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INVESTIGATING THE IMPACT OF COMBINED ORAL CONTRACEPTIVES ON ORAL HEALTH: A CASE-CONTROL STUDY

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ABSTRACT

Background: Oral health is an essential component of an individual's general health, and since many medications are taken orally, this increases the risk of infections by external microorganisms. Oral contraceptives (OCPs) are used by almost 50 million women globally and are associated with many systemic and oral manifestations. **Purpose**: In this case-control study, we aim to investigate the association between the use of combined OCPs and oral health. **Methods**: We conducted a case-control single-center study at Prince Hashim Military Hospital between the period of January 1st until April 30th of 2024. Women in the reproductive age and on OCPs presenting to the Dental Clinic were included in addition to a control group of women in the reproductive age with no reports of using OCPs. Periodontal examination included a full-mouth examination and was evaluated using the plaque index (PI) and gingival bleeding index (GBI). Demographic and clinical data were collected, and analysis was performed using appropriate statistical testing. **Results**: A total of 200 women were included, 54% were on OCPs. Women on OCPs had a significantly higher PI (29% vs. 14%, $p < 0.001$) and higher severity of GBI in with 40% experiencing moderate inflammation and 24% severe inflammation compared to lower percentages in non-OCP users (16% and 11%, respectively, $p < 0.001$). Logistic regression showed that OCP use was strongly associated with both positive plaque index (OR: 6.19, $p < 0.001$) and severe gingival bleeding (grades 2 and 3). Duration of OCP use was not significantly related to the plaque index. **Conclusion**: Our results found a significant association between OCP use and increased plaque accumulation and gingival inflammation, with users having higher odds of moderate to severe gingival issues. However, the duration of OCP use did not correlate with disease severity, highlighting the need for awareness and regular dental check-ups for OCP users.

KEYWORDS: Oral contraceptive, gingivitis, Jordan, oral Health.

INTRODUCTION

Periodontal diseases are group of inflammatory conditions that affect the soft tissues around the teeth, leading to the progressive damage and destruction of the tissue that supports the tooth structures.[1] It is a very common disease with a 90% incidence rate globally. Several factors contribute to the development of periodontal diseases, including both patient-specific risk factors and poor oral hygiene. These risk factors can be categorized into modifiable factors, such as tobacco use, inadequate oral hygiene, diabetes mellitus, and pregnancy, and non-modifiable factors, such as age and hereditary conditions, including genetic disorders.[2,3]

Hormonal fluctuations, such as in pregnancy, have been shown to trigger an inflammatory response associated with gingivitis and periodontitis.[4,5] In addition, maternal hormone levels have been positively correlated with higher levels of Porphyromonas gingivalis, which is a bacterium with a key role in the progression of periodontal disease. Both low and high estrogen levels have been shown to contribute to the development of gingivitis.[6,7] This makes women more susceptible to oral diseases as these hormonal changes not only influence general health but also impact the oral health.[8]

Oral contraceptives (OCPs) are among the most commonly used medications by women, accounting for around 50 million women users globally. Due to their widespread use, numerous systemic and oral side effects have been identified.[9,10] However, there is a wide controversy on the effect of OCPs and duration of OCP use on the severity of periodontal diseases. Therefore, we aim to investigate the association between the severity of periodontal disease using well-validated indices, and OCP use and duration in Jordanian Women.

METHODS

Study design

We carried out a case-control, single-center study at Prince Hashim Military Hospital in Zarqa, Jordan over the period of January 1st until April 30th of 2024. We included women of reproductive age who were using oral contraceptive pills (OCPs) and presented to the Dental Clinic, as well as a control group of women of reproductive age who do not use OCPs. Exclusion criteria included pregnancy, breastfeeding, history of chemo- or radiotherapy, and systemic diseases with potential oral manifestations, such as diabetes mellitus. All participants underwent a comprehensive periodontal examination by an expert periodontist. All participants provided informed consent, and approval was obtained from the Institutional Review Board (IRB).

Periodontal Disease Assessment

A full-mouth periodontal examination was performed, by evaluating two key indices: the Plaque Index (PI) and the Gingival Bleeding Index (GBI). The GBI assessed was adopted from Loe and Silness Gingival Index, which scores from 0 to 3 to measure the severity of gingival inflammation and bleeding.[11] The PI adapted using the O'Leary Plaque Index which measures the presence of dental plaque on the gingival margins, indicating oral hygiene and plaque accumulation.[12] These indices provide a thorough assessment of each participant's periodontal health.

