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Relationship of BMI & Periodontal Status in Orthodontic & Oral Surgery Children; Correlation with Predisposing Factors

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ABSTRACT

Objective: The focus of this research was to assess the relationship between Body Mass Index (BMI) and Periodontal conditions in orthodontic children. An increase in the BMI has been associated with various systemic conditions. High BMI shows a bilateral relationship with inflammatory diseases like periodontitis. **Study Design:** Cross-Sectional Observational Study. **Settings:** De Montmorency College of Dentistry, Lahore Pakistan. **Duration:** 31-1-2023 to 30-12-2023. **Methods:** 72 subjects, 40 females and 32 males, participated in this study. The Community Periodontal Index was used for Periodontal measurements, which included bleeding on probing, calculus formation, and the presence and depth of periodontal pockets. Complete periodontal examination was performed in all subjects. Anthropometric examination consisted of BMI (kg/m^2), which was adjusted for age. The groups were divided into children of normal weight, underweight, and overweight, according to the BMI classification charts provided by the WHO, with respect to specific age groups. **Results:** The gender-related outcome indicated that male subjects with a weight above the standard mentioned above exhibited noteworthy percentages of CPl code, specifically fifty-three per cent, in contrast to females, who displayed twenty-seven per cent. Weight exceeding the standard criteria mentioned earlier reflected no notable relation with hemorrhage on probing. The pervasiveness of CPl code was noted. **Conclusion:** No significant association was found between body weight and predisposition to gum disease in the inspected individuals, indicating a negative association between BMI and periodontitis in juvenile subjects.

Keywords: *Community periodontic index, Orthodontic, Probing.*

INTRODUCTION

Overall health has a significant association with a thriving oral cavity, and vice versa.[1]

Teeth in the oral cavity are the hardest structure in the body, containing 96% hydroxyapatite crystals. Genes regulate the development and building of teeth, but the genetic program is influenced by disturbances in the oral cavity, such as infectious agents and certain medications. Loss of teeth may be due to the action of microorganisms, as in dental caries, or due to diseases affecting the periodontium.[2]

Periodontitis is a chronic inflammatory disease that primarily affects the supporting structures of teeth. It is an outcome of the interplay between pathogens and the body's defence mechanism.[1] Clinical representation of periodontitis includes Swollen, puffy, bright red, purplish, tender, bleeding, receded gums, pocket formation, mobility of teeth, change in contour, etc.[3]

Calculus, retained cements, over-contoured restorations, plaque retention, orthodontic forces, self-inflicted injuries, tooth brush trauma, gingival trauma, malocclusion, partial denture, tooth position, enamel pearl, cervical enamel projection, age, diabetes mellitus,

pregnancy, medications, blood dyspraxia, etc., are factors leading to periodontitis.[4-6]

Biofilm is a microbial population on the surface of teeth. "Microbial cell encased within a matrix of extracellular polymeric substance such as polysaccharides, proteins and nucleic acid. The intracellular matrix encompasses numerous noteworthy components.[7] It contains complex carbohydrates, proteins, glycoproteins, DNA, calcium phosphate, sodium, potassium, bacteria, viruses, yeast, and protozoa, among other components.[8] Evaluation of periodontitis began with a comprehensive history, during which the patient was asked about their oral habits, including tooth brushing, gum bleeding, and any associated pain.[9] A patient dental evaluation was conducted to examine tooth mobility, tooth spacing, gum appearance, gum bleeding, foul taste, gum itching, dull tooth pain, sensitivity to hot and cold temperatures, and a burning sensation in the gums. Oral hygiene should be evaluated, including general dental habits such as chewing and clenching, as well as any previous periodontal problems. Extraoral examination is done to evaluate any facial asymmetry, TMJ disorder, competency of lip seal.[10-12]

Grades indicate information about the biological features of periodontitis, its progression, and the outcome of the treatment analysis. Staging of periodontitis is done in four stages. Stage 1 indicates initial periodontitis, which includes bleeding on probing. The presence of calculus characterizes stage 2 moderate periodontitis. Stage 3 reflects an intense periodontal illness that may progress to tooth loss, characterized by a pocket depth of 3.5-5.5mm. Stage 4 advanced periodontitis with pocket depth more than 5.5mm, Extensive Tooth Loss and Loss of Dentition.[13-14] It is based on the mass of a body with reference to height and weight, which indicates whether a person is healthy, overweight or underweight. BMI is calculated by dividing a person's weight in kilograms by the square of their height in meters.[15-17]

The objective of this study was to evaluate the connection between BMI and the health of the periodontium in juvenile subjects.

