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Association of Alveolar Bone Loss with Obesity: A Comparative Study

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ABSTRACT

Background: Obesity acts as a risk factor for many diseases like diabetes mellitus, hypertension, and ischemic heart disease. Recently, it has been found that obesity is also associated with periodontal disease especially in adults and urban population. **Objective:** The objective of the present study was to assess association between obesity and alveolar bone loss caused by periodontal diseases in urban Pakistani population in 30-40 years age group. **Subjects and Methods:** 100 patients of established periodontal disease were selected based on Community Periodontal Index (CPI). Patients were divided into obese and non-obese groups of 50 each. The criterion for diagnosis obesity was based on body mass index (BMI). The selection of all 100 subjects was done according to exclusion and inclusion criteria which possibly excluded all other factors which might enhance alveolar bone loss except obesity. Then panoramic radiographs of all subjects were taken and alveolar bone loss was measured. Then to rule out the effect of age on alveolar bone loss an age-related alveolar bone score was calculated for all subjects of both; obese and non-obese group. **Results:** In this study there were 43 males and 57 females with the mean age of 35.10$\pm$2.24 and mean alveolar bone score 64.51+8.21. Obese patients had higher Alveolar Bone loss sore than non-obese individuals with an odds ratio of 4.33 (2.43 - 6.57). **Conclusion:** In middle aged patients of periodontal disease belonging to urban Pakistani population obesity as assessed by body mass index (BMI) is associated with increased alveolar bone loss.

Key Words: Alveolar bone loss, Body mass index, Community Periodontal Index of Treatment Needs.

INTRODUCTION

Loss of alveolar bone occurs with age related changes[1] but more significant and premature loss is due to pathological processes like inflammatory conditions[2] malignancy[3] and metabolic disorders.[4]

The prevalence of moderate and severe periodontal disease ranges from 0.82% to 18.3% for adults aged more than 20 years. Periodontal disease is more prevalent among males than females for all age groups (except those whose age is 75 years and older).[5]

Periodontal disease is a major cause of alveolar bone destruction leading to premature tooth loss and is one of the most common dental problem in middle aged population.[6] It is an inflammatory disease of the supporting tissue of the teeth caused by a specific group or groups of microorganisms resulting in progressive destruction of periodontal ligament and alveolar bone.[7]

Chronic inflammation of periodontal disease results from interaction of plaque bacteria and host response.[8,9] The interaction of host and microbiological agent leads to production of a large number of inflammatory mediators like Interleukin-1, tissue necrosis factor-alpha (TNF-alpha), prostaglandin E-2. These mediators play an important role in soft tissue and bone destruction so any systemic condition or disease which leads to enhanced tissue levels of these mediators can augment the periodontal inflammatory process and tissue destruction.[8]

Many factors ranging from emotional stress,

smoking, diabetes mellitus or AIDS affect the periodontal disease. Another recent addition to this list is the obesity which has been reported to increase the loss of alveolar bone, a manifestation of chronic periodontitis.[10] The incidence of obesity is getting so high that it has reached epidemic proportions globally[11] and a similar trend has been observed in adult urban Pakistani population because of changing life style, high-energy diets and declining physical activity.[12] A statistically significant link between alveolar bone loss / periodontal disease and obesity has already been found in Japanese[13,14] North American[15] and Saudian populations.[10] So it is quite relevant to study the link between obesity and alveolar bone loss in Pakistani urban population. Thus in this study the direct relationship between obesity and alveolar bone loss was evaluated.The aim of this study was to assess association between obesity and alveolar bone loss caused by periodontal diseases in urban Pakistani population in 30-40 years age group.

SUBJECTS AND METHODS

Present comparative study was conducted department of Anatomy Federal Postgraduate Medical Institute Lahore in collaboration with Department of Dentistry and Department of Radiology Shaikh Zayed Hospital, Lahore. 100 patients were included from OPD of Dentistry department who had age between 30-40 years and diagnosed to have periodontal disease on Community Periodontal Index (CPI) and were divided into two groups of obese (cases) and non-obese (controls). Criteria for diagnosis of obesity was BMI>30kg/m^2 and non-obese was BMI<25kg/m^2. Patients having diabetes, smokers, alcohol users, having H/O/ fracture because of Osteoporosis or malignancy, having Vitamin D deficiency or autoimmune diseases were excluded or who did not give informed consent were excluded from the study.

Orthopantogram (OPG) Radiographs were taken and were used to assess the degree of alveolar bone loss in both groups. The distance between cementoenamel junction and alveolar bone crest was measured and were recorded to near half millimeters (mm). Alveolar bone score was calculated according to the following formula adjusted for age:

$$\text{AB score} = \frac{\sum (100 - \text{tooth bone level})}{\text{No. of teeth} \times \text{Age}}$$

Statistical analysis

Data was entered and analyzed through SPSS version 13. Mean±SD was calculated for quantitative variables like age and alveolar bone score. Frequency and percentage was calculated for qualitative variables like gender and number of teeth. Odds ratio and 95% confidence limits were calculated through logistic regression analysis to find out the association between alveolar bone loss and obesity. OR > 1 was taken as the contribution of factor (obesity). P-value $\leq$ 0.05 was taken as significant for the association in alveolar bone loss and obesity.