Data Collection

In addition to periodontal measurements, demographic and clinical data was collected which include participant age, type and duration of OCP use, number and type of contraceptive methods, and any comorbidities. The periodontal and gingival indices were also recorded to compare OCP users with non-users.

Statistical Analysis

Continuous variables were presented as mean (standard deviation (SD)) and categorical variables as frequencies and percentages. Associations between demographic and clinical characteristics and the study groups were evaluated using the Wilcoxon (Mann-Whitney U). For categorical variables with fewer than five categories, chi-squared (χ^2) and Fisher's exact tests were employed. A p-value of less than 0.05 was considered statistically significant. All analyses were conducted using R software (Version 4.3.1), utilizing the glm and gtsummary packages.

RESULTS

A total of 200 women presenting to the dental clinic were included. The mean age was 32.0 (8.0) years. Based on OCP use, a total of 108 (54%) women were on OCPs, while 92 (46%) were not on any OCP. The mean duration of OCP use was 2.64 (1.66) years. The plaque index grade was positive in 129 (65%) of women suggesting presence of plaque at the gingival margins, with a mean percentage of 22.0% (21.0). While the gingival bleeding index showed that 52(26%) had grade 0 indicating no bleeding or inflammation with normal gingival appearance, 54(27%) had grade 1 with mild inflammation but no bleeding, 58 (29%) had grade 2 with moderate inflammation and bleeding on pressure, and 36 (18%) women had grade 3 with severe inflammation and spontaneous bleeding (**Table 1**).

When comparing between women on OCPs and women not on OCPs, there was a significant difference in the plaque index grade and percentage. Women on OCPs had a significantly higher plaque index percentage (mean %: 29.0% vs. 14.0%, p-value <0.001), and 87 (81%) of women on OCPs had positive plaque index compared to 42 (46%) of women not on OCPs (p-value <0.001) as shown in **(Table 2)**. The gingival bleeding index also differed significantly between women on OCPs and women not on OCPs, in which 43 (40%) of women on OCPs had grade 2 compared to 15 (16%) of women not on OCPs, and 26 (24%) of women on OCPs had grade 3 compared to 10 (11%) of women not on OCPs (p-value <0.001).

The logistic regression model showed a significant association between the plaque index and use of OCPs, in which women on OCPs had 6.19 higher odds of having positive plaque index (OR: 6.19, 95% CI: 2.00-19.20, p-value <0.001). There was no significant association between the duration of OCP use and the plaque index. Regarding the gingival index, there was a significantly higher association between OCP use and having grade 2 gingival bleeding index (OR: 8.29, 95% CI: 2.05-33.60, p-value <0.001), and grade 3 (OR: 8.80, 95% CI: 1.91-40.51, p-value = 0.01) as shown in **(Table 3)**.

Tables

Table 1: Characteristics of included patients.

Characteristic	N = 200
Age (Years), Mean (SD)	32.0 (8.0)
Use of OCPs, n (%)	108 (54%)
Duration of OCP use (Years), Mean (SD)	2.64 (1.66)
Plaque index, n (%)	
Negative	71 (36%)
Positive	129 (65%)
Plaque index percentage, Mean (SD)	22.0% (21.0)
Gingival bleeding index, n (%)	

0	52 (26%)
1	54 (27%)
2	58 (29%)
3	36 (18%)

Table 2: Comparison between OCP use and gingival health.

Characteristic	Yes, N = 108	No, N = 92	p-value
Age (Years), Mean (SD)	32 (8)	33 (8)	0.5
Plaque index, n (%)			**<0.001**
Negative	21 (19%)	50 (54%)	
Positive	87 (81%)	42 (46%)	
Plaque index percentage, Mean (SD)	29 (21)	14 (18)	**<0.001**
Gingival bleeding index, n (%)			**<0.001**
0	15 (14%)	37 (40%)	
1	24 (22%)	30 (33%)	
2	43 (40%)	15 (16%)	
3	26 (24%)	10 (11%)	

Table 3: Logistic regression model for the comparison between OCP use and plaque and gingival indices.

