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Polycystic Ovarian Syndrome (PCOS) and Chronic Periodontitis - An Epidemiological Study

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Abstract

Background: Polycystic ovary syndrome (PCOS) is the most common endocrine disorder in women of reproductive age affecting 4 to 18% of this population. Metabolic syndrome is associated with periodontal diseases, as has been reviewed previously. The present study was designed to evaluate the relationship between PCOS and periodontal diseases.

Materials and Methods: The study recruited 100 women, divided into the groups according to diagnosis: 50 women with PCOS and 50 healthy controls. The diagnosis of PCOS was made by medical history, physical examination, clinical characteristics, lab test (biochemical), and ultrasound detection. All patients were examined by the same periodontist according to the following periodontal parameters: (BOP) bleeding on probing, Pd (probing depth), CAL — clinical attachment loss, PI — plaque index and tooth loss. Exclusion criteria included pregnancy, smoking, malignancy, osteoporosis, or being noncompliant with taking prophylactic antibiotics for dental procedures or periodontal treatment in the past 6 months. Differences between these groups of characteristics was analyzed using t-tests for continuous variables and Chi-square tests for categorical variables, with statistical significance at the $P < 0.05$ level.

Results: Periodontal disease parameters – Clinical attachment loss and sites with bleeding on probing were significantly raised in women with. PCOS (P < 0. Nonetheless, concerning the mean lifetime of teeth, the differences between the body mass index (BMI) groups and PCOS and control groups were not found to be statistically significant (P = 0. 384).

Conclusion: Periodontal disease is more common in women with PCOS than in a non-PCOS population, as has been postulated by this study. This observation could be attributed to the pro-inflammatory state seen in chronic systemic inflammation that is associated with both conditions.

Keywords: Polycystic Ovary Syndrome, Endocrine Disorder, Pregnant Women, Periodontal Disease, Metabolic Syndrome

Introduction

Periodontology is a type of disease that is chronic and inflammatory in nature and relates to the destruction of the supporting periodontal tissues such as the gum, the alveolar bone, and the periodontal ligament fibers. It is an elaborate process where pus-forming bacteria and the host's body engage in a battle that causes deterioration of the tissues and shedding of the teeth. Specifically, female sex steroid hormones: estrogen; particularly progesterone, have been proven to play a key role in the enhancement of periodontal diseases by increasing inflammation and tissue breakdown.[1]

PCOS is an endocrine disorder, assigned to the group of dysfunctions of female reproductive system, which occurs in 4-18% of female population in a child-bearing age. [2,3] It might be associated with reproductive system problems but it has deeper systemic consequences on women's health. COPD has many symptoms that interconnect with other physiological and psychological complications in affected women. Some of the features and components of the syndrome are; endocrine abnormalities, specifically amenorrhea, obesity, female infertility, high levels of fasting lipid profile, CVD, hypertension, hyperandrogenica, and polycystic ovaries.[4]Other symptoms include hyperlipidemia, insulin resistance, hypertension and hyperinsulinemia among women with PCOS More recent studies have also indicated increased rates of IGT, type II DM, and disturbances in lipid profiles among women with PCOS. Implicitly, metabolic dysregulation is usually accompanied by raised levels of oxidative stress and general markers of inflammation such as interleukin-6 (IL-6) and C-reactive protein (CRP).[5] The state of relatively steady ''low-grade'' inflammation in PCOS can be compared to the inflammation which occurs in periodontal diseases therefore there can be the connection between these diseases.[6]

There are several linkages through which the two conditions are related, as shall be discussed in the following sections. Both conditions are associated with Low-Grade Systemic Inflammation and Oxidative Stress, which are major causes of tissue damage and advancement of diseases. Periodontal diseases are inflammatory conditions which involve the destruction of periodontal tissues and as PCOS can lead to insulin resistance the condition may be worsened. In addition, activated receptor for AGEs (RAGE) and AGEs, which are upregulated in both diseases, can also aggravate inflammation and oxidative stress.

It is further supported that certain glandular hormones dubbed as sex steroids and androgens are involved in the development of both, PCOS and periodontal diseases.[7] For instance, the increased levels of androgen in woman with PCOS were associate with modulation of the immune system and inflammation in periodontal disease. Additionally, the metabolic abnormalities associated

with PCOS include dyslipidemia and hyperglycemia; the former of which may affect periodontal status by ensuring appropriate conditions for bacterial colonization and inflammation.[8]

Hence, this study sought to establish the link between the menstrual cycle irregularity associated with PCOS and periodontal disease by exploring the bidirectional interaction pathways that relate the two conditions, namely inflammation, OS, IR, and hormonal disturbances. Understanding of these links is important to improve the understanding of how both conditions are interrelated and how treatment plans aimed at management of PCOS and OA might be linked to enhance health outcomes of women with this condition.

