Current status of periodontitis and its association with tobacco use among adult population of Sunsari district, Nepal

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Abstract

Background: Tobacco products are considered significant but preventable factors related to initiation and progression of periodontal diseases. We assessed the prevalence of periodontitis and evaluated its association with tobacco use and other factors among the adult population of eastern Nepal.

Methods: A community-based cross-sectional study was conducted in the rural municipalities in the province one of eastern Nepal. A total of 440 individuals were interviewed with a set of a standardized pre-tested semi-structured questionnaire. Data on social demographics, adverse oral habits followed by periodontal clinical examination were recorded. Prevalence of periodontitis was assessed by a case definition given by CDC-AAP. Univariate and multivariate logistic regression analysis was used to measure the association between tobacco use and other factors with periodontitis.

Results: The overall prevalence of periodontitis was found to be 71.6%. Majority (85.4%) of tobacco users had periodontitis and they were significantly associated with the disease and its severity. The study identified age groups, 45 – 65 years (AOR=7.58, 95% CI, 3.93-14.61), plaque index (AOR=1.01, 95% CI, 1.00-1.02), smoking (AOR=3.14, 95% CI, 1.36-7.27), khaini users (smokeless tobacco, AOR=2.27, 95% CI, 1.12-4.61) and teeth loss (AOR=2.02, 95% CI, 1.21-3.38) as the significant factors associated with periodontitis.

Conclusion: The prevalence of periodontitis is high in the surveyed rural adult population. Along with age, plaque, teeth loss and smoking, smokeless tobacco in the form of khaini are identified as significant factors contributing to periodontitis.

Background

Periodontal disease result from disruption in the host microbial interaction and is one of major causes of tooth loss [1]. Overall, this disease affects about 20-50% of the global population [2] and its severe form ranks sixth among the most prevalent disorders [3]. Although dental plaque-associated microorganism is the primary etiologic agent, several other factors such as genetic, systemic, immunological, environmental and behavioral factors play an important role in determining the susceptibility of individuals to periodontal diseases [4,5].

Among the environmental factors, tobacco smoking is considered one of the true risk factors and is independently related to periodontal destruction [6]. The common forms of tobacco smoking are cigarette, beedi, chutta and hooka, with cigarettes being the main product smoked [7]. More than seven thousand toxins are present in tobacco smoke [8] which includes carcinogens and addictive psycho-active substances like nicotine which are detrimental to general health and is a major public health concern [9]. In addition, the use of smokeless tobacco (SLT) as an alternative tobacco product for cigarette smoking is gradually becoming popular. An estimated 346 million people in the world use SLT products and the prevalence of use is relatively high in Southeast Asian region accounting for nearly 86 per cent of the global users [10].

SLT is consumed un-burnt and exists in numerous forms across the globe with various applications. The most common products available in the US are the form of chewing and snuff (moist and dry) and in Sweden its snus [11]. In South East Asian countries, most commonly available and used SLT products is “khaini” (powdered tobacco/leaves and slaked lime paste) that is placed in mouth for use or held between the gum and cheeks for variable time intervals. Other products that are ingested through the oral tissues, chewed or swallowed [12] are betel quid with or without tobacco, zarda (boiled tobacco leaves with water and slaked lime) and gutkha (areca nut with added tobacco, slaked lime and catechu) [11,13]. Unlike tobacco smoke that is a risk for overall periodontitis, reports suggest greater clinical attachment loss only near the area where the smokeless tobacco products are placed in the mouth [14]. However, conclusion vary when the loss of interproximal bone is discussed. Few studies corroborate the association between SLT use and bone loss [15] but it is not in agreement with others [14,16]. SLT use and generalized periodontitis is also, a debatable issue as the use is not necessarily associated with overall periodontitis.

Early evidence has given an indication that the Nepalese population is highly susceptible to periodontitis and other oral health related problems [17]. Subsequently, the rising burden of the cost of dental services and lack of proper oral hygiene practices contributes to the poor oral health status in Nepal. In addition, habits of smoke as well as smokeless tobacco use are common and prevalent in Nepal [18]. Hence, identification of socio-demographic factors, habits and disease prevalence becomes crucial to take action and implement oral health promotion interventions in rural and urban areas. The aims of this study are therefore, to assess the prevalence of periodontitis and to evaluate its association with tobacco use and other factors among the adult population of eastern Nepal.

