Establishing the association of periodontal disease with obesity and overweight

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Abstract

Background and Objective: According to statistics provided by WHO, in 2014, over 600 million individuals were declared obese. India alone accounts for 20% of the world's obese adults. It has been established that obesity is associated with various other systemic diseases. This study aimed to establish if there existed a similar association between Body Mass Index (BMI) and periodontal disease among the North Indian adult population.

Materials and Method: A cross sectional study was conducted from October - December 2015, recruiting a total of 199 subjects who had been diagnosed with chronic periodontitis and gave no history of systemic illness. The personal details of the subjects including their age, sex, etc. were recorded along with their height (in cm) and weight (in Kg). Body mass index was calculated and subjects were categorized based on the same. Periodontal status was assessed using Russell's Periodontal Index (PI).

Results: A significant difference was seen in the values of BMI and PI, as well as in the BMI categories, among the study participants when categorized by gender. When the subjects were stratified according to 3 age groups: young (18–34), middle aged (35–60) and older adults (60+), a highly significant change was observed in the mean BMI and PI scores between the 3 categories. A weak and statistically insignificant association was found between the subjects' BMI and their respective periodontal status.

Conclusion: Though the literature supports a positive correlation between obesity and periodontal disease incidence and severity, the findings of our study implied the presence of an indistinct link between periodontal disease and body mass index among different variables in the North Indian adult demographic.

Keywords: Body mass index, Periodontal disease, Obesity, North India, Russell's Periodontal Index, Cross-sectional

Introduction

The Glossary of Periodontal Terms defines periodontitis as "the inflammation of the supporting tissues of the teeth, usually a progressively destructive change leading to loss of bone and periodontal ligament."[(1)] Periodontitis is known to be a common cause of tooth loss and is often associated with various systemic diseases such as stroke, heart disease and endocrine disorders. According to the WHO overweight and obesity are defined as "abnormal or excessive fat accumulation that presents a risk to health."[(2)] A basic measure for the presence of obesity is the Body Mass Index that reflects a weight (in kilograms) – to – height (in meters) ratio parameter.[(3)] Individuals with BMI in the range of 25-30 are considered overweight, whereas a BMI of over 30 is categorized as obese.[(3)] Obesity has now been declared as a growing cause for concern with global prevalence doubling over the past 4 decades.

According to statistics provided by the WHO, in 2014, more than 1.9 billion adults were found to be overweight, with over 600 million among them falling under the category of obese persons.[(3)] India alone accounts for approximately 1/5th of the world's obese adults.[(4)] It has been found that obesity is associated with a number of systemic conditions, such as sleep apnoea, diabetes, cardiovascular disease, gastric discomfort, osteoarthritis and certain categories of cancers.[(5,6)] In recent studies, obesity also appears to be an independent risk factor for the development of periodontal disease even after controlling for other risk factors such as age, smoking habits and associated medical conditions.[(7)] Fat cells, which were once considered to have limited function solely in the form of energy stores, are now known to also produce hormones and other substances, many of which are now thought to increase the inflammatory response of the body.[(8)] This may, thus, lead to a weakened immune status, which may in turn cause an increase in predisposition to periodontal disease.

This study aimed to establish the link between BMI and periodontal disease, among the North Indian adult population.

Materials and Method

A cross sectional study was conducted from October - December 2015 in the Department of Periodontics and Implantology, National Dental College and Hospital, Dera Bassi, Punjab, recruiting a total of 199 subjects. The sample was selected through convenience sampling of patients visiting the Department of Periodontics and Implantology during the time period selected, who agreed to participate, had been diagnosed with chronic periodontitis and gave no history of systemic illness. Such a sampling design made for an uneven distribution of subjects in each category.

A standard form was made to be filled out with the personal details of the subject, i.e., name, age, sex, occupation for record purposes. The subjects were categorized by age as young (18–34), middle aged (35–59) and older (60–90) adults.