RESULTS

In this study there were 43 males and 57 females with the mean age of 35.10 ± 2.24 years. The mean age of male and female patients was 34.74±2.07 and 35.37±2.34 respectively (p-value = 0.17) and the mean age of obese and non-obese patients was 35.04±2.36 and 35.16±2.14 respectively which is not significantly different (p-value = 0.79) as highlighted in Table 1. The mean alveolar bone score was 64.51±8.21.

The mean alveolar bone score of male and females in this study were similar while there was a major difference between mean alveolar bone score of obese and non-obese patients with much lower score in patients with high BMI that is 58.06±4.49 and better scores for non-obese individuals (70.96±5.59). This difference was highly significant statistically with a *p*-value of < 0.01 (Table 1).

When the patients were divided in two groups based on the mean alveolar bone scores (Table 2) and odds ratio (OR) was computed using logistic regression analysis, it showed that there were more obese patients involved in Alveolar bone score $\leq$ 64 category, with OR= 4.331 with a confidence interval of 2.43 - 6.57, implying that obese individuals have

approximately 4 times more chances of having bone loss as compared to non obese individuals of 30-40 years age group in Pakistan.

Table 1: Characteristics of patients included in the study.

Mean Age of patients	35.10±2.241
Obese	35.04±2.36
Non-obese	35.16±2.14
Male	34.74±2.07
Female	35.37±2.34
Gender:	
Male	43
Female	57
AB score	64.51±8.212
Obese	**58.06±4.49**
Non-obese	**70.96±5.59**
Male	64.09±9.71
Female	64.82±6.95
Number of teeth	**n (%)**
28	5 (5.0%)
29	5 (5.0%)
30	5 (5.0%)
31	28 (28.0%)
32	57 (57.0%)

Table 2: Odds Ratio showing the risk of Alveolar bone loss.

AB score	Obese	Non-obese	Total
≤ 64	48 (90.5%)	12 (25.5%)	60 (60%)
> 64	5 (9.4%)	35 (74.5%)	40 (40%)
Total	53	47	100 (100%)

Odds Ratio = 4.33 (2.43 - 6.57)
p-value = <0.01 (Significant)

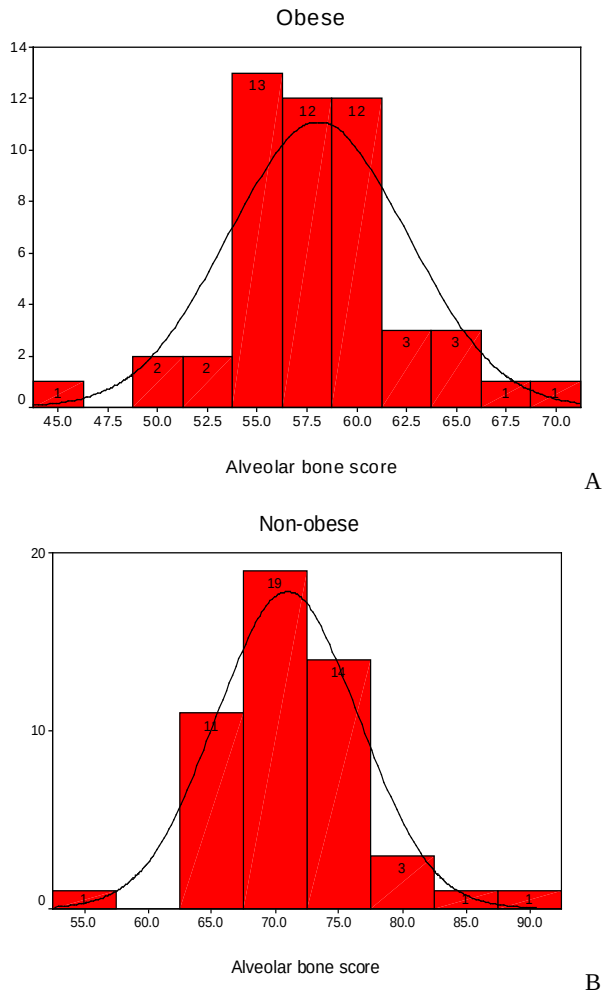

Fig. 2: Graphical presentation of alveolar bone score of obese (A) and non-obese patients (B)

DISCUSSION

There were 100 adult urban Pakistani people were included in the study 50 were obese and 50 were non-obese who presented with periodontal disease in the department of dentistry, Shaikh Zayed Hospital, Lahore. It is also known that alveolar bone loss increases with increasing age therefore to control the effect of age 30-40 year age group was included. Obesity is an intensifying public health problem worldwide. In our study there were 47.4% female and 53.5% males who were obese. A similar trend is observed in Pakistan, 22% men and 37% women are obese in urban areas of Pakistan.[12]