Methods

A cross-sectional study was carried from duration from April 2018 to July 2019. This study was approved by the institutional review committee of BPKIHS, Dharan (IRC/0959/017). The principles of the Declaration of Helsinki were followed during this study. Written consent was obtained from each participant after explaining the objectives of the study. Study population were inhabitants from the rural area of Sunsari district in the eastern region of Nepal. Sunsari district includes a total of twelve both rural and urban municipalities. Dental health camps were organized by department of public health dentistry in different wards of six rural municipalities (Koshi, Gadhi, Barju, Bhokraha, Harinagara, Dewanganj). One ward of every six rural municipality was selected via lottery method. The total eligible population of these wards was approximately 16120 (percentage of the population above 20 years old and below 65 years old) [19]. Approximately 1578 inhabitants, who attended the dental health camps were registered in the camp register list and two out of every seven registered individuals were selected in a random manner and examined (Fig. 1: flow chart of the study population). Among them a total of 440 individuals who met the inclusion criteria were interviewed and enrolled in the study.

Criteria for selection: Inclusion Criteria: Patients between 20 and 65 years old, tobacco users as an individual who was currently consuming tobacco in the form of smoke or smokeless tobacco, non-

tobacco users as an individual who had never used tobacco in the form of smoke or smokeless tobacco, patient who consented for clinical examination and answered the comprehensive questionnaire**.** Exclusion Criteria: Former smokers, patients who consumes alcohol, patients suffering from known systemic illness, pregnant and lactating females.

Method of data collection: A set of standardized pre-tested semi- structured questionnaire were applied to all the selected individuals. Face-to-face interviews on basic information and social demographics were recorded. Age was categorized as “20–34”, “35–44”, “45–65” years. Body mass index (BMI) was calculated as body weight (kg) divided by height (m^2). Socio-economic status (SES) was assessed and categorized into upper, lower middle and lower class [20]. Direct questions were asked to the participants regarding the use of tobacco. Current smokers were defined as subjects smoking more than five cigarettes per day for the past 2 years or more, subjects consuming smokeless tobacco on a daily basis for the past 2 years or more [21]. The SLT users were dichotomized as individuals who consumed khaini and those who chewed SLT (gutkha, betel quid with tobacco, zarda). Intraorally, plaque index (PLI) was recorded as the presence or absence of visible plaque [22]. Bleeding point index (BPI) was used to examine for the presence and absence of bleeding on probing [23]. Simplified Oral Hygiene Index (OHI-S) was recorded according to Greene and Vermillion, 1964 [24]. A periodontal probe, UNC-15 (University of North Carolina-15, Hu-Friedy, Chicago, IL) was used for all periodontal recordings. To avoid inter-observer variation, a single experienced periodontist (K.G) examined all subjects and a dental hygienist was trained by the researcher to fill the questionnaire form. The kappa statistics was used to assess the intra-examiner reliability among the forty-four individuals who were not enrolled in the study. The kappa value for single examiner was 0.8 for that showed good agreement between two examinations. The estimation of periodontal disease in this study was based on the case- definition given by CDC–AAP and updated by Eke, Page [25]. No periodontitis was defined as no evidence of mild, moderate, or severe periodontitis, mild periodontitis as ≥2 interproximal sites with attachment loss (AL) ≥3 mm, and ≥2 interproximal sites with PD ≥4 mm (not on same tooth) or one site with PD ≥5 mm, moderate periodontitis as ≥2 interproximal sites with AL ≥4 mm (not on same tooth), or ≥2 interproximal sites with PD ≥5 mm (not on same tooth) and severe periodontitis as ≥2 interproximal sites with AL ≥6 mm (not on same tooth) and ≥1 interproximal site with PD ≥5 mm. Probing depth (PD) was measured to the nearest millimeter as the distance from the gingival margin to the bottom of the periodontal sulcus/pocket (cut-offs at ≥4 mm and ≥5mm). Clinical attachment level (CAL) was computed from the cemento-enamel junction (CEJ) to the base of pocket/sulcus (cut-offs at ≥3mm, ≥4 and ≥ 6mm). Presence of caries was examined with a dental explorer, teeth loss and the reason for each tooth loss as self-reported by the individuals were recorded.

