PREVALENCE OF ROOT CARIES AND ASSOCIATED FACTORS AMONG ELDERLY POPULATION VISITING A DENTAL TEACHING HOSPITAL IN KATHMANDU, NEPAL

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ABSTRACT

Among the oral ailments which are observed by dental practitioners in elderly, root caries is a significant one. It has been reported that about a third of older population bears most of the root caries burden. Root surface caries is one of the significant oral health problems in the elderly, and the incidence of root surface caries has been found to be one of the major risk factors for tooth loss. Limited studies have been carried out on root caries in elderly patients in context of Nepal. Hence, the objective of this study was to find the prevalence of root caries and its associated factors among the elderly population. This observational cross sectional study was done on 188 adult patients of 60 years and above. A specifically designed questionnaire was used to collect the following information: socio-demographic characteristics, use of medication, oral hygiene practices and oral health behaviour. Data were analyzed using Chi square test and descriptive statistics were calculated. It was found that the prevalence of root caries was 61.7% and it increased with age. There was an association between root caries and socioeconomic status which showed root caries was seen more in adults of upper middle class. More of root caries was seen in females, those who were unmarried, taking medications and non vegetarians. Oral hygiene habits and oral health behaviour had a positive impact on root caries. More of root caries was seen on buccal surface of molars.

KEYWORDS

Elderly, root caries, tooth loss

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INTRODUCTION

The global population aged 60 years or over had numbered to 962 million in 2017, more than twice as large as in 1980 when there were 382 million older people worldwide. The number of older people is expected to double again by 2050, then it is projected to reach nearly 2.1 billion. Two thirds of the world's older population live in the developing regions, where their numbers are growing faster than in the developed regions. In 2050, it is expected that nearly 8 in 10 of the world's older population will be living in the developing regions.[1] The government of Nepal has declared people 60 years or more as elderly citizens. In Nepal, the growth rate of the elderly population is faster than that of the total population.[2] Improvements in oral health, along with the increase in life expectancy ensure that many individuals will retain more teeth during the later stages of life.[3]

Among the oral ailments which are observed by dental practitioners in elderly, root caries is a significant one. Tooth loss is a chief oral health-related negative variable to the quality of life in elderly and root caries is the major cause of tooth loss among them.[4] It has been reported that about a third of older population bear's most of the root caries burden.[5] Root surface caries is one of the significant oral health problems in the elderly, and the incidence of root surface caries has been found to be one of the major risk factors for tooth loss in elderly.[6]

Hazen *et al*[5] defined root caries as 'a soft, irregular progressive lesion that is found anywhere on the root surface that has lost connective tissue attachment and is exposed to the oral environment.' In recent years with increasing oral health awareness and advanced treatment modalities, more people retain their natural teeth into old age. With the increasing old age, there is a susceptibility to periodontal problems, leading to gingival recession and root surfaces getting exposed to oral environment making them vulnerable to root caries.[7]

Presence of cariogenic biofilm and fermentable carbohydrates is one of the etiologic factors of root caries.[8] The process of demineralization is similar to coronal caries but is twice as rapid on root surfaces then on enamel as root cementum contains less mineral content (65.0%) compared to enamel (96.0%).[9] Also, unlike coronal caries, root caries is associated with demineralization as well as collagen destruction.[10] Like coronal caries, unfavorable balance on the remineralization would lead to demineralization of root surface. Root caries is alarming because it is rapidly progressive, often asymptomatic, closer to the pulp, and is more difficult to restore.[11] In a systematic review conducted by Ritter *et al*[12] on the risk models of root caries risk indicators identified that the prevalence of root caries at baseline, number of retained teeth and plaque index are more frequent indicators.

Numerous factors can cause the initiation of development of root carious lesions like advanced age, medications, comorbidity like xerostomia, lifestyle factors like tobacco and alcohol consumption, frequency of carbohydrate consumption, low fluoride exposure, proximity to dentures, limited manual dexterity for plaque control.[13]

There is an increase in the prevalence of root caries in males, patients in the older age group (>60 years) and in the rural population. A relationship between dietary habits and oral hygiene practices and the development of root caries was also found to exist.[14] Higher level of educational attainment is also seen to be associated with lower experience of root caries.[15]

Limited studies have been carried out on root caries in elderly patients in context of Nepal. Joshi *et al*[16] has stated that a high prevalence of root caries has been observed among older adults in Nepal. Hence, the objective of this study was to find the prevalence of root caries and its associated factors among elderly population.

