



RELATIONSHIP BETWEEN OBESITY AND PERIODONTAL DISEASE: A CROSS-SECTIONAL STUDY

Dental Science

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ABSTRACT

INTRODUCTION: Obesity is characterized by abnormal/excessive deposition of fat in adipose tissue. This might have adverse effects on metabolism resulting in increased production of cytokines and hormones by adipose tissues. The cytokines are involved in the inflammatory processes thus, having pathways similar to periodontal diseases. Thus, a relationship between obesity and periodontal diseases and potential underlying biological mechanisms needs to be established.

OBJECTIVE: To investigate periodontal status and the relationship between obesity and periodontal status in patients who visited the outpatient department of Guru Nanak Institute of Dental Sciences and Research, Kolkata.

METHODOLOGY: A systematic random sample of 203 persons aged between 18 and 70 years were selected. All patients underwent periodontal examination and anthropometric measurements. Body mass index (BMI) was used as a measure of overall fat content. Periodontal examination included oral hygiene index (OHIS), bleeding on probing (BOP), pocket probing depth (PPD), loss of attachment (LOA) and mobility. Significant interactions with age were found and analyses were then stratified by age.

RESULT: The statistical analysis showed significant increase in the prevalence of periodontitis in people with BMI > 25 and significantly lower in people with BMI < 25

CONCLUSION: Periodontal status in obese subjects was poorer than non-obese ones. A significant association between the measure of body fat and periodontal disease has been achieved.

KEYWORDS

Body mass index, obesity, Periodontitis, bleeding on probing

INTRODUCTION:

Periodontitis is a chronic inflammatory disease that affects the supporting structure of the teeth (including, gingiva, cementum, PDL and alveolar bone) resulting from the interaction between pathogenic bacteria and host-immune response.^{1,2} Tissue destruction results in periodontal pocket formation and alveolar bone resorption. Advanced periodontitis is associated with gingival bleeding, mobility, drifting of teeth, suppuration from periodontal pocket and tooth loss.

A number of studies have shown that there are many different systemic risk factors for periodontal disease; these factors include tobacco use, obesity, diabetes, cardiovascular disease, osteoporosis, rheumatoid arthritis, kidney disease, etc.⁵

Obesity is defined by World Health Organization (WHO) as abnormal/excessive fat accumulation that may impair physical health.³ Obesity leads to large amount of adipose tissue leading to secretion of increased amounts of cytokines and hormones, collectively called adipokines, which may in turn affect the periodontal tissues.^{7,8} It also produces increased levels of pro-inflammatory cytokines, such as IL-1 β , TNF- α and IL-6. This in turn affects the host immune response and individuals are more susceptible to bacterial infections.⁴ Thus, onset and progression of periodontal disease are associated with increased level of pro-inflammatory cytokines.

Obesity has a significant association with periodontitis in terms of BMI, waist-to-hip circumference ratio, body fat, and maximum oxygen consumption. The body mass index has always been considered a simple method for analysis of the nutritional status.⁶

A relationship between severity of periodontal disease and obesity will help us to intensively treat the obese patients. Thus, the aim of the study is to investigate a relationship between obesity and periodontal health status in patients.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted over a period of 2 months (Between January- March 2019), including 203 patients, both males and females, who had reported to Guru Nanak Institute of Dental

Sciences and research, Kolkata, after obtaining informed written consent. Ethical clearance was obtained from the institutional review board of GNIDSR, Kolkata.

Inclusion criteria:

- Participants above the age of 18 years
- Participants having >15 natural teeth present in the oral cavity.
- Participants who gave consent were included in the study

Exclusion criteria:

- Patients who have any systemic disease like diabetes mellitus, thyroid diseases, etc and those who have received any periodontal treatment in last 3 months
- Individuals having < 15 natural teeth and those who denied giving the consent were excluded from the study.

Collection of Data:

All patients underwent periodontal examination and anthropometric measurements.

Body mass index (BMI) was used as a measure of overall fat content.

$$\text{BMI} = \text{Weight (kg)} / \text{Height (m}^2\text{)}$$

Patients were then categorized into underweight, normal weight, overweight, or obese based on the WHO criteria of BMI <18, <25, <30, and >30 respectively.

Periodontal examination included oral hygiene index (OHIS), bleeding on probing (BOP), pocket probing depth (PPD), loss of attachment (LOA) and mobility. All these parameters were recorded by a single trained, calibrated examiner with the use of CPITN probe, mouth mirror and under good illumination light.