Statistical Analysis: Descriptive statistics, mean, standard deviation, percentage and frequency were calculated for all the variables along with tabular presentation were made. Univariate and forward conditional method for multivariate logistic regression analysis was done to find out the crude and adjusted odds ratio at 95% CI for the association between tobacco use and other factors with periodontitis. Level of significance was set at $p<0.05$. Those variables that fell under $p<0.2$ at univariate

analysis, were considered for multivariate logistic regression. Collected data were entered into Microsoft Excel 2007 and converted into the statistical software package SPSS 11.5 (SPSS, Chicago, IL, USA) for further analysis.

Results

A total of 440 participants with the mean (SD) age of 43.80 (13.17) with 42.3% males and 57.7% females were examined in the study. Periodontitis was found to be present in 71.6% of the surveyed population. The average BMI of individuals was 24.18±2.74 with the mean PLI score (min-max) as 67.82±21.83 (10-100) and median BPI with IQR (min-max) score of 43 (23-65) (5-100). The 57 individuals who had lost their teeth due to periodontal disease (TLPD), all had some form of periodontitis in their remaining teeth with 57.9% having severe, 33.3% moderate and 8.8% having a mild form of periodontitis. Dental caries was present in 63% of the individuals. Nearly one in every two individual aged 21–65 years were found to be using some form of tobacco. The distribution of selected variables is mentioned in table 1.

Table 2 shows the prevalence of periodontitis based on severity and its association according to age. Mild, moderate and severe periodontitis was present in 32.7%, 35.6% and 31.7% respectively in the surveyed population. The severity of periodontitis increased with increasing age. The PD ≥ 4 mm were present in 181 (57.5%) sites and ≥ 5 mm in 111 (35.2%) sites amongst the periodontitis patients. A total of 26.3% of the population were affected with deep PD in 35-44 years age group that increased to 43.6% in 45-65 years age group.

Table 3: The overall consumption of tobacco products in our study reported was 46.6%. Tobacco users were significantly associated with periodontitis and its severity ($p<0.001$). Among tobacco users, mild, moderate and severe periodontitis was present in 20.0%, 35.4% and 44.6% respectively.

Table 4 illustrates the factors such as gender, BMI, BPI and OHI-S that were significant at univariate analysis lost significance at multivariate analysis. Significant factors associated with periodontitis in the study population were age, PLI, missing teeth, smokers and khaini users. Periodontitis increased with increasing age. Older age groups had an odd of 7.58 times increased risk of having the disease when compared with the young group. Individuals with mean plaque score percentage of 72% had an odd of 1.01 times for periodontitis. Individuals consuming tobacco showed a significant strength of association with periodontitis, as smoking and khaini users showing odds of 3.14 and 2.27 times respectively. The prevalence data should also correlate with tooth mortality and patients who had teeth loss had an odd of 2.02 for periodontitis and showed significant strength of association with the disease. Males had 2.49 times odds of developing periodontitis than females despite being less in frequency, however no gender differences were observed for periodontitis at multivariable analysis. Similarly, individuals with poor oral hygiene had 6.24 times odds of developing periodontitis but it failed to show significant effect at the multivariable level. The socio-economic status and brushing frequency showed no significant association with the disease. Participants who chewed SLT has higher chance of occurrence of periodontitis than non-chewer. However, the association was not statistically significant.

