

## Relation between hs-CRP, Lipid Profile, Obesity and Periodontitis among Patients Attending a Dental College in Gandhinagar, Gujarat: A Cross Sectional Study

Dr Rupal Mehta<sup>1</sup>, Dr. Neeta Bhavsar<sup>2</sup>, Dr. Jhankar Shah<sup>3</sup>, Dr. Santosh Kumar<sup>4</sup>, Dr. Sujay Shah<sup>5</sup>, Dr. Tanvi Hirani<sup>6</sup>

<sup>1</sup>- Prof and Head, Dept of Periodontology, Karnavati school of Dentistry, Gandhinagar.

<sup>2</sup>- Prof and Head, Dept of Periodontology, Govt Dental College and Hospital, Ahmedabad

<sup>3</sup>- P.G. Student, Dept of Periodontology, Karnavati school of Dentistry, Gandhinagar

<sup>4</sup>- Prof., Dept of Periodontology, Karnavati school of Dentistry, Gandhinagar

<sup>5</sup>- Reader, Dept of Periodontology, Karnavati school of Dentistry, Gandhinagar

<sup>6</sup>- Reader, Dept of Periodontology, Karnavati school of Dentistry, Gandhinagar

Corresponding Author - Dr Rupal Mehta

### Abstract:

**Background:** Association between obesity & periodontitis and the hypothesis that obesity is a risk factor for periodontitis has been evidenced by several epidemiological studies. Prevalence of obesity is increased three times since 1975 and it is mentioned in WHO report.

**Objectives:** To study the association between obesity as risk factor for chronic periodontal disease.

**Materials and Methods:** This was a cross-sectional study conducted among fifty patients diagnosed with chronic generalized periodontitis after ethical permission of Institutional Ethical Committee. Clinical attachment loss (CAL) was used to find the association. Statistical analysis was performed using Chi-square test to estimate the association between BMI and periodontitis.  $P < 0.05$  was considered as statistically significant.

**Results:** Mean age was 47.0 years & 40.6 years, 28.0% male & 72.0% female, BMI was 27.7 kg/m<sup>2</sup> & 22.1 kg/m<sup>2</sup> in case & control group respectively. Mean OHI-S score was 4.1 & 3.3 ( $p < 0.05$ ), Mean GI score was 2.1 & 1.5 ( $p < 0.05$ ). Mean PD score was 4.1 & 3.3 ( $p < 0.05$ ). Mean SBI score was 2.8 & 2.1 ( $p < 0.05$ ), Mean CAL score was 4.8 & 3.7 ( $p < 0.05$ ) in case and control group respectively. The association between obesity category and CAL score was statistically significant ( $p < 0.05$ ).

**Conclusion:** Proinflammatory cytokines may be a multidirectional link among periodontitis, obesity and other chronic diseases. Obese person must go for periodic dental checkup. They can be counseled for weight reduction and make them aware about the grave complications of the obesity.

**Keywords:** Body mass index, Obesity, Periodontitis, Clinical attachment loss (CAL), Oral Hygiene Index-Simplified (OHI), Pocket Depth (PD)

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### I. Introduction

Prevalence of obesity is increased three times since 1975 and it is mentioned in WHO report. Overweight was observed in more than 1.9 billion adults, 18 years & older in 2016 and out of these over 650 million were obese. Overweight and obesity killed more people than underweight all over world. In 2016, around 41 million children under the age of 5 and 340 million children and adolescents aged 5-19 were overweight or obese in 2016<sup>1</sup>. Arterial hypertension, type 2 diabetes mellitus, atherosclerosis and cardiovascular diseases are the consequences of obesity. And obesity has been found to be a one of the risk factor for periodontitis<sup>2-5</sup>. Perlstein and Bissada et al<sup>6</sup> first reported in animals in 1977 and Saito et al<sup>7</sup> observed in humans in 1998 the association between obesity & periodontitis and the hypothesis that obesity is a risk factor for periodontitis has been evidenced by several epidemiological studies.<sup>5</sup>