The data obtained was statistically analysed and relationship was obtained.

STATISTICAL ANALYSIS:

For statistical analysis data were entered into a Microsoft excel

spreadsheet and then analyzed by SPSS (version 24.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. A chi-squared test (χ^2 test) was any statistical hypothesis test wherein the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short for Pearson's chi-squared test. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate. p -value ≤ 0.05 is considered as statistically significant.

RESULT ANALYSIS:

We found that in under weight, 1(100.0%) patient had 31-40 years of age. In normal weight, 3(5.6%) patients had 31-40 years of age, 13(24.1%) patients had 41-50 years of age, 23(42.6%) patients had 51-60 years of age, 12(22.2%) patients had 61-70 years of age and 3(5.6%) patients had 71-80 years of age. In overweight, 8(9.4%) patients had 31-40 years of age, 33(38.8%) patients had 41-50 years of age, 25(29.4%) patients had 51-60 years of age, 18(21.2%) patients had 61-70 years of age and 31 (1.2%) patients had 71-80 years of age. In mild obesity, 3(7.5%) patients had 21-30 years of age, 7(17.5%) patients had 31-40 years of age, 11(27.5%) patients had 41-50 years of age, 11(27.5%) patients had 51-60 years of age, 6(15.0%) patients had 61-70 years of age and 2(5.0%) patients had 71-80 years of age. In moderate obesity, 3(20.0%) patients had 21-30 years of age, 1(6.7%) patients had 31-40 years of age, 5(33.3%) patients had 41-50 years of age, 4(26.7%) patients had 51-60 years of age and 2(13.3%) patients had 61-70 years of age. In severe obesity, 2(25.1%) patients had 31-40 years of age, 2(25.1%) patients had 41-50 years of age, 2(25.1%) patients had 51-60 years of age and 2(25.1%) patients had 61-70 years of age. Association of age in years vs. BMI was statistically significant ($p=0.0087$).

It was found that in under weight, 1(100.0%) patient had male. In normal weight, 17(31.5%) patients had female and 37(68.5%) patients had male. In overweight, 40(47.1%) patients had female and 45(52.9%) patients had male. In mild obesity, 20(50.0%) patients had female and 20(50.0%) patients had male. In moderate obesity, 11(73.3%) patients had female and 4(26.7%) patients had male. In severe obesity, 5(62.5%) patients had female and 3(37.5%) patients had male. Association of sex vs. BMI was statistically significant ($p=0.0490$). Association of mobility vs. BMI was not statistically significant ($p=0.6383$). Association of loss of attachment vs. BMI was not statistically significant ($p=0.1930$).

We found that in under weight, 1(100.0%) patient had poor oral hygiene. In normal weight, 30(55.6%) patients had good oral hygiene, 22(40.7%) patients had fair oral hygiene and 2(3.7%) patients had poor oral hygiene. In overweight, 4(4.7%) patients had good oral hygiene, 36(42.4%) patients had fair oral hygiene and 45(52.9%) patients had poor oral hygiene. In mild obesity, 10(25.0%) patients had fair oral hygiene and 30(75.0%) patients had poor oral hygiene. In moderate obesity, 1(6.7%) patients had good oral hygiene, 5(33.3%) patients had fair oral hygiene and 9(60.0%) patients had poor oral hygiene. In severe obesity, 2(25.0%) patients had fair oral hygiene and 6(75.0%) patients had poor oral hygiene. Association of oral hygiene vs. BMI was statistically significant ($p<0.0001$).

It was found that in under weight, 1(100.0%) patient had bleeding on probing. In normal weight, 12(22.2%) patient had bleeding on probing. In overweight, 75(88.2%) patient had bleeding on probing. In mild obesity, 39(97.5%) patient had bleeding on probing. In moderate obesity, 14(93.3%) patient had bleeding on probing. In severe obesity, 8(100.0%) patient had bleeding on probing. Association of bleeding on probing vs. BMI was statistically significant ($p<0.0001$).

We found that in under weight, 1(100.0%) patient had pocket 1. In normal weight, 40(74.1%) patients had pocket 0 and 14(25.9%)

patients had pocket 1. In overweight, 17(20.0%) patient had pocket 0, 65(76.5%) patients had pocket 1 and 3(3.5%) patients had pocket 2. In mild obesity, 7(17.5%) patient had pocket 0, 29(72.5%) patients had pocket 1 and 4(10.0%) patients had pocket 2. In moderate obesity, 3(20.0%) patients had pocket 0 and 12(80.0%) patients had pocket 1. In severe obesity, 2(25.0%) patient had pocket 0 and 6(75.0%) patients had pocket 1. Association of bleeding on probing vs. BMI was statistically significant ($p<0.0001$).

