



Association Of Hypertension With Tooth Loss Among Middle And Older Aged Indian Population

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Abstract

Background-Increasing longevity is a trend in developed and developing countries around the globe. In public health, this multifaceted dynamics considered a challenge to society, must be understood in a holistic way. Hypertension is recognized as one of the leading challenge for society and risk factor for chronic diseases. Apart from well-established causes of hypertension, markers of oral inflammation, such as periodontal diseases and tooth loss are found to be independently associated with hypertension in the previous literature. However, this opined was inconclusive.

Objective-To find association of hypertension and toothloss in middle and old aged population.

Methodology-A cross-sectional study conducted among adults aged above 40 years reported to the Outpatient Department of the Kothiwal Dental College and Research Centre Moradabad. The study procedure included face to face interview using prestructured questionnaire which included demographic characteristics (age, sex, education, marital status, area of residence), socioeconomic status, health-related behaviour, periodontal status. Hypertension and diabetes were recorded as reported by the participants.

Results- Hypertension was found associated with partial tooth loss on crude comparison.24% of participants with hypertension had partial toothloss, but after adjusting confounding variables there was no statistical significant association between hypertension and partial tooth loss(OR 0.260; 95%CI:0.081-2.101) with p-value =0.722.

Conclusion-Hypertension was higher among the participants with partial tooth loss. But there was not found independent association between hypertension and tooth loss.

Keywords: Hypertension; Tooth loss

Introduction

Increasing longevity is a trend in developed and developing countries around the globe [1]. This phenomenon has influenced several aspects that modify the social, political, economic and biomedical dynamic [2]. In public health, this multifaceted dynamics considered a challenge to society, must be understood in a holistic way [3]. Hypertension is recognized as the leading risk factor for chronic diseases [4]. It is considered as a modifiable risk factor for life threatening conditions such as coronary

artery disease, heart failure, cerebrovascular disease, and chronic renal failure [5]. Apart from the well-established causes of hypertension, markers of oral inflammation, such as periodontal diseases and tooth loss are independently associated with hypertension [6-10]. Evidence from cohort studies of older people and cross-sectional studies confirm an association between periodontal diseases or tooth loss and hypertension [11,12,6,13,14]. A direct relationship between levels of subgingival periodontal bacteria and both systolic and diastolic blood pressure, as well

as hypertension have been reported [15]. Volzke et al. 2006 study showed an inverse association between number of teeth, and hypertension among men but not in women [16].

During the aging process, the cumulative nature of commonly reported oral diseases (dental caries and periodontitis) can promote a significant pattern of severity that culminates in tooth loss [6]. Extensive tooth loss is responsible for physiological and psychosocial complications that are considered a public health problem. This issue can be more critical in individuals of disadvantaged countries and those who suffer from chronic conditions [6].

The well-established risk factors for blood pressure, such as obesity, lack of physical activity, smoking, low income, low education level, studies have suggested that they are also markers of oral inflammation, such as periodontal diseases and tooth loss [17]. However, most of the studies have focussed on older population and fewer studies have targeted the middle aged population. A study in South African population reported that the complete edentulousness is a risk indicator for hypertension [6]. However, the relevant literature is not conclusive about the association. Furthermore, there is a need for further studies to be done on middle aged population to strengthen the evidence for association between hypertension and tooth loss. Hence, the aim of the current study was to assess the association of hypertension and tooth loss among middle aged and elderly Indian population.

Methodology

Study Design And Participants

A cross-sectional study was conducted among adults aged above 40 years reported to the Outpatient Department of the Kothiwal Dental College and Research Centre Moradabad. The minimum sample size taken was 300. Non-probability (convenience sampling) was used to select the participants. The study procedure included face to face interview using prestructured questionnaire.

The covariates considered in the study were based on the biological plausibility and the theoretical evidence of their role in the association between hypertension and tooth loss. With reference from the previous studies, we considered demographic characteristics, socioeconomic status, health-related

behavior, periodontal status as the confounding variables.

The questionnaire included were about demographic characteristics (age, sex, education, marital status, area of residence), socioeconomic status (acc. to Kuppuswamy scale 2021) [18], health-related behaviour (type of tobacco use, alcohol intake), periodontal status (acc. to CPI). The number of missing teeth of the participants were counted including the 3rd molar. The questionnaire regarding the hypertension and diabetes were asked and the response was recorded as self reporting by the participants. The reliability of measurement of periodontal status was assessed using 10% of the total sample size. (Kappa statistic = 0.83)

Inclusion Criteria

The present study included participants from both the sexes aged above 40 years and who have completed the questionnaire in the presence of the investigator. The third molar was also included in the study while counting the number of missing teeth.

