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Maternal Periodontal Disease During Pregnancy and Its Association with Preterm Birth and Low Birth Weight

Amparo Pérez Silva[1], Ester Villalón González-Conejero[1], Andrea Poza Pascual[2]*, Clara Serna-Muñoz[1], Yolanda Martínez-Beneyto[1] and Antonio José Ortiz-Ruiz[1]

[1]*Department of Dermatology, Stomatology and Radiology, Faculty of Medicine-Dentistry, University of Murcia, Hospital Morales Meseguer, 30008. Murcia, Spain*

[2]*Department of Stomatology, Faculty of Medicine and Nursing, University of The País Vasco, Leioa, Bizkaia, Spain*

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***Corresponding author:** Andrea Poza Pascual, Department of Stomatology, Faculty of Medicine and Nursing, University of The País Vasco, Leioa, Bizkaia, Spain.

Abstract

Background: Periodontal disease is a multifactorial inflammatory condition that includes gingivitis and periodontitis and has increasingly been associated with systemic health outcomes. During pregnancy, hormonal, immunological, microbiological, and behavioral changes may increase susceptibility to periodontal alterations. Maternal periodontal disease has been proposed as a possible risk factor for adverse perinatal outcomes, particularly preterm birth (PTB) and low birth weight (LBW).

Objective: To analyze the possible association between periodontal disease during pregnancy, including gingivitis and periodontitis, and the occurrence of preterm birth and/or low birth weight.

Methods: An observational clinical study was conducted in pregnant women in the third trimester of pregnancy recruited from two primary healthcare centers in Murcia, Spain. After informed consent, participants underwent an intraoral periodontal examination using the Community Periodontal Index of Treatment Needs (CPITN/CPI). Following delivery, gestational age at birth and neonatal birth weight were obtained by telephone follow-up. The main study variables were maternal periodontal status, preterm birth, and low birth weight.

Results: A total of 35 pregnant women were initially included, and 30 provided complete postnatal outcome data. Gingivitis was observed in 91.4% of participants and periodontitis in 60%. Most births were full-term, and only one case of preterm birth was recorded. No statistically significant associations were found between gingivitis and PTB or between periodontitis and PTB. A moderate positive correlation was observed between gingivitis and LBW, whereas periodontitis showed a small positive correlation with LBW.

Conclusions: A high frequency of gingival and periodontal alterations was observed in this sample of pregnant women. Although no statistically significant association was found between periodontal disease and preterm birth, a positive correlation was identified between maternal periodontal disease and low birth weight, particularly in the case of gingivitis. These findings should be interpreted with caution due to the study's methodological limitations.

Keywords: Pregnancy; Periodontal disease; Gingivitis; Periodontitis; Preterm birth; Low birth weight; Maternal oral health.

Introduction

The oral microbiota constitutes a complex ecosystem composed of more than 700 bacterial species, many of which are organized into biofilms adhered to dental surfaces and oral tissues [1-3]. These biofilms, also referred to as oral biofilm or dental plaque, are part of the physiological balance of the oral cavity; however, alterations in their composition or in the host response may lead to dysbiosis capable of triggering inflammation and damage to periodontal tissues [4]. Periodontal disease is a multifactorial inflammatory condition that mainly includes gingivitis and periodontitis. Gingivitis is a reversible inflammatory process limited to the gingival tissues, whereas periodontitis represents a more advanced and irreversible form characterized

by destruction of the periodontal ligament and alveolar bone [5]. Due to its high prevalence, especially in the case of periodontitis, estimated at approximately 11% worldwide, this condition represents a significant public health concern.

In recent years, growing evidence has highlighted the bidirectional relationship between periodontal health and systemic health [6]. In this context, pregnancy is of particular interest, since the hormonal, immunological, microbiological, and behavioral changes that occur during gestation may favor the onset or progression of periodontal alterations [7,8]. Pregnancy gingivitis is highly prevalent and has been associated with an exaggerated gingival response to oral biofilm, even in the presence of plaque levels that are not necessarily high [9,10]. In addition, pregnancy has been associated with increased levels of periodontal pathogens such as Prevotella intermedia, Porphyromonas gingivalis, and Aggregatibacter actinomycetemcomitans, as well as vascular and immunological changes that increase periodontal inflammatory susceptibility [11]. Changes in diet and oral hygiene habits may also contribute to oral health deterioration during this period. The clinical relevance of this association lies in the possible relationship between maternal periodontal disease and adverse obstetric outcomes, including preterm birth (PTB), low birth weight (LBW), and preeclampsia3. Proposed pathophysiological mechanisms include hematogenous dissemination of periodontal pathogens or their lipopolysaccharides (LPS), as well as the systemic release of inflammatory mediators such as IL-1β, IL-6, TNF-α, and prostaglandin E2 (PGE2), potentially involved in disruption of the fetoplacental environment and induction of premature uterine contractions [12-15]. Despite the increasing body of evidence, the association between periodontal disease and adverse perinatal outcomes remains controversial, particularly regarding the true magnitude of this association and the influence of confounding factors. In this context, the aim of the present study was to analyze the possible association between periodontal disease during pregnancy, including gingivitis and periodontitis, and the occurrence of PTB and/or LBW. It was hypothesized that maternal periodontal disease could be significantly associated with both perinatal outcomes.