Discussion

Periodontal diseases are one of the two most prevalent dental disease worldwide. It has been concluded that subjects with Asian ethnicity have the third-highest prevalence of periodontitis [26]. The overall prevalence of periodontitis in this study was found to be 71.6%. The general trend observed was for a higher loss of attachment than probing pocket depths. Tobacco habits, brushing frequency and technique could have contributed to an increase in attachment loss. In countries like the United States and Europe, the prevalence rates reported were 47% to 76% in an age range of 30-74 years [27,28]. Shaju J et al in 2011 in an Indian population reported a prevalence of 89.6% to 79.9% in the age group of 12-74 years [29]. In the middle age population of south-east Asian countries such as India, Nepal, and Vietnam, reported nearly one- third to half the population were affected with periodontitis [30]. A direct comparison of prevalence rates may not be made as the case definition used differs in most studies and therefore, heterogenicity in the results are observed. Despite this, periodontitis is still prevalent with no gender differentials observed in the studied population. Important factors responsible could be poor oral hygiene with high plaque score along with tobacco consumption rather than gender, geography or economic status.

Periodontitis is a multifactorial disease with various factors affecting it that may be modifiable or non-modifiable [31]. Factors associated with periodontitis do not necessarily imply the cause and effect relation, but identifying them may have a significant impact on prevention, treatment, and progression of the disease [32]. This study showed a significant strength of association between periodontitis and tobacco users (smokers, khaini users), along with age, teeth loss and high plaque score as significant factors associated to periodontitis. The results of our study are in agreement to study done by Bhat et al in 2018 that concluded a high prevalence of periodontitis, with sociodemographic factors, plaque, and tobacco as the main risk indicators to periodontitis [33]. Age has been described as a non-modifiable predisposing factor, and there is ample epidemiological evidence suggesting progressive worsening of periodontal status with increasing age [34,35]. In this study an increasing age was a significant risk to periodontitis and the study adds to evidence that the disease tends to cumulate for life [36]. The number of lost teeth in adults has also been used as a marker of periodontitis in epidemiologic literature. This study showed that patient’s with teeth loss had an odd of 2.02 for periodontitis. The reasons for tooth loss may be high plaque score, loss of attachment, dental caries and widespread tobacco use in the population. The results are in agreement with the studies that refer to the combination of age, modifiable factors such as smoking, smokeless tobacco as the strongest predictor of tooth loss [37,38,39]. Both factors, high plaque score levels and tobacco consumption are preventable and can be modified. Plaque is considered the primary etiological factor for periodontitis, [40,41] and it’s also noted that controlling it may form the basis for management of periodontitis. In this study, over 90% of the population answered that they use toothbrushes for cleaning their teeth at least one time in frequency. However, the population assessed had a significantly high plaque score percentage. This signifies the need for proper brushing techniques and oral hygiene awareness programmes to be reinforced at community level.