MATERIALS AND METHODS

This observational cross-sectional study was performed in the Department of Conservative Dentistry and Endodontics at Nepal Medical College Teaching Hospital, Kathmandu, Nepal from March 2022 - August 2022, after receiving ethical approval from Nepal Medical College Institutional Review Committee (Ref: 058-078/079). The patients were informed about the study and written consent was taken from patients who were willing to participate in the study. The sample size was calculated by using the formula, $n = (Z^2pq)/d^2 + (Z^2pq)/N$. Hence, a sample size of 188 was taken. Adults who were above 60 years of age and willing to answer the questionnaire and give consent were included in the study. Those who were edentulous, uncooperative and not willing to answer the questionnaire were excluded from the study.

The intraoral examination was carried out by three examiners under light source from the dental unit using mouth mirror and explorer.

Presence of root caries was recorded in a full mouth design, including the third molars.[3]

Root surface caries was identified using criteria described by Banting *et al.*[17] The identification of root caries was done following the criteria given below for categorizing it into present or absent: (1) a discrete well-defined and discolored soft area, (2) an explorer enters easily and displays some resistance and (3) the lesion is located either in the cement-enamel junction or on the root surface. Root surface caries was recorded on exposed buccal/labial and palatal/lingual, mesial/distal aspects of the roots of each tooth. Root caries was dichotomized into root caries present and root caries absent.

Personal interviews using a structured and validated questionnaire was conducted to collect the following information: socio-demographic characteristics, use of medication, oral hygiene practices and oral health behaviour.[3] A modified Kuppuswamy's Socioeconomic Status Scale in the Context of Nepal, 2019 was used for classifying the individuals into socio-economic categories.[18]

RESULTS

The data was be entered in Microsoft Excel version 2013. Data was exported and analyzed using SPSS-16. Descriptive statistics were calculated in the form of frequency, percentage, mean and standard deviation. Chi-square test

Table 1: Socio-demographic characterstics of the study participants

Variables		n (%)
Gender	Male	105 (55.9)
	Female	83 (44.1)
Age group (years)	60-70	131 (69.7)
	71-80	47 (25.0)
	>80	10 (5.3)
Marital status	Married	182 (96.8)
	Unmarried	6 (3.2)
Socio economic status	Upper middle class	29 (15.4)
	Lower middle class	94 (50.0)
	Upper lower class	59 (31.4)
	Lower class	6 (3.2)
Total		**188 (100.0)**

Table 2: Association of root caries with socio-demographic characterstics

Characteristics		Root caries		p-value
		Present n (%)	Absent n (%)	
Gender	Male	61 (58.1)	44 (41.9)	0.253
	Female	55 (66.3)	28 (33.7)	
Age group	60-70	76 (58.0)	55 (42.0)	0.105
	71-80	31 (66.0)	16 (34.0)	
	>80	9 (90.0)	1 (10.0)	
Marital status	Married	112 (61.5)	70 (38.5)	>0.99
	Unmarried	4 (66.7)	2 (33.3)	
Socio-economic status	Upper middle class	23 (79.3)	6 (20.7)	0.002*
	Lower middle class	64 (68.1)	30 (31.9)	
	Upper lower class	25 (42.4)	34 (57.6)	
	Lower class	4 (66.7)	2 (33.3)	

Chi square test, p-value<0.05 statistically significant There was a statistically significant association between root caries and socio-economic status (p-value 0.002).

Table 3: Association of root caries with diet and medication

Characteristics		Root caries		p-value
		Present n (%)	Absent n (%)	
Diet	Vegetarian	31 (59.6)	21 (40.4)	0.716
	Non-vegetarian	85 (62.5)	51 (37.5)	
Medication	Yes	80 (66.1)	41 (33.9)	0.094
	No	36 (53.7)	31 (46.3)	

Chi square test, p-value<0.05 statistically significant

Table 4: Association of root caries with oral hygiene habits				
Characteristics		**Root caries**		**p-value**
		Present n (%)	**Absent n (%)**	
Material used for brushing	Toothbrush	115 (61.5)	72 (38.5)	NA
	Fingers	1 (100.0)	-	
Method of cleaning	Horizontal	97 (59.9)	65 (40.1)	0.330
	Vertical	16 (76.2)	5 (23.8)	
	Circular	3 (60.0)	2 (40.0)	
Frequency of brushing	Once	68 (66.0)	35 (34.0)	0.314
	Twice	46 (56.1)	36 (43.9)	
	Thrice	2 (66.7)	1 (33.3)	
Mouth rinsing	Never	12 (75.0)	4 (25.0)	0.519
	Always	89 (60.5)	58 (39.5)	
	Sometimes	15 (60.0)	10 (40.0)	
Tongue cleaning	Yes	53 (55.2)	43 (44.8)	0.061
	No	63 (68.5)	29 (31.5)	