Obesity is a disease of the supporting structures of the teeth resulting from the interaction between pathogenic bacteria and the host immuneresponse<sup>8</sup>. Adverse effect of obesity on the periodontium may be mediated through pro-inflammatory cytokines such as interleukins (IL-1, IL-6 and tumor necrosis factor- $\alpha$ ), adipokines (leptin, adiponectin, resistin, and plasminogen activator inhibitors-1), and several other bioactive substances like reactive oxygen species, which may affect the periodontal tissues directly<sup>8</sup>. These observations illustrate the adipose tissue secretes several cytokines and hormones that are involved in inflammatory processes, indicating similar pathways are involved in the pathophysiology of obesity

and periodontitis<sup>9,10</sup>. So, the present study was carried out to find the association between obesity as risk factor for chronic periodontal disease.

## II. Material And Methods

This was a cross-sectional study conducted among fifty patients diagnosed with chronic generalized periodontitis at Dept. of Periodontics, Karnavati School of Dentistry, Gandhinagar, Gujarat during April 2018 to March 2019 after ethical permission of Institutional Ethical Committee. Inclusion criteria for study participants was age group of 18-60 years of either sex & Patients having probing depth  $\geq$  4mm and/or attachment loss  $\geq$  3mm in at least 30% of teeth in oral cavity (to diagnosis as periodontitis) and exclusion criteria was Patients who are on any medication that could affect the manifestation of periodontal disease such as chronic antibiotic treatment, phenytoin, anti-inflammatory drugs, cyclosporine or Ca channel blockers, Patient should not have any kind of inflammatory disease, and systemic disease during the study period, Patient less than 18 years of age & Pregnant women or lactating mothers. Study divided study participants in equal two groups (25 participants in each group): Group 1: subjects having BMI 24.9 kg/m<sup>2</sup> or less. Group 2: subjects having BMI more than equal to 25 kg/m<sup>2</sup>. BMI was measured according to World Health Organization (WHO) guideline. The data were recorded in an Excel sheet and descriptive analysis was performed, of which data are presented in the tables.

## III. Results

**Table 1:** Socio-clinical parameters of study participants (N=50)

Parameters	Number (%)		P value
	Case Group (n=25)	Control Group (n=25)	
Mean Age (in year)	47.0	40.6	p>0.05
Gender			p>0.05
➤ Male	7 (28.0)	14 (56.0)	
➤ Female	18 (72.0)	11 (44.0)	
Body Mass Index (BMI) (mean $\pm$ SD) (wt/ht <sup>2</sup> )	27.7 $\pm$ 3.44	22.1 $\pm$ 1.73	p<0.05
Waist Circumference (WC) (mean $\pm$ SD)(kg)	98.6 $\pm$ 9.50	83.1 $\pm$ 4.67	P<0.05

Table 1 shows that mean age was 47.0 years and 40.6 years in case and control group respectively (p>0.05). Study included 28.0% male & 72.0% female and 56.0% male & 44.0% female participants in case and control group respectively (p>0.05). BMI was 27.7 kg/m<sup>2</sup> with 3.44 SD & 22.1 kg/m<sup>2</sup> with 1.73 SD in case and control group respectively (p<0.05). WC was 98.6 cm with 9.5 SD & 83.1 cm with 4.67 SD in case and control group respectively (p<0.05).

**Table 2:** Distribution of periodontal parameters among study participants (N=50)

Parameter	Mean $\pm$ SD		P value
	Case Group (n=25)	Control Group (n=25)	
Oral Hygiene Index-Simplified (OHI-S)	4.13 $\pm$ 0.29	3.30 $\pm$ 0.21	P<0.05
Gingival Index (GI)	2.14 $\pm$ 0.33	1.50 $\pm$ 0.26	P<0.05
Pocket Depth (PD)	4.08 $\pm$ 0.56	3.29 $\pm$ 0.44	P<0.05
Sulcus Bleeding Index (SBI)	2.75 $\pm$ 0.63	2.13 $\pm$ 0.63	P<0.05
Clinical attachment level (CAL)	4.83 $\pm$ 0.89	3.67 $\pm$ 0.74	P<0.05

Table 2 shows that mean OHI-S score was 4.1 with 0.29 SD & 3.3 with 0.21 SD in case and control group respectively (p<0.05). Mean GI score was 2.1 with 0.33 SD & 1.5 with 0.26 SD in case and control group respectively (p<0.05). Mean PD score was 4.1 with 0.56 SD & 3.3 with 0.44 SD in case and control group respectively (p<0.05). Mean SBI score was 2.8 with 0.63 SD & 2.1 with 0.63 SD in case and control group respectively (p<0.05). Mean CAL score was 4.8 with 0.89 SD & 3.7 with 0.74 SD in case and control group respectively (p<0.05).