This study is one of the few cross-sectional survey conducted to document the impact of smoking and smokeless tobacco in alternative forms on the periodontium in a rural adult Nepalese population. In the present study, an association between tobacco consumption and periodontitis was established, supporting previous research data [42,43]. The prevalence of tobacco smoking was 20.7% in our study and the results are in accordance with the STEPS survey done in 2012-13 in the Nepalese population [44]. The influence of tobacco smoking has been studied extensively and has been implicated as one of the important risk factors to periodontitis This study also showed that smokers to have a significant impact and had an odd of 3.14 for periodontitis, comparable to results with the global population [45,46,47,48]. However, tobacco smoking has been on the decline [49] and the rate of SLT users has surpassed to that of tobacco smoke. The reason may be an increase in cigarette taxation and smoke-free policies implemented at a vast scale. Another strong reason may be the perception that SLT use is relatively safer than cigarette smoking and may be an alternate to tobacco consumption [50]. This is a question to be raised as a staggering 83.5% of population using SLT in both the forms had periodontitis and were two times more likely to have the disease than non-users. The results are in agreement with the studies that have reported an odds ratio of 2.1 in a US study [15] and 1.7 in an Indian population [47]. In the current study, 66.4% of individuals consumed khaini, also known as surti in the local language followed by 33.6 % individuals who were SLT chewers. Nepal STEPS survey reveals khaini (77.6%) to be the most common SLT product used followed by chewing tobacco [51]. The results of this study are in agreement to a hospital-based study done in India by Katuri et al in 2016 [52] which showed the most commonly used SLT product as khaini (51.3%) and concluded SLT users to have greater attachment loss. Study done by Kulkarni et al [21] and Kathiriya et al [53] in 2016 reported gutkha followed by khaini to be the most commonly used, and identified SLT to have similar impact on periodontium as tobacco smoke. Research in other South-East Asian populations reports a strong association between chewing quid with tobacco and periodontal diseases [54], however, the current study fails to show a significant association with SLT chewers. The reason may be SLT chewers either spitted the products after chewing or swallowed them. In many countries in South East Asia, including India and Nepal, over 90% of SLT users use tobacco as the main constituent or often betel quid, slaked lime, catechu is added to tobacco [55]. Therefore, nicotine exposure may be supposed to exert its wide range of effects on the periodontal tissues. Traditional khaini and zarda available in south east Asian countries are supposed to contain the highest levels of carcinogenic substances. In addition, the product available also have high pH and nicotine content that may facilitate rapid absorption of chemicals through oral mucosa making the population more susceptible to periodontitis [11]. Therefore, differences in the effects of SLT products in relation to periodontium exists across the globe and, the results should be interpreted based on population studied. However, it would be fair to predict that due to pervasive use of SLT, periodontitis will be higher than projected and this study indicates that SLT users to have similar impact as smokers on the periodontium. Based on the evidence and result of the current study, oral hygiene awareness programmes and tobacco cessation policies emphasizing in all alternative forms should be targeted during comprehensive oral health community-level preventive programmes.

The limitations of the study include that only those individuals were examined who attended the dental health camps and thus, it may not represent the true population status. Also, there were serious constraints in terms of resources, lack of experts and time as single-day health camps were organized in different wards. Therefore, further studies in a large number of populations, in the community are needed to validate the impact of different forms of tobacco products on the periodontium.

Conclusion

Almost three-quarters of the adult rural population had some form of periodontitis. The reason can be attributed to factors such as high plaque scores and socially ingrained tobacco consuming habit. Tobacco cessation should be given a high priority during planning and management of comprehensive tobacco control programmes.

List Of Abbreviations

AOR: Adjusted odds ratio

BMI: Body mass index

BPI: Bleeding point index

COR: Crudes odds ratio

CAL: Clinical attachment level

CDC-AAP: Center for disease control-American academy of periodontology

CEJ: Cemento-enamel junction

NS: Not significant

OHI-S: Simplified oral hygiene index

PD: Probing depth

PLI: Plaque index

SES: Socio-economic status

SD: Standard deviation

SLT: Smokeless tobacco

TLPD: Tooth loss due to periodontal disease

UNC-15: University of North Carolina-15

Declarations

Ethics approval and consent to participate: This study was approved by the institutional review committee of BPKIHS, Dharan (IRC/0959/017). Written consent was obtained from each participant after explaining the objectives of the study.

Consent for publication: Not applicable

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Contributions: The principal author designed the study, collected the data, and drafted the manuscript. The second author critically revised the data and approved the final manuscript. The third author gave an intellectual input and approved the statistical analysis. The fourth author gave the statistical input and organized the dental health camps.

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Tables

Table 1: Characteristics of study population (n=440). **Column percentage*

Variables	Subcategory	Frequency (%)*
Age groups	20 – 34	110 (25.0)
	35 – 44	124 (28.2)
	45 – 65	206 (46.8)
Gender	Females	254 (57.7)
	Males	186 (42.3)
SES	Upper class	16 (3.6)
	Lower middle	166 (37.7)
	Lower	258 (58.6)
Brushing frequency	≤ once/day	312 (70.9)
	≥ twice/day	128 (29.1)
Tobacco users	Yes	205 (46.6)
	No	234 (53.2)
Smoking status	Current smokers/Bidi smokers	91 (20.7)
	Non smokers	349 (79.3)
Smokeless tobacco (SLT)	Users	152 (34.5)
	Non users	288 (65.5)
	Khaini users	101 (66.4)
	SLT chewers	51 (33.6)
OHI-S	Good	67 (15.2)
	Fair	202 (45.9)
	Poor	171 (38.9)
Teeth loss	Present	218 (49.5)
Reason for teeth loss	Caries	115 (52.7)
	Periodontitis	57 (26.1)
	Others	46 (21.1)
Periodontitis	Present	315 (71.6)
	Absent	125 (28.4)