Predictor	Odds ratio	95% CI		P-value
		Lower	Upper	
Plaque Index:				
Use of OCP				
Yes – No	6.19	2.00	19.20	**0.00**
Age (Years)	0.99	0.95	1.03	0.53
Duration of OCP use (Years)	0.92	0.65	1.29	0.62
Gingival bleeding index:				
1 – 0				
Use of OCPs				
Yes – No	1.21	0.26	5.65	0.81
Age	1.01	0.96	1.06	0.76
Duration	1.19	0.74	1.91	0.47
2 – 0				
Use of OCPs				
Yes – No	8.29	2.05	33.60	**0.00**
Age	0.99	0.94	1.04	0.78
Duration	0.94	0.61	1.44	0.77
3 – 0				
Use of OCPs				
Yes – No	8.80	1.91	40.51	**0.01**
Age	0.98	0.92	1.03	0.37
Duration	0.88	0.55	1.40	0.59

DISCUSSION

Periodontal diseases are common inflammatory conditions affecting the soft tissues around the teeth, leading to progressive damage of supporting structures.[13] Hormonal alterations can trigger gingivitis and periodontitis, however, the impact of OCPs on periodontal disease is still unclear.[14] In this study we aimed to explore the relationship between OCP use, its duration, and periodontal disease severity in Jordanian women.

In our cohort, OCP use was reported in 54% of women with an average duration of 2.6 years. Overall, 65% of the women had a positive plaque index, indicating plaque presence at the gingival margins. In addition, our results showed a significant association between OCP use and higher odds of having a positive plaque index compared to non-users. However, the duration of OCP use was not significantly related to the plaque index, indicating that the presence of plaque might be more related to the use itself rather than how long the OCPs were taken. In contrast, a study by et al. showed that plaque index in OCP users increased with longer durations of OCP use.[15] In a systematic review by Ali et al. on 13 studies investigating the effect of OCP use and duration on plaque index showed that three studies only reported increased plaque index with increased OCP duration.[15-18] There is still no clear consensus on the association

between OCP duration and periodontal health. In a study by Domingues et al. showed no significant association between the duration of OCP use and periodontal indices.[19]

Furthermore, the gingival bleeding index revealed a range of severity in gingival inflammation and bleeding, from no bleeding in 26% of participants to severe bleeding in 18%, with a significantly higher proportion of OCP users in the moderate (grade 2) and severe (grade 3) gingival inflammation categories compared to non-OCP users. In addition, our results revealed a significantly higher association between moderate or severe gingival inflammation and OCP use, with 8.29- and 8.80-times higher odds of having grade 2 and grade 3 gingival bleeding index, respectively. In line with our results, a study by AlGhamdi et al. showed that 25.5% of women had increased dental caries after OCP use, and 36% had gingival disease with 51% having gingival bleeding after brushing their teeth.[20] However, they did not evaluate the gingival health based on the gingival bleeding index.

Our study presents several strong points. One of the main strengths is the inclusion of comprehensive periodontal examinations, performed by expert periodontists and using well-validated indices like the Plaque Index (PI) and Gingival Bleeding Index (GBI), which ensures robust and objective assessment of periodontal health. In addition, we excluded women with any systemic manifestation that could affect the oral health to investigate the influence of OCPs solely. However, several limitations need to be acknowledged. First, this is a single-center study, which may limit the generalizability of the findings to other populations or regions. Second, we relied on self-reported data for OCP use and its duration, which may introduce recall bias. Furthermore, the cross-sectional nature of the study limits the ability to establish a causal relationship between OCP use and periodontal disease. Future multicenter prospective studies are needed to enhance the generalizability of the findings across different populations and settings, and to investigate the causal relationship between OCP use and periodontal health over time. Additionally, exploring the role of other potential confounders such as diet, socioeconomic status, and lifestyle factors could provide a more comprehensive understanding of the influence of OCPs on periodontal disease.

In conclusion, our results showed a significant association between OCP use and increased plaque accumulation and gingival inflammation, as measured by the Plaque Index and Gingival Bleeding Index. Women using OCPs were found to have higher odds of having moderate to severe gingival inflammation compared to non-users. However, the duration of OCP use did not significantly correlate with the severity of periodontal disease. These findings underscore the need for increased awareness of the potential oral health impacts of OCP use and the importance of regular dental check-ups for women using oral contraceptives.

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