Materials and Methods

Study Design and Sample

An observational clinical study was conducted in pregnant women in the third trimester of gestation, recruited from two Primary Health Centers located in Murcia, Spain, where they attended prenatal education and childbirth preparation sessions. Both health centers authorized the conduct of the study.

After receiving information about the study, the participants who agreed to collaborate signed an informed consent form and underwent an intraoral examination. Following delivery, a telephone follow-up was carried out to record gestational age at birth and neonatal birth weight.

Women in the third trimester of pregnancy, without gestational pathologies and without toxic habits such as smoking or alcohol consumption, were included. Pregnant women in the first or second trimester, those with diseases during pregnancy, or those with toxic habits were excluded. The study was approved by the Ethics Committee of the University of Murcia.

Periodontal Evaluation

Clinical gingival and periodontal assessment was performed using the Community Periodontal Index of Treatment Needs (CPITN/CPI) (Table 1), with an intraoral mirror and a WHO millimetric periodontal probe. The oral cavity was divided into sextants, and the highest CPI code observed in each sextant was recorded. Six probing sites per tooth were assessed, and in epidemiological studies the index teeth established for this system were examined. Each of the conditions described above is identified by a numerical code (score), and a corresponding periodontal treatment need is assigned to each one. The CPI scores and their corresponding treatment needs (TN) are presented in (Table 2). Based on the clinical examination, the participants were classified in an orientative manner as having periodontal health, gingivitis, or periodontitis, according to the presence of gingival inflammation, bleeding on probing, and probing depth.

Table 1: Distribution of oral sextants assessed according to the CPI/CPITN system.

Dental Arch	Sextant	Tooth Range
Maxillary	Sextant 1	17–14
Maxillary	Sextant 2	13–23
Maxillary	Sextant 3	24–27
Mandibular	Sextant 6	47–44
Mandibular	Sextant 5	43–33
Mandibular	Sextant 4	34–37

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Table 2: Correspondence between Community Periodontal Index (CPI) codes and treatment needs (TN).

CPI Codes	Clinical Finding	Treatment Need (TN)
0	Healthy periodontal condition	TN0: No treatment required
1	Bleeding on probing	TN1: Oral hygiene instruction
2	Calculus and/or iatrogenic plaque-retentive factors	TN2: TN1 + non-surgical periodontal treatment (scaling and root planing [SRP]) + elimination of iatrogenic factors
3	Probing depth 4–5 mm	TN2: TN1 + non-surgical periodontal treatment (scaling and root planing [SRP]) + elimination of iatrogenic factors
4	Probing depth > 6 mm	TN3: TN1 + TN2 + complex treatment, which may include periodontal surgery

Study Variables

The main variables analyzed were maternal periodontal status during pregnancy and perinatal outcomes, specifically preterm birth (PTB) and low birth weight (LBW).

- PTB was defined as delivery before 37 weeks of gestation.
- LBW was defined as a neonatal birth weight below 2500 g.

Statistical Analysis

Continuous variables were expressed as mean ± standard deviation (SD) when normally distributed, or as median and interquartile range (IQR) when non-normally distributed. Categorical variables were described using frequencies and percentages. Group comparisons were performed using the chi-square test, and when required due to sample size, Fisher's exact test was used. The association between categorical variables was evaluated using Pearson's chi-square test. Statistical analysis was performed using R Core Team 2020, and a p-value < 0.05 was considered statistically significant.

Of the 35 pregnant women initially included, all completed the periodontal examination, although only 30 provided complete information regarding gestational age at delivery and neonatal birth weight; therefore, the analysis of PTB and LBW was performed on this subsample. Most participants were between 30 and 39 years of age (65.7%), and the median gestational age at the time of examination was 32.21 weeks (Table 3). Gingivitis was observed in 91.4% of the pregnant women and periodontitis in 60%. Regarding perinatal outcomes, 82.9% of deliveries were full-term, and only one case of preterm birth was recorded. The median birth weight was 3.46 kg (Table 4).

Table 3: Maternal age distribution and gestational age at delivery.