METHODS

This Cross-Sectional observational research was conducted at the De Montmorency College of Dentistry, Lahore, from January 31, 2023, to December 30, 2023. Convenient Sampling technique was used. The sample size consists of 72 subjects with an age group of 2 to 15 years and was calculated using the formula: n=Z (PX1-P/a², n° (1.96)° (0.05) (1-0.05)/ (0.05)?, n=72 P=0.05.[17]

The patients are aged 2 to 15 years and the children are undergoing dental treatment were included in the study. Patients who had received periodontal treatment, patients who had a fixed orthodontic appliance within the past month and subjects having any systemic disease (Diabetes Mellitus, Thyroid disease, tooth cleaning) were excluded from the study.

Written or verbal consent was taken from parents/guardians. It was ensured that the variables were consistent with the study's objectives and that no confusing, leading, or inappropriate variables were included that would need to be modified or removed. The total number of participants who fulfilled the inclusion criterion was clinically evaluated, and the variables were measured. For measuring periodontal pockets, the WHO periodontal probe was used, and height and weight were measured using a weight machine.

To gather the data for this study, a form was designed. The proforma was designed to evaluate variables for assessing the association between BMI and periodontal status in children. Reliability of a proforma is the consistency of a set of measurements, or is determined by an instrument frequently used to describe a test. This indicates whether the measurement of the variables yields the same result when repeated over time. In this study, the reliability of the proforma was verified using Cronbach's Alpha, a commonly used instrument.

Data analysis was conducted using SPSS version 25. The relationship between categorical variables was explained using the chi-square test. Descriptive analysis was used to describe the basic features of the data in the study. It provided a simple summary about the sample and the measures. Together with simple graphical analysis, it formed the basis of any quantitative analysis or data.

Both categories of the chi-square test are taken into consideration. The data obtained from the subjects is considered observed. Descriptive analysis was used to describe the basic features of the data; the chi-square test was applied to measure the association among the different categorical variables. This test is based on the disparity between the detected and predicted values for individual categories. The Chi-square statistic is calculated by determining the variance between the observed cases and the expected cases. This variance is then squared. It is then divided by the predictable number of cases in that particular group. The subsequent values for all groups are summed together, and the total is denoted as the Chi-square value.

RESULTS

An association between BMI and bleeding on probing was observed in the total population, with the maximum frequency of bleeding reported in subjects with normal body weight, as shown in Figure 1. Similarly, the relationship between BMI and pocket formation was seen

in children of all age groups, and it was found that none of the individuals had any pocket formation, as shown in Figure 2. Representation of BMI and calculus was observed in all subjects, with maximum yellowish hard deposit calculus found in patients with a normal BMI. Specifically, 62% of underweight, 66% of normal, and 72% of overweight patients showed calculus. Bleeding was observed in patients aged 7-10 and 12-14 years.

The chi-square test was applied to determine any association between BMI and calculus. It was found to be insignificant (p = .975), indicating no correlation between these two variables, as shown in Table 1. The chi-square test was applied to determine the association between BMI and bleeding on probing. The correlation was found to be insignificant (p = 0.436), indicating no correlation between these two variables, as shown in Table 2. Table 3 shows the association between BMI and Periodontitis. Out of 72 patients, 3 scored 0 (healthy gums), 5 scored 1 (bleeding on probing), and 28 scored 2 (presence of calculus) on the Community Periodontal Index. According to BMI scoring, 13 patients scored 1 (underweight),52 scored 2 (normal weight), and 7 scored 3 (Overweight). The CPI score was prevalent in females, with a maximum score of 0, compared to males. In males, CPI score 3 was in greater proportion than in females.