Chi square test, p-value<0.05 statistically significant , NA: Not applicable

Table 5: Association of root caries with oral health behavior				
Characteristics		**Root caries**		**p-value**
		Present n (%)	**Absent n (%)**	
Smoking status	Yes	19 (73.1)	7 (26.9)	0.199
	No	97 (59.9)	65 (40.1)	
Betel nut chewing	Yes	9 (69.2)	4 (30.8)	0.769
	No	107 (61.1)	68 (38.9)	
Alcohol consumption	Yes	17 (63.0)	10 (37.0)	0.884
	No	99 (61.5)	62 (38.5)	

was used to find the association of root caries with sociodemographic factors, oral hygiene habits and oral health behavior. Level of significance was set at p-value <0.05.

A total of 188 elderly patients had participated in this study. The majority of the participants were males (55.9%), of 60-70 years age group (69.7%), married (96.8%) and lower middle class (50.0%). The age of the patients ranged from 60 to 90 years with mean age 67.96±6.73 years (Table 1).

Amongst the total study participants, 116 (61.7%) had root caries. They had root caries in 296 teeth of which majority of the teeth (40.5%) were molars (Fig. 1).

According to gender root caries was seen more in female participants (66.3%) than male participants (58.1%). It was seen that root caries increased with age 81-90 years (90.0%) followed by 71-80 (66.0%) and 60-70 (58.0%). The results were statistically significant for socioeconomic status with a p value of 0.002% (Table 2) which showed more root caries in upper middle class.

In the association of root caries with diet and medication. More root caries was seen in non vegetarians (62.5%) compared to vegetarians (59.6%) and was seen more in those who were taking medication (66.1%) than those who were not (53.7%). But the result was not statistically significant (Table 3).