Weight (in Kg) and height (in cm) of the subjects were recorded. Body mass index (BMI) was calculated using the formula, BMI = $\frac{\text{Weight}}{\text{Height}^2}$ and was further broadly classified as per the WHO criteria.[9] Thus, subjects with BMI values below 18.5 kg/m^2, were classified as 'underweight'. Those with BMI values in the range of 18.5 – 24.99 kg/m^2 were categorized as 'normal', and those with BMI values between 25.0 – 29.99 kg/m^2 were categorized as 'overweight'. Subjects whose BMI values were equal to or exceeded 30.0 kg/m^2 were classified as obese.

The periodontal status was assessed according to Russell's Periodontal Index (PI).[10]

The statistical analysis was done using SPSS 21.0 (Chicago, USA). Descriptive statistics and cross tabulation were done. Comparison of BMI and Periodontal Index score among different demographic variables were made using Chi-Square test and ANOVA.

Results

The study subjects included 64 females, with mean age of 29.64 years, and 135 males, with mean age of 35.6 years. The mean BMI of the male subjects and female subjects was 29.055 and 27.495, respectively, which was found to be statistically significant (P = 0.001). Other demographic variables are shown in Table 1.

A significant difference was observed in the BMI and PI values, as well as in the BMI categories, among the study participants when categorized by gender. (Table 2)

When the subjects were stratified according to 3 age groups: young (18 – 34), middle aged (35 – 60) and older adults (60 +), a highly significant difference was observed in the mean BMI and PI scores between the 3 categories (P = 0.00). (Table 3)

The mean PI scores for the underweight, normal, overweight and obese categories were found to be 2.00, 1.98, 2.09, 2.21, respectively. The difference between the scores for these respective categories was not found to be statistically significant (P value = 0.657). Fig. 1 depicts distribution of BMI categorization and PI Interpretation among study subjects.

Discussion

In this study, the mean BMI and PI scores were observed to increase significantly as age group increased from young (18 – 34 years) to middle age (35 – 60 years) to older (60 +) adult ages. As adults progress towards older adulthood, some amount of weight gain is normal in apparently healthy individuals, and that may contribute to a greater mean BMI among the older adult age groups.[11] A weak correlation was found between the BMI and PI scores among the young and middle aged adult age brackets but this is not statistically significant. The absence of such an association among the older adults is thought to be a result of a variety of other factors taking precedence as part of the ageing process, such as an increasing incidence of systemic diseases that may be more significant risk factors for periodontal disease. According to a similar study held by Al-Zahrani et al to study the relationship between obesity and periodontal disease among young, middle aged and older adults, a link was found between the two factors only among younger individuals.[12]

A possible explanation for this may be that both periodontitis and obesity could be precipitated in young individuals due to poor dietary habits. A diet consisting of a large percentage of simple sugars would cause an increase in the visceral fat accumulation in the body. Such a diet could also cause a much greater plaque accumulation by providing adequate substrate for pathogens to bind to and multiply around. A substantial buildup of plaque would unavoidably cause greater risk for the destruction of the underlying periodontium. Hence, periodontal disease and obesity may be linked by a shared etiology.

The mean PI scores for male and female individuals exhibited a significant difference in the periodontal disease prevalence and severity among the genders in the sample. In addition, the BMI scores among males and females also exhibited significant variation, with over 88% of males having BMI $\geq$ 25, whereas only 75% of female subjects had a BMI $\geq$ 25. These gender differences may be ascribed to treatment bias, lifestyle differences and societal factors.

In other studies done to further understand the significance of a higher body mass index in the prevalence of periodontitis, it was found that higher BMI and excess abdominal fat were associated with a greater risk for developing periodontal disease, greater mean probing depth and greater bone destruction.[13-16]

The basis for this association may lie in the metabolic activities carried out by the excess adipose tissue in the body. As we now know, adipose tissue is a biologically active tissue that carries out a variety of functions, one of which is the production of circulating pro-inflammatory cytokines.[8,17] A rise in the numbers of these substances would cause a more aggressive inflammatory response to the toxins released by orally present pathogens, thus causing a greater severity of tissue destruction resulting in periodontal disease.[18] This argument was further substantiated by a study conducted by Lakkis et al that showed an improved periodontal status and better response to periodontal therapy among subjects whose adiposity had been surgically reduced.[19]