Figure 1: Graphical representation of BMI with bleeding

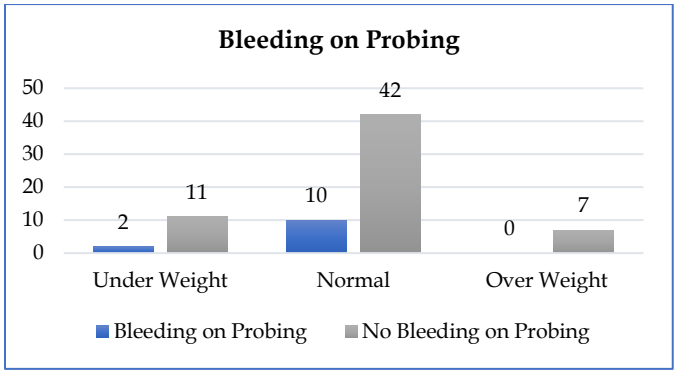

Figure 2: Graphical representation of BMI with pocket formation

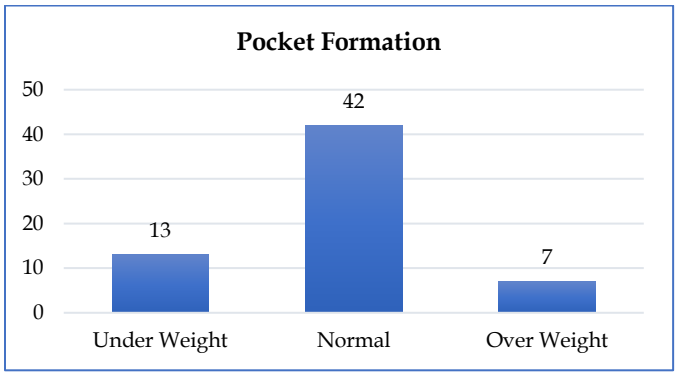

Table 1: Crosstab of BMI and calculus

Chi-Square Test			
	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	.051	2	.975
Likelihood Ratio	.051	2	.975
Linear-by-Linear Association	.024	1	.878

Table 2: Crosstab of BMI and bleeding

Chi-Square Test			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.662	2	.436
Likelihood Ratio	2.805	2	.246
Linear-by-Linear Association	.364	1	.546

Table 3: Association of BMI and community periodontal index

		Periodontal Scale			**Total**
		Healthy (0)	**Bleeding (1)**	**Calculus (2)**	
BMI Coding	Underweight (1)	7	1	5	13
	Normal (2)	28	4	20	52
	Overweight (3)	4	0	3	7
Total		39	5	28	72

DISCUSSION

The literature showed that the prevalence of periodontal disease is greater among obese patients, and studies have proposed that an increased BMI may be a potential risk for periodontitis. Previous studies have included both young and older groups, and data from these studies have suggested that periodontal status deteriorates with obesity.[13] However, the association between BMI and periodontitis in children is still controversial, showing a negative relation between normal weight, underweight and periodontitis.[14]

In the present study, the calculated p-value between BMI and periodontitis is 0.894, which is greater than the p-value calculated by Sinha *et al*.[14] Therefore, in 2018, there was an insignificant association between increased BMI and periodontitis. Similar results were found in a study by Zuza *et al* in 2017 and Ling-Wei in 2018, with a p-value less than 0.05, showing a significant association between BMI and periodontitis.[18,19]

Distribution of CPI score (0) was more prevalent in normal weight subjects, CPI score 2 (yellow hard deposit calculus) was observed frequently with increasing age (Zuza *et al*, 2017),[18] which is an agreement with the present study. A Study by Zuza et al in 2017 reported more bleeding on probing in patients with increased

body mass index, however in the current study 16% patients showed bleeding on probing 14% was observed in patients with normal BMI, 2% in underweight.[18]

The present study showed that hard deposits (calculus) were found in 38% of individuals, 27% with a normal BMI, 7% with a low body mass index, and 4% with overweight. However, Franchini *et al* (2011) reported an equal incidence of calculus in patients with normal and increased body mass index.[20]

Distribution of CPI score (1) and (2) was more prevalent in females score (3) in males which indicated that moderate periodontitis was observed more in males reporting with calculus formation which may lead to differential changes in periodontium around teeth (L Martens, 2017), similar findings were reported regarding prevalence of periodontitis in gender between present study.[21]

Out of 72 patients, 55% were female, 14% were underweight, 75% were of normal weight, and 1% were overweight. 44% were males, with 21% underweight, 68% normal weight, and 9.3% overweight, reporting an increased prevalence of increased BMI in males (Ling-Wei Li, 2018).[19]

Females scored 65% CPI score (0), 7.5% CPI score (1), 27% CPI score (2), males scored 40% CPI score (0), 6.25% CPl score (1), 53% scored CPI (2) showing prevalence of more CPI score (2) which is an agreement with the study conducted by (Ling-Wei Li,2018).[19]

This study will help assess the relationship between BMI and periodontal status. This will enable us to evaluate the potential risk of aberrant BMI in relation to oral disease, thereby predicting oral health status prior to any severe oral health malfunctions. It would be dental health professionals and future researchers who screen patients more appropriately. The Government of Pakistan would also benefit from improving dental health facilities.

CONCLUSION

The available evidence suggests no association between increased BMI and periodontitis in orthodontic children of age group 2-15 years; however, the prevalence of CPI score (2) in males indicates that males are at a higher risk of having moderate periodontitis incidence than females.

LIMITATIONS

The current study has several limitations that should be considered when interpreting its findings. Due to its cross-sectional design, it can only establish associations between BMI and periodontal status, and cannot determine a cause-and-effect relationship. Furthermore, the use of convenient sampling from a single institution limits the generalizability of the results to a broader population of orthodontic children.

SUGGESTIONS / RECOMMENDATIONS

Clinically, while a direct association was not found, dental health professionals should be encouraged to routinely screen for BMI and educate patients and parents on the importance of overall health for oral well-being.

CONFLICT OF INTEREST / DISCLOSURE

The study's authors disclose that they have no conflicts of interest.

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