Table 2: Distribution of periodontitis and its severity according to age (CDC-AAP case definition) [25]

Periodontitis	Age groups (%)			Total	p value
	20 – 34	35 – 44	45 – 65		
Present	47 (42.7)	80 (64.5)	188 (91.3)	315 (71.6)	<0.001
Absent	63 (57.3)	44 (35.5)	18 (8.7)	125 (28.4)	
Total	110 (100)	124 (100)	206 (100)	440 (100)	
Severity of periodontitis					
Mild	38 (80.9)	23 (28.8)	42 (22.3)	103 (32.7)	<0.001
Moderate	6 (12.8)	45 (56.2)	61 (32.4)	112 (35.6)	
Severe	3 (6.4)	12 (15.0)	85 (45.2)	100 (31.7)	
Total	47 (100)	80 (100)	188 (100)	315(100)	

Table 3: Association of periodontitis and its severity among the tobacco users

Periodontitis	Tobacco users (%)	Non-tobacco users (%)	Total (%)	p value
Present	175 (85.4)	140 (59.6)	315 (71.6)	<0.001
Absent	30 (14.6)	95 (40.4)	125 (28.4)	
Total	205 (100)	235 (100)	440 (100)	
Severity of periodontitis				
Mild	35 (20.0)	68 (48.6)	103 (32.7)	<0.001
Moderate	62 (35.4)	50 (35.7)	112 (35.6)	
Severe	78 (44.6)	22 (15.7)	100 (31.7)	
Total	175 (100)	140 (100)	315 (100)	

Table 4: Univariate and multivariate logistic regression analysis between tobacco use and other factors with periodontitis

	Periodontitis present	COR#	p value	AOR	95%CI(L-U)	p value
Age groups						
20 – 35	47 (42.7%)	Constant		Constant		
35 – 44	80 (64.5%)	2.43	<0.001	1.98	1.12-3.49	<0.018
45 – 65	188 (91.3%)	14.00		7.58	3.93-14.61	<0.001
Gender						
Female	163 (64.2%)	Constant		Constant		
Male	152 (81.7%)	2.49	<0.001	1.37	0.75-2.48	NS
SES						
Upper	14 (87.5%)	3.08	0.363			
Lower middle	122 (73.5%)	1.22		-		
Lower	179 (69.4%)	Constant				
Brushing frequency						
≤once/day	229 (73.4%)	Constant	0.190	Constant		
≥ twice/day	86 (67.2%)	1.34		1.19	0.68-2.06	NS
OHI-S						
Good	34 (50.7%)	Constant	<0.001	Constant		
Fair	133 (65.8%)	1.87		1.01	0.50-2.01	NS
Poor	148 (86.5%)	6.24		1.86	0.77-4.51	NS
Missing teeth						
Absent	134 (60.4%)	Constant	<0.000	Constant		
Present	181 (83.0%)	3.21		2.02	1.21-3.38	0.007
Smoking Status						
Absent	232 (66.5%)	Constant	<0.001	Constant		
Present	83 (91.2%)	5.23		3.14	1.36-7.27	0.007
Khaini						
Absent	226 (66.7%)	Constant	<0.001	Constant		
Present	89 (88.1%)	3.70		2.27	1.12-4.61	0.023
SLT chewers						

Absent	277 (71.2%)	Constant			-	
Present	38 (74.5%)	1.18	0.623			
BMI	24.6 + 2.6	1.23	<0.001	1.07	0.96-1.19	NS
PLI	71.9+ 20.2	1.03	<0.001	1.01	1.00-1.02	0.004
BPI	49.7 + 24.4	1.02	<0.001	1.00	0.99-1.02	NS

