Odontology

Do the clinical criteria used to diagnose periodontitis affect the degree of association with prematurity?

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Corresponding Author:	Jaume Miranda-Rius, M.D., D.D.S, Ph.D Departament d'Odontostomatologia. Facultat d'Odontologia. Universitat de Barcelona SPAIN
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	Departament d'Odontostomatologia. Facultat d'Odontologia. Universitat de Barcelona
Corresponding Author's Secondary Institution:	
First Author:	Jordi Moncunill-Mira, DDS
First Author Secondary Information:	
Order of Authors:	Jordi Moncunill-Mira, DDS
	Lluís Brunet-Llobet, MD, DDS, PhD
	Daniel Cuadras, PhD
	Núria Lorente-Colomé, MD
	Rosalia Pascal, MD
	Carlota Rovira, MD
	Alfons Nadal, MD, PhD
	Jaume Miranda-Rius, M.D., D.D.S, Ph.D
Order of Authors Secondary Information:	
Funding Information:	
Abstract:	In recent years several studies have examined the possible relationship between periodontal disease in pregnant women and preterm birth. One of the difficulties facing these studies is the heterogeneity of the clinical criteria used to define periodontitis. The aim of this cross-sectional study was to determine the degree of association between maternal periodontitis and preterm birth according to different consensus definitions of periodontitis. A study of 146 pregnant women was carried out at the Sant Joan de Déu Maternal and Children's Hospital in Barcelona. Periodontal examination was carried out within two days of birth. The study sample comprised 60 women with preterm births and 86 with term deliveries. The presence of periodontal disease was evaluated using the main clinical classifications published in the literature. The prevalence of periodontitis ranged from 25.4% to 52.1%, depending on the criteria used for its definition. Using the most restrictive criteria, pregnant women with periodontitis had a higher risk of preterm birth (OR: 7.49; p <0.001) and premature rupture of membranes (OR: 2.49; p = 0.017). Premature infants born to mothers with periodontitis presented a tendency towards low weight, adjusted for gestational age (OR: 3.32; p=0.065). Our findings suggest that the association between periodontitis and preterm birth is influenced by the definitions of periodontitis used. In the future, clinical studies should be complemented by the analysis of the biomolecular products derived from periodontal disease in the fetoplacental unit.

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Abstract

In recent years several studies have examined the possible relationship between periodontal disease in pregnant women and preterm birth. One of the difficulties facing these studies is the heterogeneity of the clinical criteria used to define periodontitis. The aim of this cross-sectional study was to determine the degree of association between maternal periodontitis and preterm birth according to different consensus definitions of periodontitis. A study of 146 pregnant women was carried out at the Sant Joan de Déu Maternal and Children's Hospital in Barcelona. Periodontal examination was carried out within two days of birth. The study sample comprised 60 women with preterm births and 86 with term deliveries. The presence of periodontal disease was evaluated using the main clinical classifications published in the literature. The prevalence of periodontitis ranged from 25.4% to 52.1%, depending on the criteria used for its definition. Using the most restrictive criteria, pregnant women with periodontitis had a higher risk of preterm birth (OR: 7.49; p <0.001) and premature rupture of membranes (OR: 2.49; p = 0.017). Premature infants born to mothers with periodontitis presented a tendency towards low weight, adjusted for gestational age (OR: 3.32; p=0.065). Our findings suggest that the association between periodontitis and preterm birth is influenced by the definitions of periodontitis used. In the future, clinical studies should be complemented by the analysis of the biomolecular products derived from periodontal disease in the fetoplacental unit.

Keywords: clinical diagnosis; periodontitis; gingivitis; epidemiology; premature birth.

Introduction

The association between periodontitis and cardiovascular disease, diabetes mellitus and certain adverse pregnancy outcomes has been extensively investigated in the literature [1]. Applying the criteria of causality described by Bradford Hill (1965), numerous studies have indicated a possible correlation between the presence of periodontal disease in pregnant women and some of the major gestational complications, such as preterm birth (PB) or low birth weight (LBW). Active periodontal disease during pregnancy favors the spread through the bloodstream of bacteria and inflammatory mediators from the oral cavity to the fetoplacental unit [2-5].

A growing body of evidence has attributed PB to multiple pathological processes. Among them, only intra-amniotic infection has been identified as a direct cause of PB. Periodontitis may in fact be involved in this infection, since the bacteria that cause it have been detected in the amniotic fluid. If this is the case, it would explain the dispersion of pathogens from the periodontal pockets via the bloodstream and their spread across the placenta [5-10]. However, the results obtained so far regarding the risk of association between PB and periodontitis are controversial. The lack of clarity may be due, in part, to the use of different diagnostic criteria to define periodontal disease; in general, the clinical diagnosis is based on the assessment of the presence and extent of periodontal pockets, clinical attachment loss (CAL) and the amount of alveolar bone loss, or a combination of these factors. In a recent meta-analysis (2019) assessing the association between periodontitis and preterm birth, Manrique-Corredor et al. found a positive relationship in 60% of studies. The authors identified inconsistent and dissimilar definitions of periodontitis as the most important limitations [11].