It may also be argued that certain environmental factors may play a significant role in the etiology of obesity as a result of certain neuroendocrine responses to stress.[20,21] Conversely, obesity along with its associated comorbidities, can in turn result in increased psychosocial strain as a result of societal attitudes relating to overweight and obesity. These physical responses to mental distress have further been hypothesized to strongly influence the inflammatory changes in periodontal disease.[22,23]

We appreciate that one of the limitations of this study lies in its cross-sectional format, where changes that have occurred with time in each patient are unable to be brought into consideration. Though the literature supports a positive correlation between obesity and periodontal disease, our study reports the pertinence of an indistinct link between periodontal disease and body mass among different in the North Indian demographic. However, we aim to gather more detailed data to further substantiate the nature and validity of this association while taking into consideration more complex confounding factors.

Table 1: Demographic details of study subjects

Gender	Number	Percent
Male	135	67.8
Female	64	32.3
18 - 34	90	45.2
35 - 60	75	37.6
60 +	32	16.0
Underweight	2	1
Normal	30	15.1
Overweight	94	47.2
Obese	73	36.7
Established Destructive Periodontal Disease	86	43.2
Terminal Disease	113	56.8

Table 2: Distribution of BMI and PI among study participants based on gender

Gender	BMI Categorization				PI Interpretation	
	Underweight	Normal	Overweight	Obese	Established Destructive Periodontal Disease	Terminal Disease
Male	2 (100%)	14 (46.7%)	63 (67%)	56 (76.7%)	55 (40.7%)	80 (59.3%)
Female	0 (0%)	16 (53.3%)	31 (33%)	17 (23.3%)	31 (48.4%)	33 (51.6%)
P Value	<0.05				<0.05	

Table 3: Distribution of BMI and PI among study participants based on age

Age	BMI Categorization				PI Interpretations	
	Underweight	Normal	Overweight	Obese	Established Destructive Periodontal Disease	Terminal Disease
18 – 34	2 (2.2%)	22 (24.4%)	45 (50%)	21 (23.3%)	57 (63.3%)	33 (36.7%)
35 – 60	0 (0%)	7 (9.3%)	38 (50.7%)	30 (40%)	22 (29.3%)	53 (70.7%)
60+	0 (0%)	1 (3.1%)	10 (31.2%)	21 (65.6%)	7 (21.9%)	25 (78.1%)
P Value	<0.001				<0.001	