DISCUSSION

In the present study, BMI classification given by WHO,2000 was considered. In this study it was found that the non-obese group were younger when compared to the obese group, which was significant. The same relationship was found in another study conducted by Anne et al.⁹

There is an evidence that supports the association between obesity and gender predilection.¹⁰ In this study, the association between BMI and gender was statistically significant.

A study conducted by Saito et al. found non-significant association between obesity and attachment loss.¹¹ In the present study, it was found that there is no significant relationship between obesity and attachment loss with p -value 0.1930.

Overweight and obesity as assessed by BMI are evaluated as risk indicators for periodontal disease. (Vichea et al). The periodontal parameters like bleeding on probing was statistically significant with BMI. Mean probing depth was found to be greater among obese participants and was statistically significant with p -value < 0.0001 .

A study conducted by Saito et al.¹² observed significant relationship between oral hygiene index and obesity. A significant relationship was found in this study between oral hygiene and obesity with p value < 0.0001 .

In this study, there was no statistically significant difference among obese and non-obese versus tooth mobility.

CONCLUSION

Obesity is one of the major health concerns in both developed and developing countries. It has been implicated as a significant risk factor for several systemic condition like Diabetes, cardiovascular diseases, hypertension, stroke and osteoarthritis. The results described earlier and related researches indicates that obese individuals may have a potential for periodontal disease. The current study focused on the association of obesity and periodontal diseases. It may be useful for BMI evaluations to be included on a regular basis during general and oral health examinations. Interdisciplinary approaches are beneficial for identifying and treating signs of oral diseases among obese individuals.

LIMITATIONS

One of the limitations of this study is its cross-sectional study design, which is known to hinder the establishment of a definitive cause and effect relationship. To measure obesity, BMI was taken into consideration in our study while several studies used Waist to hip ratio also, which was not considered in this study.

The sample size in this study is comparatively low to generalize the results for a large scale of population.

In the present study, patient's deleterious oral habits were not taken into consideration.

Our study does not address any mechanism of how obesity may have an adverse effect on the periodontium.

Table 1: Association of age in years, sex, mobility and loss of attachment with BMI

		Underweight	Normal Weight	Overweight	Mild Obesity	Moderate Obesity	Severe Obesity	TOTAL	Chi-square value	p-value
Age in Years	21-30	0	0	0	3	3	0	6	44.8440	0.0087
	Row %	0.0	0.0	0.0	50.0	50.0	0.0	100.0		
	Col %	0.0	0.0	0.0	7.5	20.0	0.0	3.0		
31-40		1	3	8	7	1	2	22		
	Row %	4.5	13.6	36.4	31.8	4.5	9.1	100.0		
	Col %	100.0	5.6	9.4	17.5	6.7	25.0	10.8		