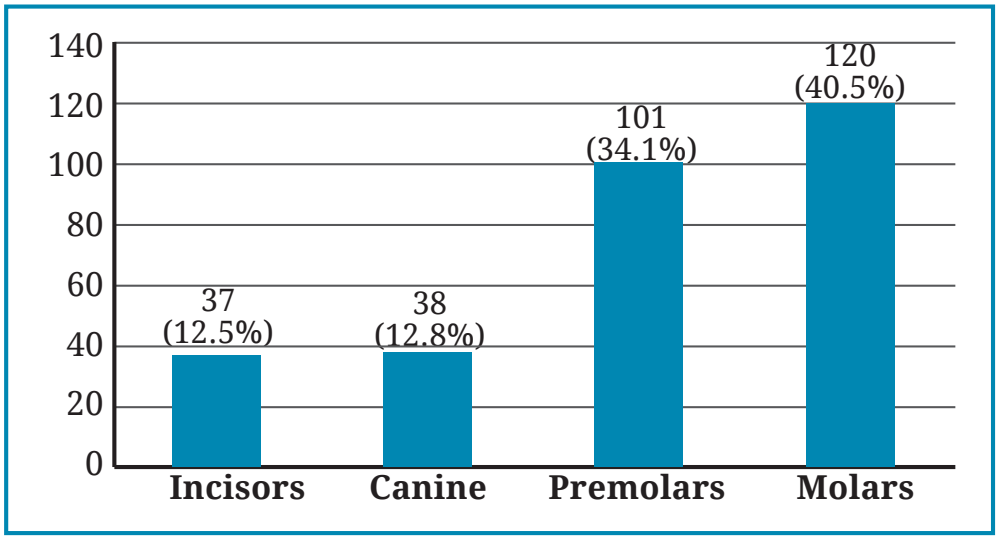

Fig. 1: Distribution of teeth with root caries

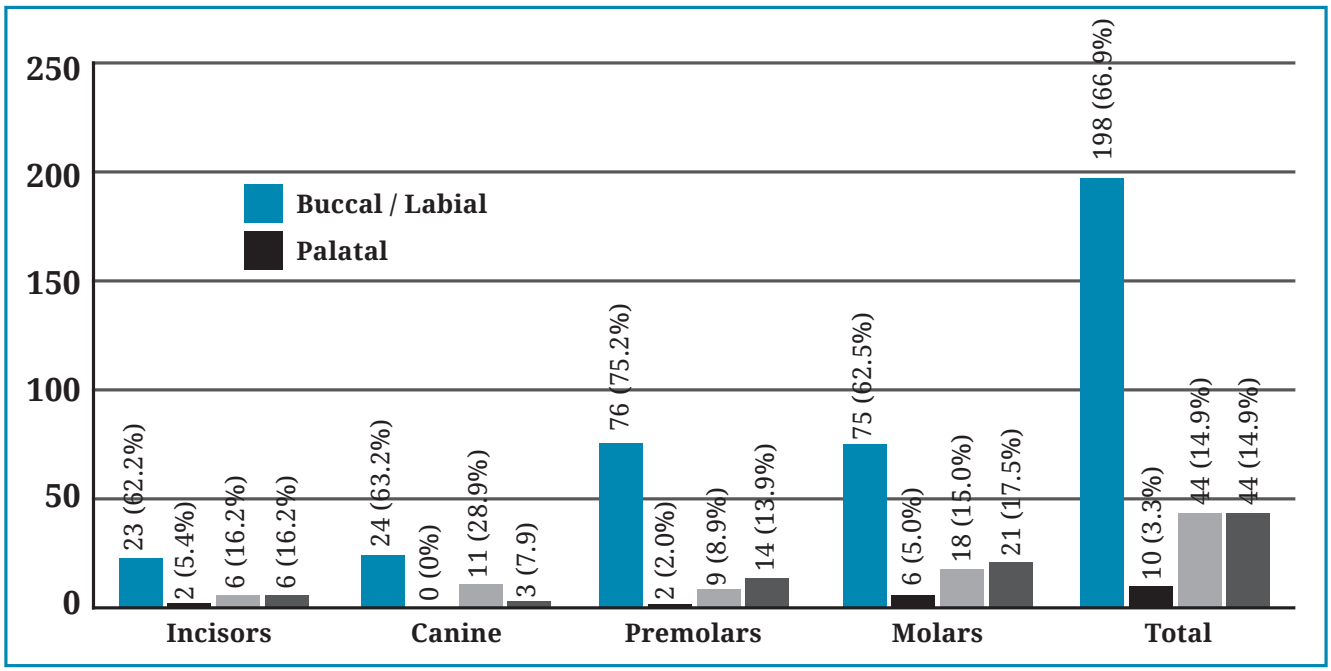

Fig. 2: The surface involved with root caries

In our study comparing the association of root caries and oral hygiene habits. The results were not applicable for the materials used for tooth brushing. Root caries was seen more in those who used vertical method of tooth cleaning (76.2%) followed by circular (60.0%) then horizontal (59.9%) method. It was present more in those who brushed their teeth thrice a day (66.7%) than those who brushed once (66.0%) and twice a day (56.1%). Participants who never rinsed their mouth (75.0%) had higher root caries followed by those who always rinsed their mouth (60.5%) and who sometimes rinsed their mouth (60.0%). It was seen more in those who didn't clean their tongue (68.5%) than those who did (55.2%) (Table 4).

For association of root caries and oral health behavior. Root caries was seen more in participant who had a habit of smoking (73.1%), betel nut chewing (69.2%), alcohol consumption (63.0%) in those who did'nt have these habits (Table 5).

More of root caries was seen in molars (40.5%) followed by premolars (34.1%), canines (12.8%) and incisors (12.5%). The surface most involved was buccal/ labial in all teeth, incisors (63.2%), canines (63.2%), premolars (75.2%) and molars (62.5%) (Fig. 2).

DISCUSSION

Root surface caries is one of the significant oral health problem in the elderly and the incidence of the root caries has been found to be one of the main risk factors for tooth loss in the older adults.[19] In our study, the prevalence of root caries was 60.7%. The prevalence was consistent with a study done in India by Hegde *et al*[14] with a prevalence of 56.76%. Whereas in studies done in Srilanka by Kulratne *et al*[20] and in India by Agrawal *et al*[19] reported a high prevalence of root caries which was 90% and 93.5%. In a study done by Joshi *et al*[16] in Nepal the prevalence of root caries was 25.88% taken from an age group of 35 years and above which was lower than our study. This can be due to a decrease in age group than in our study. We found root caries prevalence increased with advancing age. Similar results have been seen in studies done by Bharteesh *et al*[6] from India and Du *et al*[21] from China.