Exclusion Criteria

The subject who did not give informed consent were excluded from study. The impacted teeth, the decayed teeth, congenital missing teeth were not included in the criteria for the tooth loss in the study.

Ethics

Ethics committee approval was obtained before the commencement of the study from the Institutional Research and Ethics Committee of Kothiwal Dental College and Research Centre, Moradabad (affiliated with Mahatma Jyotiba Phule Rohilkhand University). Information regarding the study was provided to the participants, and the informed verbal consent from each participant was taken in the presence of two witnesses without any competing interests prior to the distribution of the questionnaire, and the completed questionnaire was collected on the same day. It was made very clear to the participants that they had a free choice to decide whether or not to participate. The research was conducted in accordance with the Declaration of Helsinki [19].

Sample size calculation

The sample size calculation was based on the data from a pilot study with 30 participants. For a 95% confidence interval and, significance level $\alpha = 5\%$, P

= 57%, Q = 43%, allowable error = 10, our required sample size was 300, where P is the percentage of hypertensive patients.

Data management and Statistical analysis-

Statistical analyses were done using SPSS version 21 for data entry and data analysis. Descriptive statistics such as frequency, percentage were calculated for categorical variables. Multinomial regression models were constructed with 95% CI and level of significance at 5% to determine any independent association between different covariates and tooth loss.

Result-

A total of 300 participants from the Moradabad participated in the study. Overall 57.6% of participants were found partially edentulous and out of this 24% of participants had been diagnosed with hypertension. The participants who were

hypertensive had more prevalence of partial tooth loss than completely edentulous and dentate population. The crude estimate from the multinomial regression in Model 1 showed that participants with hypertension had an 1.092 times higher odds of having partial tooth loss when compared to participants with no hypertension and this was statistically significant.

After adjusting for other covariates in Model 2, there was no statistical significant association between hypertension and partial tooth loss. However age, gender, smoking, diabetes, periodontal status and socioeconomic status is significantly associated with partial tooth loss after adjustment of confounding variable in multinomial regression. Partial tooth loss was seen 4.613 times higher in the age group 56-75 years than the older one. Also males are found to have 1.017 times higher odds of being partial edentulous than the female.

Prevalence of tooth loss according to sample characteristic-

Characteristics	Categories	No loss of tooth (%)	Some loss of tooth (%)	Edentulous (%)	P-value
Sex	Male	16.50	34.29	6.51	.006
	Female	14.50	24.31	4.89	
Age	41-55yrs	22.61	35.81	2.88	.000
	56-75 yrs	5.91	16.58	4.21	
	75 above	1.88	5.21	4.91	
Education	No schooling	5.82	16.31	4.87	.005
	Primary completed	11.79	18.14	3.07	
	High school completed	9.59	14.21	2.20	
	Graduation and above	3.8	8.94	1.26	
Smoking	Never smoker	26.18	25.31	6.81	.023
	Ever smoker	3.82	30.14	3.04	
	Former smoker	1.01	2.15	1.55	
Alcohol intake	Non- user	24.31	52.13	7.16	.071
	Quit alcohol	0.91	2.31	0.78	
	Current user	5.78	3.16	3.46	

Self reported diabetes	Yes	4.13	16.26	4.21	.030
	No	26.87	41.34	7.19	
Area of residence	Urban	18.87	21.22	6.21	.300
	Rural	12.13	36.38	5.19	
Marital status	Never married	1.08	1.21	0.31	.070
	Married	29.21	53.31	8.48	
	Widowed	0.71	3.08	2.61	
Periodontal status	Generalized gingivitis	15.62	26.31	4.67	.000
	Generalized periodontitis	6.08	29.21	6.31	
	Healthy gingiva	9.3	2.08	0.42	
Socioeconomic status	Upper middle	10.10	6.30	2.20	.003
	Lower middle	19.14	38.04	4.12	
	Upper lower	1.76	13.26	5.08	
Hypertension	Yes	10	24	5.3	.033
	No	21	33.6	6.1	

Table 2: Multinomial regression between hypertension and tooth loss-

	MODEL 1 (CRUDE)		MODEL 2 (Adjusted)	
	OR(95% CI)	P- VALUE	OR(95% CI)	P-VALUE
1. Hypertension				
No	Reference		Reference	
Yes	1.092(1.011-2.312)	.033	0.260(0.081-2.101)	.722
2. Age				
75 above			Reference	
41-55 yrs			4.122(2.181-4.312)	.001
56-75yrs			3.613(2.212-5.432)	.008
3. Education				