However, the aim of this present study is to evaluate the association between PCOS and periodontitis in female patients.

Materials and Methods

Study Design and Participants

In this observational study, 100 women aged between 20-50 years were selected from the general population of Khammam. The participants were randomly matched for age and sex, and informed consent was obtained from all.

Data Collection

A detailed questionnaire was administered to gather information on past medical history, habitual history, clinical signs and symptoms, and anthropometric parameters. The study consisted of two groups: 50 women diagnosed with PCOS and 50 systematically healthy subjects. PCOS diagnosis was based on the Rotterdam criteria, which includes medical history, clinical signs, physical examination, laboratory parameters, and ultrasound findings.

Inclusion criteria

- Age between 20-50 years
- History of PCOS without any other systemic disorder for test group
- Systemically healthy for control group
- Atleast 16 natural teeth excluding third molars

Exclusion criteria

Participants were excluded if they were:

- Pregnant or lactating
- Smokers
- Consumers of alcoholic drinks
- Users of prophylactic antibiotics for dental procedures
- Possessing fewer than 15 teeth in their oral cavity
- Recipients of periodontal treatment within the past 6 months.
- PCOS patients with a body mass index (BMI) > 25 or impaired glucose tolerance (IGT)

Periodontal Examination

Both groups underwent periodontal examinations conducted by a single investigator using a periodontal probe and mirror. The periodontal parameters assessed included bleeding on probing (BOP), clinical attachment loss (CAL), probing depth (PD), and plaque index (PI). To minimize the effects of hormonal changes during the menstrual cycle on periodontal tissue, all examinations were conducted in the early follicular phase of the menstrual cycle.

Methodology

BOP: Assessed at six sites per tooth (excluding third molars) using the NIDCR protocol and reported as a percentage after drying the gums with dental compressed air.

PD and CAL: Measured at six sites per tooth (excluding third molars) according to the classification proposed by the American Academy of Periodontology(figure1) and

reported as percentages based on gum involvement around tooth surfaces.

PI: Assessed using the O'Leary index. Participants rinsed for 30 seconds with a disclosing solution, and the presence or absence of disclosed plaque was recorded on the mesial, distal, buccal, and lingual surfaces of all teeth. The percentage of disclosed plaque was then calculated for each participant. A reasonable periodontal health is indicated when 10% or less of the surfaces contain plaques.

Ultrasonography: Recorded for all participants in test and control group (figure 2)

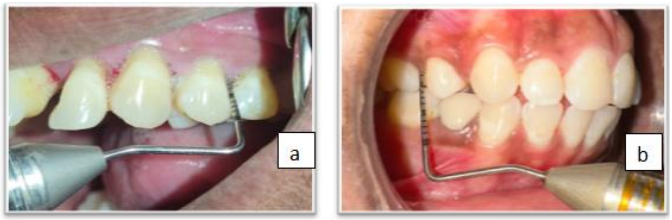


Figure 1: Assessment of probing depth a) Test group (pcos) b) Control group (non pcos)

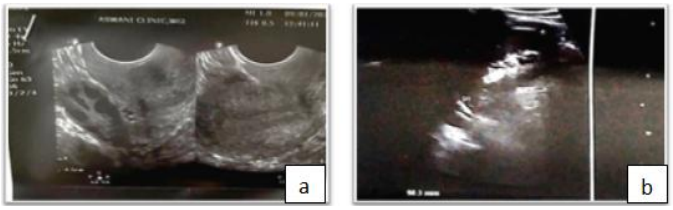


Figure 2 : Ultrasonography a) Test group showing multiple follicles (pcos) b)Control group (non pcos , no evidence of multiple follicles)

This study explored the relationship between PCOS and periodontal diseases, considering the potential influence of systemic inflammation, oxidative stress, and hormonal imbalances that are common in both conditions.

Statistical analysis

Statistical analysis was conducted using SPSS software version 20.0 (SPSS Inc., Chicago, IL, USA). The following methods were employed to analyze the data:

Kolmogorov-Smirnov Test: Used to assess the normality of all variables.

Independent Sample t-tests: Applied to normally distributed variables, with results presented as mean ± standard deviation.

Mann-Whitney U-test: Applied to non-normally distributed variables.

Pearson's Chi-square Test: Used to compare qualitative data.

For all tests, statistical significance was set at $P < 0.05$.