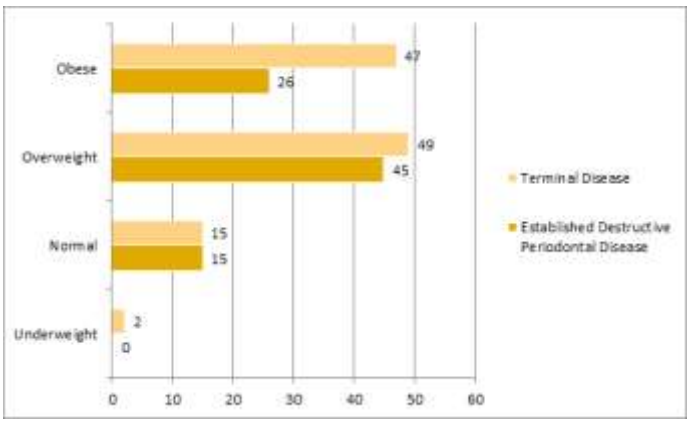

Fig. 1: Relationship of BMI and PI score among study participants

References

1. Newman MG, Takei H, Klokkevold PR, Carranza FA. Carranza's clinical periodontology. 11thed, Philadelphia: Elsevier Health Sciences; 2011.
2. World Health Organization. Obesity [Internet]. Geneva: World Health Organization; [Date Unknown] [Cited 2016 August 30]. Available from: http://www.who.int/topics/obesity/en/.
3. World Health Organization. Obesity and overweight [Internet]. Geneva: World Health Organization; 2014 [Updated 2016 June; Cited 2016 August 30]. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/.
4. India has third-highest number of obese people, reveals study. DNA. Mumbai. [Internet]. 2015 Apr 9. [Cited 2016 Aug 30]. Available from: http:// www.dnaindia.com/health/report-india-has-third-highest-number-of-obese-people-reveals-study-2076131
5. Pi-Sunyer X. The Medical Risks of Obesity. Postgrad Med 2009;121(6):21–33.
6. Burton BT, Foster WR, Hirsch J, Vanltallie TB. Health implications of obesity: NIH consensus development conference. Int J Obes Relat Metab Disord1985;9:155-169.
7. Genco RJ, Borgnakke WS. Risk factors for periodontal disease. Periodontol 2000. 2013;62(1):59-94.
8. Pischon N, Heng N, Bernimoulin JP, Kleber BM, Willich SN, Pischon T. Obesity, inflammation, and periodontal disease. J Dent Res 2007;86(5):400-9.
9. World Health Organization. BMI classification [Internet]. Geneva: World Health Organization; 2006 [Updated 2016 Sep 8; Cited 2016 Aug 30]. Available from: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html
10. Russell AL. The Periodontal Index. J Periodontol 1967;38(6):Suppl585-91.
11. Fukagawa NK, Bandini LG, Young JB. Effect of age on body composition and resting metabolic rate. Am J Physiol 1990;259(2):E233-8.
12. Al-Zahrani MS, Bissada NF, Borawskit EA. Obesity and periodontal disease in young, middle-aged, and older adults. J Periodontol 2003;74(5):610-5.
13. Saito T, Shimazaki Y, Koga T, Tsuzuki M, Ohshima A. Relationship between upper body obesity and periodontitis. J Dent Res 2001;80(7):1631-6.
14. Nishida N, Tanaka M, Hayashi N, Nagata H, Takeshita T, Nakayama K et al. Determination of smoking and obesity as periodontitis risks using the classification and regression tree method. J Periodontol 2005;76(6):923-8.
15. Saito T, Shimazaki Y, Kiyohara Y, Kato I, Kubo M, Iida M et al. Relationship between obesity, glucose tolerance, and periodontal disease in Japanese women: the Hisayama study. J Periodontol Res 2005;40(4):346-53.
16. Alabdulkarim M, Bissada N, Al-Zahrani M, Ficara A, Siegel B. Alveolar bone loss in obese subjects. J Int Acad Periodontol 2005;7(2):34-8.
17. Kern PA, Ranganathan S, Li C, Wood L, Ranganathan G. Adipose tissue tumor necrosis factor and interleukin-6 expression in human obesity and insulin resistance. Am J Physiol Endocrinol Metab 2001;280(5):E745-51.
18. Genco RJ, Grossi SG, Ho A, Nishimura F, Murayama Y. A proposed model linking inflammation to obesity, diabetes, and periodontal infections. J Periodontol 2005;76(11 Suppl):2075-84.
19. Lakkis D, Bissada NF, Saber A, Khaitan L, Palomo L, Narendran S et al. Response to periodontal therapy in patients who had weight loss after bariatric surgery and obese counterparts: a pilot study. J Periodontol 2012;83(6):684-9.
20. Page RC, Schroeder HE. Pathogenesis of inflammatory periodontal disease. A summary of current work. Lab Invest 1976;34(3):235-49.
21. Björntorp P. Do stress reactions cause abdominal obesity and comorbidities? Obes Rev 2001;2(2):73-86.
22. Genco RJ, Ho AW, Grossi SG, Dunford RG, Tedesco LA. Relationship of stress, distress and inadequate coping behaviors to periodontal disease. J Periodontol 1999;70(7):711-23.
23. Da Silva AM, Newman HN, Oakley DA. Psychosocial factors in inflammatory periodontal diseases. A review. J Clin Periodontol 1995;22(7):516-26.