Dr. Prabhati Gupta
Registrar, Department of
Periodontology, Indira Gandhi
Govt. Dental College, Jammu,
India

Dr. Romesh Singh
HOD, Department of
Periodontology, Indira Gandhi
Govt. Dental College, Jammu,
India

Relationship between obesity and Periodontitis: A Cross-sectional study

Dr. Prabhati Gupta and Dr. Romesh Singh

Abstract
Background: Obesity and periodontitis are considered as severe health problems worldwide. The aim of this study was to investigate the relationship between obesity and periodontitis.
Materials and methods: One hundred and forty-one patients aged between 18-63 years, including 65 obese and 76 non-obese subjects were enrolled over a period of 6 months. The information on sociodemographic characteristics and dental habits were collected by a questionnaire. Body mass index and waist circumference were used as measures to assess obesity. Periodontal status of the subjects was recorded.
Results: The prevalence of periodontitis in obese subjects (38.6%) was significantly higher than the non-obese subjects (12.4%). The mean values of periodontal parameters were significantly higher in obese subjects. Multiple logistic regression analysis revealed that age, routine of dental visit and obesity were significantly related to periodontitis.
Conclusion: The prevalence of periodontitis is higher among obese subjects. Obesity could be a potential risk factor for periodontitis in all age groups.

Keywords: Body mass index, obesity, periodontitis, risk factor

1. Introduction
Obesity, one of the most significant health risks of modern society, is considered as a severe health problem worldwide. There is a concern for public health, as excess bodyweight is now the sixth important risk factor contributing to disease worldwide and increased level of obesity may result in a decline in life expectancy in the future [1]. Obesity is a complex and multi-factorial disease resulting from excessive storage of fat, occurs due to the interaction of social, behavioural, cultural, psychological, metabolic, and genetic factors among the population [2] Various health consequences associated with obesity are diabetes mellitus, hypertension, heart disease like coronary artery disease, cerebrovascular disease such as hemorrhagic and ischemic stroke, metabolic syndrome like insulin resistance, some cancers such as cancer of esophagus, thyroid, kidney, uterus, colon and breast, and psychosocial problems [3].
Obesity may be considered as a low-grade systemic inflammatory disease. Obese children and adults have elevated serum levels of C-reactive proteins, interleukin-6, tumor necrosis factor-α and leptin which are known as markers of inflammation and are closely associated with chronic inflammatory diseases [4]. Therefore, these findings indicate rationalized bases for association between obesity and periodontal disease, which is also an inflammatory disease resulting from complex interaction between pathogenic microbes and host immune response [5]. Investigation from the United States, using the large NHANES III database, supported association between body fat and periodontal disease [1].
Although some studies [6-8] have shown an association between obesity and periodontal disease in different populations, there have been only few studies documented in literature, in this part of northern India. Hence, an attempt was made to explore the relationship between obesity and periodontitis among the patients attending the outpatient department of Indira Gandhi Govt. Dental College in Jammu. Additionally this study evaluated the sociodemographic characteristics and dental habits in obese people and their influences on the presence of periodontitis.

Correspondence
Dr. Prabhati Gupta
Registrar, Department of
Periodontology, Indira Gandhi
Govt. Dental College, Jammu,
India

2. Materials and Methods

A cross-sectional study was conducted over a period of six months from July to December 2018 among participants attending Outpatient Department of the department of Periodontology, Indira Gandhi Govt. Dental College in Jammu. The study was approved by the Institutional Review Board and Ethics Committee. A written informed consent was obtained from all participants who fulfilled the inclusion and exclusion criteria after explaining the study protocol. A total of 141 subjects aged between 18-63 years were included in the study. The subjects with a minimum of 20 teeth were included and those with systemic diseases and conditions, past periodontal treatment within 6 months before examination, previous history of antibiotic therapy, physically and mentally challenged and pregnant women and lactating mothers were excluded from the study.

A structured questionnaire was prepared to collect information regarding demographic and sociodemographic data. The variables such as age, gender, level of education, smoking, and alcohol were included as covariates since they were identified as periodontal disease risk factors. All participants answered the questionnaire and underwent biometric measurements for height and weight and clinical measurements for periodontal status. The height of the study participants was measured in centimetres, then converted to meters and weight was measured in kilograms using a mechanical scale. These measurements were recorded by a separate investigator, who was also blinded. Body mass index (BMI) (kg/m^2) was calculated of all the subjects. Obesity was defined as BMI≥27.5 and non-obese as BMI<27.5. This BMI cut-off was based on Asian-specific cut-off values which WHO has suggested as overweight and obesity for Asian populations [9].

Full-mouth periodontal examination was performed for all the participants to assess periodontal index: Plaque index (PlI), pocket depth (PD), clinical attachment level (CAL), bleeding on probing (BOP) and gingival index (GI). PD, CAL and BOP were recorded for all the teeth in mouth except for the third molars at six sites per tooth, using a William's probe (Hu Friedy). PlI and GI were evaluated at four sites per tooth based on Loe and Silness index (1967) [10]. All clinical data were recorded by one well-trained examiner.