Results

The study examined 100 women aged 20-50 years, including 50 with polycystic ovary syndrome (PCOS) and 50 healthy controls, to investigate the relationship between PCOS and periodontal health. Both groups were matched for age and underwent thorough periodontal examinations. The findings indicated that women with PCOS had significantly higher plaque indices (PI), bleeding on probing (BOP), Probing pocket depth (PPD) and clinical attachment loss (CAL) compared to the control group, suggesting worse periodontal health. Specifically, the mean PI was 2.38 in the PCOS group versus 1.62 (Table 1, Graph 1) in the control group ($P = 0.0001$), the BOP was 2.03% compared to 0.84% (Table 2, Graph 1) ($P = 0.0001$), PPD was 5.67 in the PCOS group versus 4.68(Table 3, Graph 2) in the control group and the CAL was 5.49 mm compared to 3.60 mm (Table 4, Graph 2) ($P = 0.001$). Although there was no significant difference in the number of missing teeth between the groups, these periodontal parameters were notably worse in women with PCOS. Overall, the study highlights a significant association between PCOS and poorer periodontal health, emphasizing the need for comprehensive dental care in women with PCOS.

Table 1: Mean comparison of Plaque Index between test and control groups

Plaque Index	Groups	Mean	SD	P value
	Test	2.3800	0.3487	0.000*
	Control	1.6200	0.2710	

Table 2: Mean comparison of Bleeding Index between test and control groups

Bleeding Index	Groups	Mean	SD	P value
	Test	2.0320	0.29098	0.000*
	Control	0.8420	0.39851	

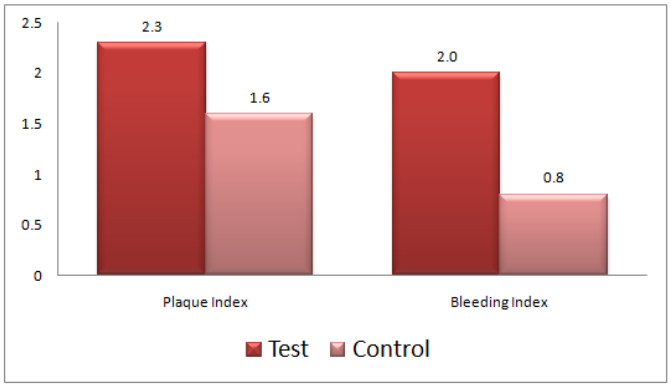
Table 3: Mean comparison of Probing pocket depth between test and control groups

Probing pocket depth	Groups	Mean (mm)	SD (mm)	P value
	Test	5.6720	0.48066	0.000*
	Control	4.6840	0.24105	

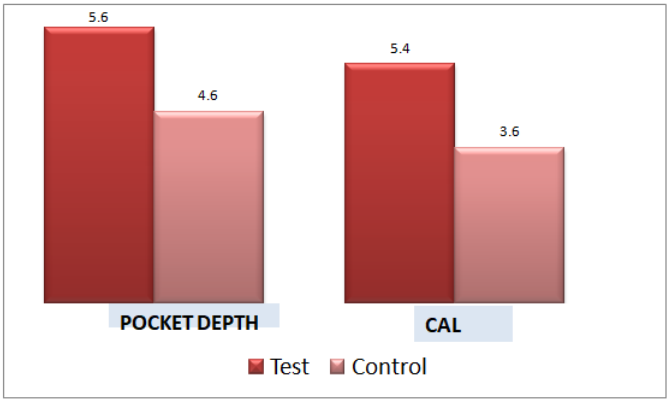
Table 4: Mean comparison of Clinical attachment loss between test and control groups

Clinical attachment loss	Groups	Mean (mm)	SD (mm)	P value
	Test	5.4940	0.64188	0.000*
	Control	3.6020	0.24701	

Graph 1: Graph on mean comparison of Plaque Index and Bleeding Index between test and control groups



Graph 2: Graph on mean comparison of Probing pocket depth and Clinical attachment loss between test and control groups



Discussion

There is enough evidence from previous studies that links gingivitis with hormonal fluctuations during puberty, pregnancy, and during menstrual period. In evaluating the role of estrogen in periodontal tissues, the influence of estrogen on the gingival epithelium, collagen synthesis, osteoblasts, and bony tissues is of significance.[9] Estrogen and progesterone exercise some influence over the capillary system, inflammation, angiogenesis procedures. These changes contribute to pathologic increased growth of the endothelial cells for the blood vessels and the keratinization of the epithelial layers of the gums. The Hyperandrogenism status caused by PCOS influences the menstrual cycles of the patients and can lead to infertility but may also cause additional risks such as periodontal diseases in these patients.

