Finally, a logistic regression model was used and the variables described were entered into the model and controlled for the tooth loss as outcome variable of interest for case-controls.

## Results

Of the 376 subjects, there were 188(50%) in each of the two groups. The mean age among the cases was

**Table-1:** Socio-Demographic information of participants and their tooth loss status.

	Cases n=188 (%)	Controls n=188 (%)	P value
Age (year) Median	30	30	
Age. Mean (SD)	37.01 ± 12.077	28.06 (± 9.591)	
<b>Age&gt;35</b>			
Yes (Tooth loss)	103(54.8%)	44(23.4%)	<0.001
No	85(45.2%)	144(76.6%)	
<b>Age Group</b>			
< 25	38(20.2%)	103(54.8%)	
26-35	47(25.0%)	41(21.8%)	
36-45	49(26.1%)	29(15.4%)	
46-55	32(17.0%)	12(6.4%)	
56-65	14(7.4%)	1(0.5%)	
>66	8(4.3%)	2(1.1%)	
<b>Gender</b>			
Male	110(58.5%)	92(48.9%)	0.063
Female	78(41.5%)	96(51.1%)	
<b>Marital Status</b>			
Married	137(72.9%)	97(51.6%)	<0.001
Unmarried	51(27.1%)	91(48.4%)	
<b>Educational Status</b>			
No Schooling	50(26.6%)	16(8.5%)	<0.001
< 10 years	36(19.1%)	37(19.7%)	
Up to 10 years	39(20.7%)	41(21.8%)	
11-14 years	43(22.9%)	66(35.1%)	
> 14 years	20(10.6%)	28(14.9%)	
<b>Ethnic Background</b>			
Punjabi	124(66%)	139(73.9%)	0.181
Pathan	45(23.9%)	34(18.1%)	
Kashmiri	7(3.7%)	6(3.2%)	
Gilgiti	3(1.6%)	6(3.2%)	
Sindhi	4(2.1%)	--	
Urdu Speaking	4(2.1%)	2(1.1%)	
Balochi	1(0.5%)	--	
Afghani	--	1(0.5%)	
<b>Family Income Group/month</b>			
No source of income	7(3.7%)	12(6.4%)	0.012
< Rs. 20,000	103(54.8%)	72(38.3%)	
Rs. 20,000 - 50,000	58(30.9%)	73(38.8%)	
> Rs. 50,000	20(10.6%)	31(16.5%)	

SD: Standard deviation.

**Table-2:** Distribution of smoking and social habits variables for cases and controls.

	Cases n=188 (%)	Controls n=188 (%)	P value
<b>Method of cleaning teeth</b>			
Tooth brushing	143(76.1%)	146(77.7%)	0.097
Maswak*	27(14.4%)	14(7.4%)	
Tooth powder	3(1.6%)	2(1.1%)	
Mouth washes	--	--	
Dental floss	--	--	
Any two methods	15(8.0%)	25(13.3%)	
More than two methods	--	1(0.5%)	
<b>Frequency of cleaning teeth</b>			
Twice a day	60(31.9%)	94(50%)	0.003
Once a day	110(58.5%)	84(44.7%)	
Once a week	4(2.1%)	1(0.5%)	
Occasional	14(7.4%)	9(4.8%)	
<b>Diet</b>			
Vegetarian	64(34.0%)	67(35.6%)	0.720
Non-vegetarian	115(61.2%)	109(58.0%)	
No preference	9(4.8%)	12(6.4%)	
<b>Visit to the dentist in the past year</b>			
Yes	55(29.3%)	60(31.9%)	0.576
No	133(70.7%)	128(68.1%)	
<b>No. Of visits to dentist in the past year</b>			
> 5	16(8.5%)	16(8.5%)	0.921
3-5	38(20.2%)	35(18.6%)	
< 3	79(42.0%)	76(40.4%)	
None	55(29.3%)	61(32.4%)	
<b>Tobacco Consumption</b>			
Yes	64(34.0%)	20(10.6%)	<0.001
No	124(66.0%)	168(89.4%)	
<b>Period of tobacco use</b>			
Non-tobacco user	124(66.0%)	168(89.4%)	<0.001
< 10 years	25(13.3%)	15(8.0%)	
10 - 20 years	24(12.8%)	3(1.6%)	
>20 years	15(8.0%)	2(1.1%)	
<b>Type of tobacco used</b>			
Non-tobacco user	124(66.0%)	168(89.4%)	<0.001
Smoking	48(25.5%)	16(8.5%)	
Smokeless tobacco	11(5.9%)	4(2.1%)	
Both	5(2.7%)	0	
<b>Daily Consumption of Tobacco</b>			
Non-tobacco user	124(66.0%)	168(89.4%)	<0.001
High (>10 times)	24(12.8%)	4(2.1%)	
Medium (5 to 10 times)	19(10.1%)	8(4.3%)	
Low (< 5 times)	21(11.2%)	8(4.3%)	
<b>Alcohol Consumption</b>			
Yes	3(1.6%)	0	0.082
No	185(98.4%)	188(100.0%)	