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages. The normality assumption was tested by Kolmogorov-Smirnov test. Statistically significant differences between obese and non-obese groups were tested using independent samples t-test, Mann Whitney U-test, Chi-square test or Fisher's exact test. Multivariate regression model was examined by using periodonttitis as dependent variable and socio-demographic characteristic or dental habit variables as independent ones. A P-value of less than 0.05 was considered statistically significant. All P-values were two tailed.

3. Results

3.1 Sociodemographic characteristics of subjects

This study included a total of 141 participants aged between 18 to 63 years with a mean (SD) of 34.2(8.27). According to BMI, there were 65 obese and 76 non-obese subjects. Sociodemographic data for the group including age, education and dental habits are shown in Table 1. There were 8.5% of subjects who were not brushing their teeth daily and 40.4% of the subjects who did not use dental flossing. Obese group had a significantly lower percentage of subjects who had routine of using dental flossing (29.8%) compared with non-obese group (70.2%). The percentages of subjects who had less regular dental visit and professional dental cleaning in obese group were respectively 57.4% and 64.1% respectively. All of these were statistically higher than in non-obese one (42.6% and 35.9% respectively). There was no significant difference in age, educational level and daily tooth brushing habit between the two groups.

Table 1: Socio-demographic characteristics of obese and non-obese groups

Variables		Obese [n=65]		Non-obese [n=76]		P-value
		No.	%age	No.	%age	
Age (years)	≤ 35	34	47.9	37	52.1	0.667
	> 35	31	44.3	39	55.7	
Educational status	≤ High School	29	38.7	46	61.3	0.059
	> High School	36	54.5	30	45.5	
Daily Tooth brushing	Yes	58	45.0	71	55.0	0.374
	No	7	58.3	5	41.7	
Dental flossing	Yes	25	29.8	59	70.2	<0.001*
	No	40	70.2	17	29.8	
Dental visit	Regular	26	35.6	47	64.4	0.009*
	Never/ rarely	39	57.4	29	42.6	
Professional cleaning	< 1 Year	24	31.2	53	68.8	<0.001*
	> 1 Year	41	64.1	23	35.9	

*Statistically Significant (P-value<0.05)

3.2 Periodontal status

There was a significantly higher prevalence of periodontitis (38.6%) in the obese group compared with the non-obese group (12.4%). Table 2 shows the periodontal status of the obese and the non-obese groups. The means of GI, BOP, PD and CAL in obese subjects were significantly higher than those in non-obese subjects ($p<0.01$). However, there was no difference in PlI between the obese and non-obese groups (p=0.361).

Table 2: Periodontal status in the obese and Nonobese groups

Parameters	Obese [n=65]		Nonobese [n=76]		P-value
	Mean	SD	Mean	SD	
Plaque Index	1.27	0.68	1.18	0.45	0.361
Gingival Index	1.19	0.41	0.98	0.37	0.002*
Bleeding on probing (%)	3.97	0.93	6.52	1.08	<0.001*
Pocket depth (mm)	1.73	0.39	1.48	0.35	<0.001*
Clinical attachment level (mm)	1.81	0.49	1.53	0.41	<0.001*

*Statistically Significant (P-value<0.05)

3.3 Multivariate logistic regression for the periodontitis

The multivariate logistic regression model was carried out to assess the association between the occurrence of periodontitis and age, dental visit and obesity with the adjustment of educational level, dental flossing and professional dental cleaning (Table 3). It showed that age, routine of dental visit and obesity were significantly associated with periodontitis ($p<0.05$). The odds ratio for age, dental visit and obesity were 2.78, 5.12 and 4.35 respectively (95% CI).

Table 3: Multivariate logistic regression model for the periodontitis

Variables		No.	OR (95% CI)	P-value
Age (years)	≤ 35	71	1.00	0.027*
	> 35	70	2.78 (0.86-5.83)	
Dental visit	Regular	73	1.00	<0.001*
	Never/rarely	68	5.12 (2.76-9.51)	
Obesity	Nonobese	65	1.00	0.006*
	Obese	76	4.35 (1.75-8.34)	

*Statistically Significant (P-value<0.05)
Adjusted by educational level, dental flossing behavior and professional dental cleaning.

4. Discussion

Findings in a recent 3rd National Health and Nutrition Examination Survey in USA (US NHANES III) suggested that obesity is significantly associated with periodontitis [1, 4]. Currently the mechanism of obesity affecting the periodontium is poorly understood, but it is known that obesity has several harmful biological effects that might be related to pathogenesis of periodontitis. According to current knowledge, the adverse effect of obesity on the periodontium might be mediated through impaired glucose tolerance, dyslipidaemia or through increased levels of various bioactive substances secreted by the adipose tissues [11].

Tumor necrosis factor-α mediates the endotoxin induced injury in various organs and periodontal tissues. Recently, adipose tissue was shown to secrete TNF- α which causes liver injury in obese rodents. Moreover, TNF- α from adipose tissue was reported to be directly associated with insulin resistance [11].