**Table 3:** Distribution of laboratory parameters among study participants (N=50)

Parameter	Mean $\pm$ SD		P value
	Case Group (n=25)	Control Group (n=25)	
High sensitivity C reactive protein (mg/L)	5.9 $\pm$ 4.9	2.2 $\pm$ 1.14	P<0.05
Triglycerides (TG) (mg/dL)	166.1 $\pm$ 48.2	111.7 $\pm$ 58.9	P<0.05
Total Cholesterol (TC)(mg/dL)	287.3 $\pm$ 20.2	170.0 $\pm$ 24.5	P<0.05
High Density Lipoprotein (HDL)(mg/dL)	43.1 $\pm$ 8.1	45.9 $\pm$ 9.0	P<0.05
Low Density Lipoprotein (LDP)(mg/dL)	196.2 $\pm$ 27.0	104.6 $\pm$ 19.8	P<0.05

Table 3 shows that value of High sensitivity C reactive protein was 5.9 mg/L with 4.9 SD & 2.2 mg/L with 1.14 SD in case and control group respectively ( $p < 0.05$ ). Triglyceride value was 166.1 mg/dL with 48.2 SD & 111.7 mg/dL with 58.9 SD in case and control group respectively ( $p < 0.05$ ). Total cholesterol value was 287.3 mg/dL with 20.2 SD & 170.0 mg/dL with 24.5 SD in case and control group respectively ( $p < 0.05$ ). HDL value was 43.1 mg/dL with 8.1 SD & 45.9 mg/dL with 9.0 SD in case and control group respectively ( $p < 0.05$ ). LDL value was 196.2 mg/dL with 27.0 SD & 104.6 mg/dL with 19.8 SD in case and control group respectively ( $p < 0.05$ ).

**Table 4:** Association between Degree of Periodontitis according to clinical attachment loss (CAL) with obesity (N=50)

CAL Score	Number (50)		P value
	Obese	Non-obese	
Mild(<3mm)	1 (4.0)	3 (12.0)	$p < 0.05$
Moderate( $\geq 3$ -5mm)	10 (40.0)	17 (68.0)	
Severe( $\geq 5$ mm)	14 (56.0)	5 (20.0)	

Table 4 shows that 4.0% obese and 12.0% non-obese participants were belonged to category mild of CAL score. Around 40.0% obese and 68.0% non-obese participants were belonged to category moderate of CAL score. Almost 56.0% obese and 20.0% non-obese participants were belonged to category severe of CAL score. The difference between obesity category and CAL score was statistically significant ( $p < 0.05$ ).

#### IV. Discussion

The present study was conducted to know impact of obesity and overweight in periodontal health. Obesity is considered as global pandemic and one of the major health problems which is growing rapidly. The adipose tissue plays several functions in the body. In obesity they are enlarged and produce pro inflammatory proteins such as TNF-alpha, IL6, plasminogen activator inhibitor type 1 and many others. Various studies indicate that inflammation may contribute to the sequel of obesity. Obesity leads to major health problems like heart disease, diabetes and many more. Apart from obesity and overweight there are other factors which can lead to periodontal ill health.<sup>10,11</sup>

Increased age is one of the risk factor for periodontitis. In present study, mean age of the participants were 47.0 years and 40.6 years in case and control group respectively. A study done by Pandey V et al<sup>13</sup>, the mean age of the obese and non-obese subjects was 38.8 years and 39.1 years respectively. It has been observed that the prevalence and severity of periodontitis increase with age, probably as a consequence of the longer exposure of the periodontal tissues to bacterial plaque. In present study obesity is found more in females as compared to males however gender is not significantly associated with cases. Similar results were found in the studies done by the study Memish et al<sup>14</sup> and Al-Hazzaa et al<sup>15</sup> with females showing higher prevalence of obesity than males.