It was seen that those who were married had a less prevalence of root caries when compared to those who were unmarried. It has been considered that living alone seems to have an influence on the disease. It is known that elders who live with a partner have better overall health status than those living alone or with no partner.[15]

Females had more root caries than males. This was consistent with a study done on Brazilian population in which females had more root caries than males.[22] This result was in contrast to a study in which males had more root caries than females.[14] This difference may be due to several factors such as oral hygiene practices, diet, general health and individual's awareness and consciousness regarding dental health.

In our study, there was an association between root caries and socioeconomic status, p value was >0.05 which was statistically significant. It was seen that upper middle class had more root caries. This was in contrast to a study done in India by Kumara-Raja *et al*.[3] While in a study done by Shah *et al*.[25] A higher percentage of elderly in middle and low socio-economic classes had caries-free teeth in comparison with high socio-economic class which is supporting our study.

Medications that are prescribed to the elderly in fact can cause impaired salivary flow with no change in the immune system.[23] Many medications, chemotherapy, radiation treatments, and some diseases can decrease salivary gland function and therefore make caries and other oral diseases more likely to occur. Some common drugs that may cause dry mouth are high blood pressure drugs, cholesterol lowering drugs, pain medications, muscle relaxants, allergy, and asthma medications.[24] Hence, more root caries was seen in participants who were taking medications than those who weren't.

Root caries prevalence was found to be higher in non-vegetarians in comparison with vegetarian elderly. This result is similar to a study conducted by Shah *et al*.[25] Whereas in a study conducted by Hegde *et al*,[14] pescatarians presented with fewer root caries compared to vegetarians and other nonvegetarians as fish is rich in fluoride and proteins that are responsible for reducing caries.

It was seen that less root caries was seen in those who brushed twice a day. Similar results were seen in studies done by Erbil *et al*[26] and Hayes *et al*[27] which showed increased frequency of brushing reduced root caries.

In our study mouth rinsing and tongue cleaning had a positive impact on root caries. Those who had a habit of mouth rinsing and tongue cleaning had less root caries than those who didn't have this habit. In a study done by Kumara-Raja *et al*,[3] it was seen that more of root caries was seen in those who had a habit of mouth rinsing than those who didn't have this habit.

More root caries was seen in those who had a habit of smoking, consuming betelnut and who consumed alcohol. This finding is in agreement with results of study done in USA which showed that in addition to its established role as a carcinogen, chewing tobacco may be a risk factor in development of root-surface caries.[28] A ten year cross sectional study done in an elderly group of Swedish individuals showed that the daily number of cigarettes consumed and root caries incidence had a Positive correlation.[29] It was found that the use of smokeless tobacco increased the prevalence of gingival recession with associated attachment loss, cervical abrasion and root caries.[30]

Various studies have shown a positive correlation between tobacco and dental caries, one of the main reasons seems to be the presence of high amount of various sugars and sweeteners added during the commercial manufacture of smokeless tobacco products, the same may be for smoking tobacco since many cigarette manufacturers use sugar as a flavoring, casing and humectants to enhance the taste and make it less harsh on the throat.[31,32] But in a study done Talib *et al*[11] it was seen that

prevalence of root caries was more in non-smokers than in smokers.

It was seen that more of alcohol consumption increases root caries. However, in a cross-sectional study done on workers showed that there was no significant association between alcohol consumption and root caries.[33]

This study showed that molar teeth were more susceptible to root caries. Molars were observed to be the most susceptible to root caries most likely because they are the first teeth to erupt and longer be exposed to the oral environment.[14] Similar results were seen in studies conducted on Brazilian and Indian population.[14,22] Du *et al*[21] confirmed that premolars and molars are most susceptible to root caries.

Majority of root caries was seen on the buccal surface in our study. The population in Pomerania showed a very similar intraoral distribution of root caries. This may be due to high rate of recession in these teeth.[34]

In conclusion, the results of our study show that root caries increases with age. More of root caries was seen in females, those who were unmarried, taking medications, non vegetarians. There is an association between root caries and socioeconomic status. Oral hygiene habits had a positive impact on root caries. Participants who brushed their teeth more than once a day, had a habit of mouth rinsing, tongue cleaning had less root caries. Similarly, oral health behaviour also had an influence on root caries. Those who smoked, had a habit of tobacco chewing and alcohol consumption had increase in root caries. More of root caries was seen on the buccal surface of molars. We can see that root caries has a multifactorial cause. Hence, the older individuals should be informed and made aware about the possible risk factors of root caries.

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