Our study showed that the periodontal status is poorer in obese than in non-obese subjects. Except for PlI, the means of GI, BOP, PD and CAL in obese subjects were significantly higher than in non-obese subjects. Similar results were shown by a study conducted by They Anh Vu Pham *et al*. on Vietnamese subjects [12]. Wood *et al*. reported that PD, CAL and BOP were significantly correlated with waist-hip ratio and BMI based on data from NHAHES III in USA [4].

In this study significantly higher prevalence of periodontitis was observed in obese subjects as compared to non-obese subjects. Similar results were seen by Haffajee and Socransky in their study [13]. The present study suggested that obese people had worse dental habits, including less regular dental flossing, dental visit and professional dental cleaning compared to non-obese ones. Hujoel PP *et al*. in 2006 [14].

observed that the higher the BMI was, the less likely to use dental floss which is similar to the observations made by our study. Anna LO *et al*. in 2012 [15] showed that obese subjects have lower likelihood of regular use of dental health services as compared to the non-obese.

In the present study, irregular dental visit was shown as a risk factor for periodontitis. This result confirms the previous research about the relationship between the utilization of dental care and periodontal status [16]. A possible explanation for this result could be that the people who have regular dental visit have a tendency to be provided adequate prevention to periodontal disease. A number of studies showed different results when evaluating the relationship between obesity and periodontitis after adjusting for other factors such as, sociodemographic factors, routine dental visit or systemic disease [1].

After being adjusted for age, education, dental habits, dental visits and professional cleaning, a significant odds ratio (OR=4.35) was observed for association between periodontitis and obesity. Nishida *et al*. determined that the obesity was the second strongest risk factor after smoking for periodontitis [17].

The majority of studies conducted to observe the association between obesity and periodontitis have been cross-sectional, thus they did not clarify whether obesity is the cause of periodontitis or not. Thus there is need of longitudinal or interventional studies to investigate this association.

5. Conclusion

This study reported the poorer periodontal condition and higher prevalence of periodontitis in obese patients as compared to non-obese ones. Also age, dental visits, dental habits and obesity are potential risk factors of periodontitis. Although the relationship between obesity and periodontitis needs further investigation, periodontist should counsel obese persons regarding the possible oral complications of obesity, to diminish morbidity for these individuals.

6. Acknowledgements: Nil

7. References

1. Al-zaharani MS, Bissada NF, Borawskit EA. Obesity and periodontal disease in young, middle aged and older adults. J Periodontal. 2003; 74:610-5.
2. Moura-Grec PG, Marsicano JA, Carvalho CA, Sales-Peres SH. Obesity and periodontitis: Systematic review and meta-analysis. Cien Saude Colet. 2014; 19:1763-72.
3. Amrutiya MR, Deshpande N. Role of obesity in chronic periodontal disease – A literature review. J Dent Oral Disord. 2016; 2:1012
4. Wood N, Johonson RB, Stereckfus CF. Comparision of body composition and periodontal disease using nutritional assessment technique: Third national health and nutritional examination survey (NHANES III) J Clin Periodontol. 2003; 30:321-7.

5. Kopelman PG. Obesity as a medical problem. Nature. 2000; 404:635-43.
6. Mathur LK, Manohar B, Shankarapillai R, Pandya D. Obesity and periodontitis: A clinical study. J Indian Soc. Periodontol. 2011; 15:240-4.
7. Palle AR, Reddy CM, Shankar BS, Gelli V, Sudhakar J, Reddy KK *et al.* Association between obesity and chronic periodontitis: A cross-sectional study. J Contemp Dent Pract. 2013; 14:168-73.
8. Kumar S, Dagli RJ, Dhanni C, Duraiswamy P. Relationship of body mass index with periodontal health status of green marble mine laborers in Kesariyaji, India. Braz Oral Res. 2009; 23:365-9.
9. WHO. Appropriate body mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004; 363(9403):158-63.
10. Herald L. The gingival index, the plaque index and the retention index systems. J Periodontol. 1967; 38(6):610-6.
11. Saito T, Shimazaki Y, Koga T, Tsuzuki M, Ohshima A. Relationship between upper body obesity and periodontitis. J Dent Res. 2001; 80:1631-6.
12. Pham TAV, Nguyen XNT. Relationship between obesity and periodontal status in Vietnamese patients: A pilot study. Int J experimental Dent Sci. 2015; 4(2):119-23.
13. Haffajee AD, Socransky SS. Relation of body mass index, periodontitis and Tannerella forsythia. J Clin Periodontol. 2009; 36(2):89-9.
14. Hujoel PP, Kressin NR. Spurious associations in oral epidemiological research: the case of dental flossing and obesity. J Clin Periodontol. 2006; 33(8):520-3.
15. Anna LO, Lissner L, Hakeberg M. Oral health and obesity indicators. BMC Oral health 2012; 12(50):324-9.
16. Al-Shammari KF, Al-Khabbaz AK, Al-Ansari JM, Neiva R, Wang HL. Risk indicators for tooth loss due to periodontal disease. J Periodontol. 2005; 76(11):1910-8.
17. Nishida N, Hayashi N, Nagata H, Takeshita T, Nakayama K. Determination of smoking and obesity as periodontitis risks using the classification and regression tree method. J Periodontol. 2005; 76(6):923-8.