\*Miswak: An herbal teeth cleaning twig made from the *Salvadora persica* tree with well-documented history and reputed for its medicinal benefits.

**Table-3:** Binary Logistic Regression Model.

Variables in the Equation	Adjusted Odds Ratio	95% Confidence Interval Lower	Upper	p Value
Age >35	3.014	1.867	4.867	0.000
<b>Educational Status</b>				
Uneducated	-	-	-	0.033
<10 years of education	0.400	0.183	0.871	0.021
Up to 10 years of education	0.370	0.170	0.805	0.012
Graduate	0.311	0.149	0.647	0.002
>14 years of education	0.336	0.140	0.806	0.015
Tobacco consumption	4.158	2.321	7.448	0.000

37.01±12.077 years and among the controls it was 28.06±9.591 years. Overall, there were 202(54%) males and 174(46%) females. Tooth loss was significantly associated with age >35 years, marital status, level of education and family income ( $p<0.05$ ). The difference was not significant in terms of gender ( $p>0.05$ ) (Table-1).

Frequency of cleaning teeth daily was significantly higher among the cases compared to the controls ( $p<0.05$ ), but when it came to the frequency of brushing, the controls were significantly ( $p<0.05$ ) found to do that twice daily than the cases.

Tobacco consumption, type of tobacco consumed as well as duration and frequency of consumption were significant markers between the two groups ( $p<0.05$  each) (Table-2).

Regression analysis showed that the odds of tooth loss with tobacco use were 4.2 (confidence interval [CI] 95%; 2.4-7.5). The odds of tooth loss were 3 (CI 95%; 1.9-4.9) times more if cases were >35 years of reported age. Similarly, the odds of tooth loss was 2.8 (CI 95%; 1.5-5.5) times more among cases with no schooling. However, the model did not show income to have an effect on tooth loss (Table-3).

## Discussion

Poor dental health is a consequence of unhealthy lifestyle that plays an important role in the quality of life. The study was undertaken to determine the factors influencing tooth loss and to assess the strength of association of these factors with tooth loss among the patients visiting the outpatient dental department of PIMS. It was revealed that tooth loss was associated with increasing age, tobacco consumption and low educational level and low income level.

The results confirmed the findings of earlier studies that increasing age was highly related to tooth loss.<sup>6,35-39</sup> The

findings are in line with the study conducted in Germany that showed an association of tooth loss with increasing age, smoking and male gender.<sup>39</sup> The logical explanation could be a cumulative effect of both tissue degeneration with age and implications of the lifestyle habits a person adopts over the years.