	41-50	0	13	33	11	5	2	64		
	Row %	0.0	20.3	51.6	17.2	7.8	3.1	100.0		
	Col %	0.0	24.1	38.8	27.5	33.3	25.0	31.5		
	51-60	0	23	25	11	4	2	65		
	Row %	0.0	35.4	38.5	16.9	6.2	3.1	100.0		
	Col %	0.0	42.6	29.4	27.5	26.7	25.0	32.0		
	61-70	0	12	18	6	2	2	40		
	Row %	0.0	30.0	45.0	15.0	5.0	5.0	100.0		
	Col %	0.0	22.2	21.2	15.0	13.3	25.0	19.7		
	71-80	0	3	1	2	0	0	6		
	Row %	0.0	50.0	16.7	33.3	0.0	0.0	100.0		
	Col %	0.0	5.6	1.2	5.0	0.0	0.0	3.0		
	TOTAL	1	54	85	40	15	8	203		
	Row %	0.5	26.6	41.9	19.7	7.4	3.9	100.0		
	Col %	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
SEX	F	0	17	40	20	11	5	93	11.1225	0.0490
	Row %	0.0	18.3	43.0	21.5	11.8	5.4	100.0		
	Col %	0.0	31.5	47.1	50.0	73.3	62.5	45.8		
	M	1	37	45	20	4	3	110		
	Row %	0.9	33.6	40.9	18.2	3.6	2.7	100.0		
	Col %	100.0	68.5	52.9	50.0	26.7	37.5	54.2		
	TOTAL	1	54	85	40	15	8	203		
	Row %	0.5	26.6	41.9	19.7	7.4	3.9	100.0		
	Col %	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
MOBILITY	NIL	1	24	42	19	10	4	100	3.4015	0.6383
	Row %	1.0	24.0	42.0	19.0	10.0	4.0	100.0		
	Col %	100.0	44.4	49.4	47.5	66.7	50.0	49.3		
	yes	0	30	43	21	5	4	103		
	Row %	0.0	29.1	41.7	20.4	4.9	3.9	100.0		
	Col %	0.0	55.6	50.6	52.5	33.3	50.0	50.7		
	TOTAL	1	54	85	40	15	8	203		
	Row %	0.5	26.6	41.9	19.7	7.4	3.9	100.0		
	Col %	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
Loss Of Attachment	0-3 mm	0	14	27	7	4	1	53	13.5799	0.1930
	Row %	0.0	26.4	50.9	13.2	7.5	1.9	100.0		
	Col %	0.0	25.9	31.8	17.5	26.7	12.5	26.1		
	4-5 mm	1	38	53	29	7	6	134		
	Row %	0.7	28.4	39.6	21.6	5.2	4.5	100.0		
	Col %	100.0	70.4	62.4	72.5	46.7	75.0	66.0		
	6-9 mm	0	2	5	4	4	1	16		
	Row %	0.0	12.5	31.3	25.0	25.0	6.3	100.0		
	Col %	0.0	3.7	5.9	10.0	26.7	12.5	7.9		
	TOTAL	1	54	85	40	15	8	203		
	Row %	0.5	26.6	41.9	19.7	7.4	3.9	100.0		
	Col %	100.0	100.0	100.0	100.0	100.0	100.0	100.0		

Table 2: Association of oral hygiene, bleeding on probing and pocket with BMI

		Underweight	Normal Weight	Overweight	Mild Obesity	Moderate Obesity	Severe Obesity	TOTAL	Chi-square value	p-value
Oral hygiene	Good	0	30	4	0	1	0	35	98.3736	<0.0001
	Row %	0.0	85.7	11.4	0.0	2.9	0.0	100.0		
	Col %	0.0	55.6	4.7	0.0	6.7	0.0	17.2		
	Fair	0	22	36	10	5	2	75		
	Row %	0.0	29.3	48.0	13.3	6.7	2.7	100.0		
	Col %	0.0	40.7	42.4	25.0	33.3	25.0	36.9		
	Poor	1	2	45	30	9	6	93		
	Row %	1.1	2.2	48.4	32.3	9.7	6.5	100.0		
Col %	100.0	3.7	52.9	75.0	60.0	75.0	45.8			
TOTAL	1	54	85	40	15	8	203			
Row %	0.5	26.6	41.9	19.7	7.4	3.9	100.0			
Col %	100.0	100.0	100.0	100.0	100.0	100.0	100.0			
Bleeding on Probing	0	0	42	10	1	1	0	54	100.2326	<0.0001
	Row %	0.0	77.8	18.5	1.9	1.9	0.0	100.0		
	Col %	0.0	77.8	11.8	2.5	6.7	0.0	26.6		
	1	1	12	75	39	14	8	149		
	Row %	0.7	8.1	50.3	26.2	9.4	5.4	100.0		
	Col %	100.0	22.2	88.2	97.5	93.3	100.0	73.4		
TOTAL	1	54	85	40	15	8	203			
Row %	0.5	26.6	41.9	19.7	7.4	3.9	100.0			
Col %	100.0	100.0	100.0	100.0	100.0	100.0	100.0			
Pocket	0	0	40	17	7	3	2	69	58.6809	<0.0001
	Row %	0.0	58.0	24.6	10.1	4.3	2.9	100.0		
	Col %	0.0	74.1	20.0	17.5	20.0	25.0	34.0		

	1	1	14	65	29	12	6	127		
	Row %	0.8	11.0	51.2	22.8	9.4	4.7	100.0		
	Col %	100.0	25.9	76.5	72.5	80.0	75.0	62.6		
	2	0	0	3	4	0	0	7		
	Row %	0.0	0.0	42.9	57.1	0.0	0.0	100.0		
	Col %	0.0	0.0	3.5	10.0	0.0	0.0	3.4		
	TOTAL	1	54	85	40	15	8	203		
	Row %	0.5	26.6	41.9	19.7	7.4	3.9	100.0		
	Col %	100.0	100.0	100.0	100.0	100.0	100.0	100.0		

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