Muestra	Category	n	%
Age group (years)	20-29	6	17,1
	30-39	23	65,7
	40-49	6	17,1
Tipos de parto			
Parto a término		29	82,9
Parto pretérmino		1	2,9
Excluded		5	14,3

Table 4: Distribution of gingival and periodontal status among the study participants.

Fundings			
		n	%
Gingivitis	Yes	32	91.4
Periodontal Status	No	3	8.6
	Healthy	14	40
	Probing depth ≤3 mm		
	Periodontitis/ Pathological Probing depth ≥4 mm	21	60,0

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Results

Combined Variable Analysis

This analysis included data from 30 participants, as complete information was unavailable for five women. No statistically significant association was found between gingivitis and gestational age at delivery (Fisher's exact test, p = 0.966). Likewise, no significant association was observed between periodontal status and gestational age at delivery (p = 0.376). Regarding neonatal outcomes, a moderate positive correlation was identified between maternal gingivitis and low birth weight (LBW) (r = 0.32), while the association between pathological periodontal findings and LBW was small (r = 0.22). These results suggest that, in this sample, periodontal variables were not significantly associated with preterm delivery, although a possible relationship with low birth weight, particularly in relation to gingivitis, was observed.

Discussion

The present study analyzed the possible association between gingival and periodontal health status in pregnant women and the occurrence of preterm birth (PTB) and low birth weight (LBW). The main findings were the high frequency of gingivitis (91.4%) and periodontitis (60%) in the sample, the absence of a statistically significant association between gingivitis or periodontitis and PTB, and the presence of a positive correlation between gingivitis and LBW of moderate magnitude, as well as between periodontitis and LBW of smaller magnitude.

The high frequency of gingival and periodontal alterations observed in this sample is consistent with previous studies describing increased gingival inflammation and periodontal susceptibility during pregnancy as a consequence of hormonal, microbiological, and immunological changes[7,14,16]. However, these findings should be interpreted with caution, since the present study did not include a comparison group of non-pregnant women, which prevents attributing the high prevalence observed exclusively to pregnancy. In addition, the percentages found were higher than those reported by other authors for both gingivitis and periodontitis [16,17], which may be explained by methodological differences, sample size, or clinical assessment criteria. With regard to gestational timing, most participants were evaluated in the third trimester, with a median gestational age of 32.21 weeks. This aspect is relevant because several studies have reported greater clinical expression of gingivitis during the final stage of pregnancy, with improvement during the postpartum period [18-23]. However, in the present study it was not possible to compare findings across trimesters or to assess postpartum evolution, and therefore a direct relationship between gestational trimester and the magnitude of periodontal disease cannot be confirmed.

Regarding perinatal outcomes, no significant association was found between gingivitis and PTB or between periodontitis and PTB, in agreement with some previous studies [24-26]. However, these results differ from other investigations that have reported an association between maternal periodontal disease and preterm birth. This discrepancy may be related to the very low frequency of PTB in the sample, as only one case was recorded, which substantially limited the statistical power of the study to detect associations between variables. As for LBW, a positive correlation was observed between maternal gingivitis and low birth weight, of moderate magnitude, as well as a weaker positive correlation between periodontitis and LBW. These findings partially agree with studies and reviews suggesting a relationship between maternal periodontal disease and adverse neonatal outcomes [27-33], although other authors have not identified significant associations [33-40]. In this regard, the present findings support the hypothesis of a possible relationship between maternal periodontal inflammation and neonatal birth weight, although the magnitude of this association appears limited and should be interpreted cautiously.

This study has several limitations. First, the small sample size and the low frequency of adverse obstetric events limit the statistical power and generalizability of the results. Second, potentially relevant confounding variables such as socioeconomic status, frequency of dental visits, previous periodontal history, and oral hygiene level were not collected. In addition, periodontal assessment was performed using the CPITN/CPI, a useful screening tool for epidemiological purposes, but insufficient to establish a complete periodontal diagnosis compared with more comprehensive methods such as full-mouth periodontal charting [41-43]. Overall, the findings of this study reinforce the high frequency of gingival and periodontal alterations during pregnancy and suggest a possible relationship with certain perinatal outcomes, particularly LBW. Nevertheless, further studies with larger samples, longitudinal designs, and more comprehensive periodontal assessments are needed to clarify more precisely the magnitude and clinical relevance of this association. In this sample of pregnant women, a high frequency of gingivitis and periodontitis was observed. No statistically significant association was found between periodontal disease and preterm birth, whereas a positive correlation was identified between maternal periodontal disease and low birth weight, particularly in the case of gingivitis. These findings should be interpreted with caution due to the methodological limitations of the study and highlight the need for future research with greater statistical power.

Ethics Statement

The study was approved by the Ethics Committee of the University of Murcia. All participants provided informed consent prior to inclusion in the study.

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