Adequate oral hygiene was found to be protective in our study, a fact proved and revealed in studies conducted earlier.<sup>33</sup> However, low frequency of cleaning causing tooth loss was found to be significant, a finding that supports the results of an earlier study conducted among adult Japanese population that concluded that the risk of tooth loss can reduce with frequent oral hygiene practices.<sup>28,40,41</sup>

In the current study, the number of visits to the dentist in the past year had no significant effect on tooth loss. On the contrary, a study conducted in Sweden revealed that routine attendance had a positive impact on the oral health-related quality of life and tooth loss.<sup>42</sup> Furthermore, there are few studies that showed that tooth loss due to periodontal diseases can be prevented through routine periodontal maintenance and dental care habits.<sup>43-45</sup>

The present study demonstrated that the cases with low income or no source of income at all were significantly found to have tooth loss, which was in line with other studies in the past that have shown that the marginalised populations have more vulnerability for tooth loss.<sup>46,47</sup> A survey conducted by the National Statistical Office, Thailand, studied the associations between social inequality and tooth loss in 2014 and it was concluded that participants with low levels of education and low income were found to retain less than 20 teeth.<sup>48</sup> Similarly, a cross-sectional study conducted in the USA in 2011 concluded that income inequality was related to tooth loss after adjusting for various confounders.<sup>49</sup> A longitudinal population-based study conducted in German population concluded that socio-economic factors like low level of education and low income were associated with tooth loss.<sup>11,47</sup>

Tooth loss was more prevalent among male participants i.e., 59%. This finding is in line with other studies conducted in Pakistan, Kuwait and Brazil, where males were predominantly affected, and smoking was an attributed factor.<sup>17,50,51</sup> However, other studies conducted in Pakistan and Turkey have reported tooth loss more among the females.<sup>37,52</sup>

The educational status has a protective role in the

process of tooth loss in all age groups and in both genders. Higher levels of education have been related to a decrease in the number of tooth loss previously.<sup>53,54</sup> Education predominantly seems to have a positive impact on tooth retention as demonstrated in a study conducted among the Turkish elderly. It showed that increased levels of education led to an increased number of remaining teeth.<sup>37</sup> Similar findings from studies conducted among the elderly in the United States concluded that increased education decreased the number of missing teeth.<sup>18</sup> A study conducted in Germany showed that participants with nine years or less of education had a 3.7 fold increased risk of tooth loss compared with participants having done their graduation.<sup>6</sup>

The current study supports the results of studies conducted in the past that have demonstrated tobacco consumption and increased duration to be a significant risk factor for tooth loss.<sup>15,19,20,25,27,44,55-58</sup>

The finding that higher tobacco consumption showed a higher chance of tooth loss is in line with the findings of studies conducted in India<sup>19</sup> and Brazil.<sup>20</sup> However, this was not the case in a recent study conducted in India, which did not show any association between smoking and tooth loss.<sup>59</sup>

The duration of tobacco consumption also had a significant effect on increased chances of tooth loss, which is in line with a study conducted in Sweden which showed that prevalence of the smoking rate was directly related to periodontal disease.<sup>24</sup>

Furthermore, higher the frequency of tobacco consumption, the higher the chances of tooth loss were consistent with a study conducted in USA that showed that tooth loss was associated with increased rate of smoking.<sup>15,18</sup>

Smokeless tobacco was also shown to increase the chances of tooth loss. Similar results found in the studies conducted in India and Cameroon where individuals consuming both forms of tobacco suffered not only from tooth loss but were more prone to oral cancers that are of high public health concern.<sup>10,19,60</sup>

The limitations of the current study include potential recall bias by the subjects, regarding the history of various habits and the exact reason for their past visits to the dentist and may have reported them even if not for the routine check-up or periodontal maintenance reasons.

By improving the educational status and focus on

changing the lifestyle behaviours and social practices of the communities, the burden of oral and dental diseases and thereby economic losses can be reduced to a greater extent. Healthy teeth contribute to the better physical appearance of the individuals that can lead to better psychological and mental health for which further studies can be designed and conducted.

## Conclusion

There was a negative consequence of tobacco use on oral health as it increased the vulnerability of tooth loss. Better educational status had a protective effect. Strategies focussing on dental education and increased awareness regarding prevention of smoking and highlighting its impact on oral health will reduce the prevalence of tooth loss.

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