Periodontal disease is a multi-factorial disease with microbial dental plaque as the initiator.[7] Obesity is known to affect host immunity. It has been reported that obese hypertensive rats are more likely to have periodontitis than arc normal rats; the periodontal blood vessels of these rats show intimal thickening, indicating diminished blood flow. Plasminogen activator inhibitor-1 (PAI-1), whose gene expression is enhanced in visceral fat, induces agglutination of blood and raises the risk of ischemic vascular diseases. Therefore PAI-1 may also decrease blood flow in the periodontium of obese subjects to promote the development of periodontitis. Plasminogen-activating system was reported to play an important role in gingival

inflammation.[13]

The criterion for diagnosis of periodontal disease was Community Periodontal Index (CPI). It is a numerical rating scale for classifying the periodontal status of a person or population with a single figure which takes into consideration prevalence as well as severity of the condition. CPI is an epidemiologic tool developed by the World Health Organization (WHO) for the evaluation of periodontal disease in population survey.[6]

The findings of our study are in line with several studies carried out in recent years which have found an association between obesity and an increased incidence of periodontal disease[14]. Among people with periodontal disease, obesity is associated with deep periodontal pockets, alveolar bone loss and body mass index (BMI) is positively correlated with the severity of periodontal attachment loss. Individuals who maintained a normal weight, pursued regular exercise, and consumed a diet in conformity with the Dietary Guidelines for Americans and Food Guide Pyramid recommendations were 40% less likely to have periodontitis. Moreover, obesity significantly contributed to the severity of periodontal disease in an animal model. In Japan, using a ligature-induced periodontitis rodent model, found that alveolar bone resorption was greater in obese compared with non-obese rats.[16] In another study in which data from the third National Health and Nutrition examination Survey USA was analyzed, prevalence of periodontal disease was found to be higher in obese people and it has been found that 76% higher in young obese persons having BMI greater than $30kg/m^2$.[14] A similar trend was observed in another study in which waist circumference was used as a criteria for obesity. The possible reason for more significant relation of periodontal disease with obesity in young people as compared with older subjects could be explained on the basis of dilution of effect of obesity in older subjects as more non-obese people would develop periodontal disease because of aging. In addition, stress associated with obesity in young age can further contribute towards development of chronic disease. In a very recent study which was done in Saudian population obesity was found to be strongly associated with alveolar bone loss, a consequent of periodontal disease which was diagnosed by radiographs (OPG) and it was independent of gender, marital status, employment, number of teeth in individuals of less than 40 years of age.[10] similar was the case in the present study.

CONCLUSION

It may concluded that obese young Pakistani urban population reporting to Sheikh Zayed Medical Complex, Lahore is 4 times at more risk of having alveolar bone loss as compared to non-obese individuals independent of age and gender.

REFERENCES

1. Bryant SR, Zarb GA. Outcomes of implant prosthodontic treatment in older adults. J Can Dent Assoc 2002; 68(2): 97-102.
2. Page RC. Milestones in periodontal research and the remaining critical issues. J Periodont Res 1999;37(7):331-9.
3. Lockart PB, Clark J. Pretherapy dental status of patients with malignant conditions of the head and neck. Oral Surg Oral Med Oral Pathol 1994; 77(3):236-41.
4. Graves DT, Al-Mashat H, Liu R. Evidence that diabetes mellitus aggravates periodontal diseases and modifies the response to an oral pathogen in animal models. Compend Contin Educ Dent 2004;25(7 Suppl 1):38-45.
5. Eke P. 1843 Prevalence of Periodontal Disease in the United States: NHANES 1999-2004. 2007.
6. Pilot T, Miyazaki H. global results: 15 years of CPITN epidemiology. Int Dent J 1994;44(5 Suppl 1):553-60.
7. Preshaw PM, Seymour RA, Heasman PA. Current concepts in periodontal pathogenesis. Dent Update 2004;31(10):570-2,574-8.
8. Kornmann KS, di Giovine FS. Genetic variations in cytokine expression: a risk factor for severity of adult periodontitis. Ann Periodont 1998;3(!):327-38.
9. Fain JN, Madan AK, Hiler ML, Cheema P, Bahouth SW. Comparison of the release of adipokines by adipose tissue, adipose tissue matrix, and adipocytes from visceral and

subcutaneous abdominal adipose tissues of obese humans. Endocrinology 2004; 145: 2273-82.
10. Al-Abdulkarim M. Bissada N, A-Zahrani M, Ficara A, Siegel B. Alveolar bone loss in obese subjects. J Int Acad Periodont 2005; 7:34-8.
11. WHO. Global Strategy on diet, physical activity and health. 2005. http://www.who.int/dietphysicalactivity/publications-obesity/en.
12. Nanan DJ. The obesity pandemic-implications for Pakistan. J Pak Med Assoc 2002;52(8):342-6.
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. 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.
15. Loe H, Aneurud A, Boysen H, Morrison E. Natural history of periodontal disease in man: Rapid, moderate and no loss of attachment in Sri Lankan laborers 14 to 46 years of age. J Clin Periodont 1986;13(5):431-45.
16. Perlstein MI, Bissada NF. Influence of obesity and hypertension on the severity of periodontitis in rats. Oral Surg Oral Med Oral Pathol 1997;43:707-719.

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