Spearheading this study is a realization that no studies have explored the possibility of links between polycystic ovary syndrome (PCOS) and periodontal health parameters. Present study results showed a notable difference concerning periodontal disease incidence in women with PCOS and matched for age and BMI in systematically healthy females. These findings are similar to earlier studies supporting the systematic grille impact of hormonal changes associated with PCOS on

gingivitis and other periodontal diseases. This change in the periodontal response was supported by the fact that the PCOS subjects presented a pro inflammatory status that can had contributed to the development of periodontal disease in these patients. PD, BOP and PI are indicators of lesional change in the periodontal tissue However, to establish a diagnosis of periodontitis, the gingivitis with pseudopockets (cosmetic) should be excluded because they bias PD, PI and BOP measurements. In this sense, there are several authors who have introduced the CAL variable in its periodontal assessment due to the fact that insertion loss indicates the process of becoming irreversible. Taking these findings into consideration, the patients with PCOS are likely to be at a higher risk of developing periodontitis and other forms of periodontal diseases including, gingivitis compared to women that do not have this pathology. In a cross-sectional comparative study in 2014, Akcali and colleagues undertook the first investigation on the relationship between oral microbial salivary organisms and serum antibody reactivity along with gingivar inflammation and PCOS.[14] They stated that only a few alterations in the microbiological makeup concerning PCOS patients and the controls with periodontal diseases exist. For the study, participants diagnosed with PCOS and gingivitis had higher deposits of P. gingivalis and F. nucleatum in the saliva, and serum antibodies against P. intermedia, P. gingivalis, and S. oralis tested positive. Given PCOS as a systemic endocrine disorder, it may qualitatively impact the characteristics of the oral microbiota and, therefore, directly contribute to systemic amped up susceptibility of the patient to specific members of this microbial consortium.

This risk may be accentuated by the increased prevalence of hyperandrogenism in PCOS, which modulates the composition of the oral flora and cytokines that are pro-inflammatory, thereby resulting in negative complications such as bone and tooth loss. [9] Nonetheless, our study could not establish any statistically significant variations in the incidence of tooth loss or the severity of the diseases in the study groups and the control group of PCOS patients Although our study did not reveal a marked difference in the two groups' rate of the common type of tooth loss or the diseases' severity, there may be a few explanations for this In particular, the participants in this study were relatively young, and this may have skewed the

However, prior research showed higher incidences of moderate periodontitis to be present into PCOS patients, underlining the necessity for a stringent periodontal monitoring in such individuals.[10] In a study by Porwal et al. regarding the risk level, prevalence of mild periodontitis in women with PCOS and healthy women has not been statistically significant with the results of the present study. The prevalence of moderate periodontitis is found to be significantly higher in case of women with PCOS as compared to control group. In study neither case nor control group were Periodontally healthy which is in contrast to Porwal et al. study. With this, newly diagnosed cases of PCOS in this study were used by Porwall S. et al in his study, revealed that newly diagnosed PCOS without medical treatment had Moderate Periodontitis Probability has increased 88 times to have moderate periodontitis. To further eliminate any extraneous influence on outcomes, we ensured to match the participants in terms of socio-demographic characteristics and also carefully recall covariates. While comparing Test group that consists of PCOS patients with Systemically Healthy (control group), the P values thus obtained for PI, BOP, PPD, CAL index, were significantly less than 0. 05, thereby

leading to the conclusion that there was an improvement in Test group in comparison to Control thus suggesting beneficial impact of scaling and root planning in Systemically Healthy patient patients suffering from PCOS.

However, the intricate interplay between PCOS, hormonal imbalances, and periodontal health warrants further exploration. This study reported that there is a positive association between periodontal diseases and PCOS because PCOS subjects were associated with a Pro-inflammatory status that may have favoured the susceptibility of these patients to periodontal disease. The results emphasize the importance of the association between PD and the clinical status of PCOS women as a common shared low-grade systemic inflammation status. Thus supporting the hypothesis, showing a bidirectional association between PCOS and PD.Studies conducted by Marquez-Arrico CF (2019),[13]Vanessa Machado et al(2020)[11], Manjusha Varadan et al(2019),[12]ChandanaTangutur et al(2018),[6]Porwal S et al (2015),[10]supports that there is an association between periodontal disease and PCOS.

The limitations of this study include

1. An association between the severity, duration and its role in causation of PD could not be determined in this present study.
2. Investigations could not incorporate serum and physical analysis of the main biomarkers of PCOS
3. The impact of nonsurgical periodontal treatment (NSPT) on PCOS patients are encouraged to clarify if treating PD might alleviate PCOS clinical course

Conclusion

The conclusions of this study establish the increased predirectness of, and increased risk of, periodontal pockets and bleeding on probing in patients with PCOS, reduced clinical attachment level, and increased plaque formation as compared to the control group. According to the findings of this study, more extended longitudinal research with increased snowball sample size and extended longitudinal periods are required to unearth the complex interactions between PCOS and periodontal disease. These kinds of studies will not only provide deeper insight into the associations mechanism but will also put forth the much needed breakthroughs for developing a better early intervention strategy for managing the higher risk of periodontal complications among the PCOS patients.

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