Graduation and above			Reference	
No schooling			2.040(.748-3.212)	.695
Primary completed			1.429(.321-2.122)	.221
High school completed			3.674(.672-4.212)	.218
4. Gender				
Female			Reference	
Male			1.017(1.002-2.812)	.016
5. Smoking				
Former smoker			Reference	
Never smoker			1.258(1.002-2.531)	.046
Ever smoker			1.512(1.121-2.912)	.029
6. Alcohol intake				
Current user			Reference	
Non user			1.671(.671-2.171)	.556
Quit alcohol			.588(.432-1.682)	.659
7. Diabetes				
No			Reference	
Yes			2.121(1.082-3.121)	.028
8. Area of residence				
Rural			Reference	
Urban			.653(.212-1.012)	.516
9. Marital status				
Widow			Reference	
Never married			1.212(.321-1.612)	.223
Married			.0571(.0212-1.806)	.325
10. Periodontal				

status				
Healthy gingiva			Reference	
Generalized gingivitis			3.642(1.863-4.523)	.027
Generalized periodontitis			3.812(1.912-4.812)	.022
11. Socioeconomic status				
Upper lower			Reference	
Upper middle			1.410(1.012-3.613)	.043
Lower middle			2.931(2.901-3.101)	.037

Discussion-

The current study assessed the association of hypertension and tooth loss amongst middle aged and older adults in Moradabad. The results showed hypertensive subjects have higher probability of having partial tooth loss. But this association did not remain significant after adjustment of all potential confounders.

In various previous studies, it has been seen that the hypertension is more prevalent in the age group 41-55 yrs old due to more stressful lifestyle of people among these age group. These people have to deal with kids, work, ageing parents and constant pull to stay connected (Cutler et al)[20].

As reported from various studies that hypertension causes renal calcium leak which further leads to overactivity of parathyroid hormone as a compensatory mechanism. This overactivity of PTH in hypertensive people leads to alveolar bone loss and tooth loss. P Strazzullo et al. investigations supported this hypothesis which has been laid down in previous studies[21].

The current study results are not in concordance with the previous studies. This discrepancy might have occurred as most of the hypertensive participants in the study were 41-55 yrs old. Also these people reported that they suffer from hypertension since 2-3 yrs . So their recent/new hypertensive condition might be less responsible for alterations in calcium

metabolism and overactivation of PTH which further did not lead to tooth loss.

C Ozemek et al. reviewed that regular consumption of diet rich in fat content, refined carbohydrates, added sugar and low in vegetables contributes to an increased risk of developing hypertension and cardiovascular disease[22]. As our study population mostly belongs to low socioeconomic status and from agricultural background. These people have a strong adherence to cultural and ethnic practices like food habits. As the most of the population belonged to agricultural group, their food including mostly whole grain cereals and locally available vegetables and fruits which are rich in fibres. Moreover they can't afford and accept the luxurious diet pattern which are more rich with processed sugar and cholesterol. So this might be the reason for lower prevalence of hypertension in study population. As the partially edentulous participants are more prevalent in the current study but still there was found no association between hypertension and partial tooth loss which might be due to role of other confounding factors in the study population.

As most of the current study population has partial tooth loss might be because they opted tooth extraction as the only treatment due to lack of dental services So the participants even with local inflammatory condition like localized periodontitis, pulpal disease might had undergone tooth extraction as they could not afford the quality treatment due to

low socioeconomic status. As Hypertension occurs due to systemic inflammation (Tomiyana et al.) which might not showed any association with local inflammatory condition responsible for partial tooth loss .

There are several studies which stated that chronic periodontal disease leads to tooth loss.(Murthykumar et al. 2020)[24] which further lead to increase of inflammatory reactants, such as C- reactive protein and this act as potential risk factor for hypertension (Lowe et al. 2003) [8]. The current study findings showed hypertensive condition was more in partially edentulous subjects and males are more partially edentulous. Also males are more hypertensive than females as per studies (Cutler et al)[20]. Also the prevalence of partial tooth loss is more in age group between 41-55 years old people and the same age group people were more hypertensive according to previous studies. So it is possible that the all these factors strengthen the possibility that hypertension may act as risk factor for tooth loss.

Our study is also in agreement with the association of education and socioeconomic status with tooth loss even after controlling the confounding variables. So this has been seen from the current study all the risk factors which leads to hypertension evident from the previous studies, found to be associated with tooth loss, but hypertension itself is not associated with it which suggests hypertension may act as risk factor of tooth loss .

Conclusion

In this study, we observed the significant association between hypertension and tooth loss on crude comparison. However, when confounding variables were adjusted, there was no significant association between hypertension and tooth loss. But the confounding variables were significantly associated with tooth loss. This study illustrates that hypertension and tooth loss may not have a causal relationship but the hypertension might act as a risk factor for the tooth loss.

Future scope of the study:

Further Longitudinal and prospective cohort studies are needed to further elucidate the causal association between hypertension and tooth loss.

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