#Crude odds ratio

Adjusted odds ratio

Figures

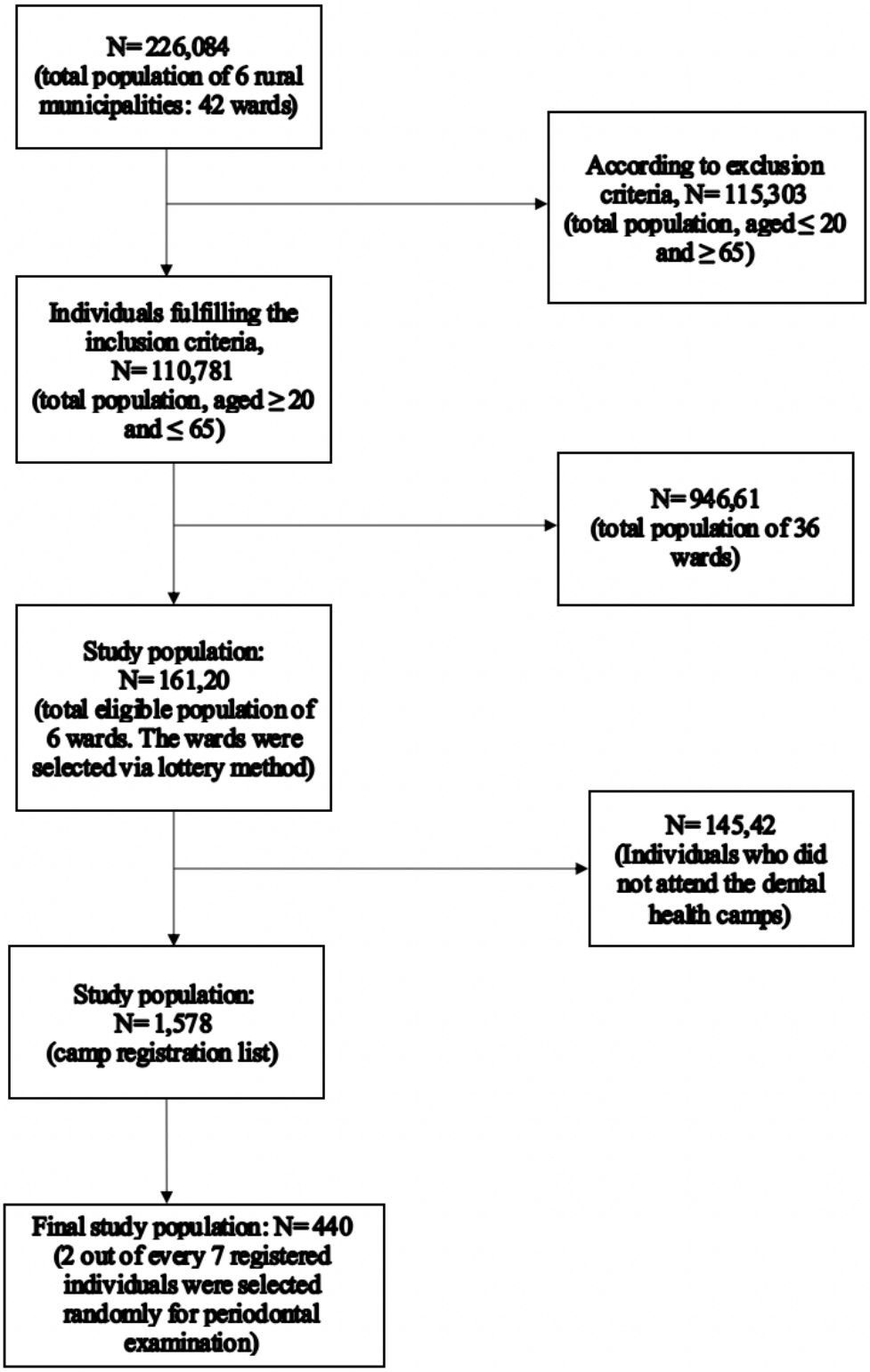

Figure 1

Flow chart of the study population.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- BMCexcel.xml
- sample.xls