In present study Body mass index among cases were significantly more than control groups. Similar association was found in Pandey V et al<sup>13</sup> where BMI of the subjects of the present study mean were 31.6 and 23.5 Kg/m<sup>2</sup> respectively and association is statistically significant. Various possible mechanisms are proposed to know the relation between obesity and periodontitis: first, obesity as widely associated with a systemic and locally increased inflammatory response; second, obesity's influence on dental plaque quantity and composition; and finally, a combination of both. The hypothesis of greater inflammatory burden triggered by obesity is shared among other co-morbidities and not just periodontitis. Adipose tissue has been shown to alter macrophage as well as T- and B-cell functions<sup>16</sup>. According to the current knowledge, the adverse effects of obesity on the periodontium might be mediated through impaired glucose tolerance, dyslipidemia or through increased levels of various bioactive substances secreted by adipose tissue. Its consequences go far beyond adverse metabolic effects on health, causing an increase in oxidative stress, which leads not only to endothelial dysfunction but also to negative effects in relation to periodontitis, because of the increase in pro-inflammatory cytokines observed by Saito T et al<sup>7</sup> & Jagannathachary S et al<sup>9</sup>.

Waist circumference was significantly higher in cases than control in our study. ( $p < 0.05$ ). Similar result found in a study done by Reeves et al<sup>17</sup>. It proved the association of body weight and waist size with chronic periodontitis among individuals aged 17-21 years and reported that weight significantly influenced the periodontal status.

It is obvious that lipid profile is deranged in case of obesity. In our study parameters of lipid profile were significantly different as compared to controls. hsCRP, TG, TC, LDL were significantly higher among obese as compared to non-obese while HDL was significantly higher among controls as compared to cases. Unhealthy life style or some time genetic cause may lead to obesity which can cause deterioration of lipid profiles. Our findings are also in agreement with the study done by who concluded that a significant association exists between plasma lipid levels and the severity of periodontal disease. Hyperlipidemia is known to cause

hyperactivity of white blood cells and increased production of oxygen free radicals, which in turn causes gingival oxidative damage and the progression of periodontitis<sup>18</sup>.

In case of periodontitis with periodontal pockets of 5 mm or deeper BMI increases. In our study Mean PD score was 4.1 with 0.56 SD & 3.3 with 0.44 SD in case and control group respectively ( $p < 0.05$ ). There is a positive association between BMI and periodontal pockets. It shows that body weight has an effect on the extent of periodontal infection among subjects with periodontal infection. Similar results were seen in a study done by Al-Qahtani SM et al<sup>19</sup> and Ana P et al<sup>20</sup>.

In present study Gingival index and CAL were significantly higher among obese participants than non-obese participants. Gingival redness is an indicator of inflammation. These findings are similar to the studies done by AL-Zahrani MS et al<sup>21</sup> and Dalla Vecchia CF<sup>22</sup> et al. They support the association between obesity and periodontal diseases. In our study, there was a significant clinical attachment loss (CAL) amongst obese individuals. Similar results were found in Pandey V et al<sup>13</sup> and AlZahrani MS et al<sup>21</sup>. Periodontitis is the inflammatory process initiated by the presence of biofilm, with destruction of the tooth's supporting structures, including bone. Clinical attachment loss is apparent with pocketing and with no gingival recession, or recession with no pocketing, or both pocketing and recession. CAL is an indicator of cumulative tissue destruction, including past periodontal disease, while PD is an indicator of current disease status (Burt B et al<sup>23</sup>). As periodontal disease progresses, clinical attachment loss (CAL) occurs through the destruction of the periodontal ligament and its adjacent alveolar bone, subsequently leading to gingival recession and pathologic periodontal probing depth.

## V. Conclusion

Obesity is in general a risk factor and a disease which give rise to many serious health problems. The relation between obesity and periodontal disease is still unclear but its association is established in so many researches. Proinflammatory cytokines may be a multidirectional link among periodontitis, obesity and other chronic diseases. Obese person must go for periodic dental checkup. They can be counseled for weight reduction and make them aware about the grave complications of the obesity.

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