Expert groups from the European Federation of Periodontology (EFP) in 2005 and the American Academy of Periodontology (AAP) in 2007 proposed definitions of the condition. Although the two groups applied the same criteria, there are some differences in relation to their categorization of severe periodontitis. (Figure 1)

At the 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions (WW17), the definitions and classifications of periodontitis currently in use were debated, and the problems with regard to reaching agreement on the diagnostic criteria were recognized. It was acknowledged that, despite many

years of research, periodontal diseases had been classified using a range of clinical criteria which in some cases were not sufficiently accurate [12].

The same workshop established that a patient has periodontitis if: (i) interdental CAL is detectable in ≥2 non-adjacent teeth or (ii) buccal/oral CAL ≥3 mm with pocketing >3mm is detectable in ≥2 teeth. Based on the pathophysiology, three clearly distinct forms of the condition have been identified: necrotizing periodontitis, periodontitis as a direct manifestation of systemic diseases, and periodontitis whose presentation and aggressiveness can be classified by stage and grade [13]. Significantly, then, the prevalence of periodontitis may vary depending on the population studied and the definition used. In the present study, in addition to the definitions of the EFP, the AAP and the WW17, we used the more restrictive classification described by Gomes-Filho et al (2007), which includes a greater number of affected teeth and allows their grading in the clinical setting [14].

Against this background, the aim of the present study was to determine the degree of association between maternal periodontal disease and preterm birth, taking into account the different criteria used to diagnose periodontitis.

Materials and Methods

A cross-sectional study was carried out at the Maternal and Children's University Hospital of Sant Joan de Déu in Barcelona, which recruited 146 patients, 60 of whom had presented preterm birth (PB) and 86 a term delivery (TD) from February 2018 to July 2019. The project was evaluated and approved by the ethics and clinical research committee of the Sant Joan de Déu Foundation (Internal code: PIC: 26-18).

Inclusion and exclusion criteria:

Single pregnancies of mothers aged between 18-46 years who had given birth between 28 and 42 weeks of gestation were included. The birth was considered as a (TD) when it occurred between 37 and 42 weeks of gestation and (PB) if it occurred between 28 and up to 37 weeks.

Multiple pregnancies, any infectious processes other than periodontitis, and patients with fewer than 20 teeth were excluded. Women receiving periodontal treatment in the year prior to the study were not included. Patients with diabetes and who had taken antibiotics, anti-inflammatory drugs or corticosteroids during pregnancy were

also excluded. In addition, all study participants were required to sign informed consent documentation before delivery.

Variables studied:

Demographic and medical data of the pregnant women were collected, as were their histories of childbirth and other pregnancies. Term or preterm birth and low birth weight (LBW) were recorded [15].

In the dental examination, oral health habits were recorded and a complete periodontal examination was performed during the first two days of the postpartum by a single observer with previous experience in periodontics. Intraexaminer calibration was performed before the start of the study. This examiner was unaware of the mother's gestational condition (PB/TD) at the time of the examination. The calibration stage was overseen by a periodontist and a senior investigator, who carried out several consecutive sessions with the same patients in order to guarantee the reproducibility of all the clinical measures (intraexaminer Kappa 81.5%).

A standard periodontal probe (Michigan 8/11, Hu-Friedy, Chicago, IL, USA) was used and the probing depth of all teeth (which included six measures for each tooth) was recorded, as well as gingival recession and bleeding on probing. Bleeding on probing was assessed at the six sites where probing depth was determined and deemed positive if it occurred within 15 seconds after probing.

The degree of gingivitis was recorded using the Löe & Silness gingival index: 0) No inflammation; 1) Mild inflammation: slight color change and little change in texture; 2) Moderate inflammation: reddening, edema and moderate overgrowth. Bleeding when pressure applied; 3) Severe inflammation, marked reddening and swelling; tendency toward spontaneous hemorrhage. Ulceration [16].

We used the criteria of periodontal disease defined by Gomes-Filho et al. (2007), according to the four types of Exposure Measurement (EM) used: EM1 when there was at least one site with CAL 3mm, EM2 when there was at least one site with a probing depth 4mm, EM3 if there were at least four teeth with one or more sites with a probing depth 4mm and with CAL ≥3mm in the same site, and EM4 if at least four teeth were observed with one or more sites with probing depth 4mm, with CAL ≥3mm in the same site and the presence of bleeding on probing. Based on their results, for our study values of EM3 and EM4 were taken to indicate periodontitis [14, 17-21]. We also used the consensus definition of periodontitis developed by the EFP (EFP/2005)

and the AAP (AAP/2007) in addition to the definition proposed in 2017 by the WW17 [13, 22, 23]. (Figure 1).

In parallel, we performed a histological analysis of several placentas which were analysed for strictly tocological reasons and as part of the internal protocol in place at the obstetrics service. In double blind mode, two pathologists analysed the presence and degree of chorioamnionitis, according to the classification of the Amsterdam Placental Workshop Group Consensus, in order to determine an association between adverse pregnancy outcomes and maternal periodontitis [24].

Statistical analysis

Comparisons between groups of quantitative variables were carried out using the Student t test and the Mann-Whitney test for normal and non-normal distributions respectively. The comparison of the frequencies of categorical variables between PB group and TD group was established using the Chi-squared test or Fisher's exact test. Results with $p < 0.05$ were considered significant. SPSS 23.0 (IBM Corp.; Armonk, NY) was used for all statistical analysis.

The percentage of low birth weight for gestational age was assessed by calculating the percentile; birth weight was defined as low when it was below the 10th percentile.

Results

The sample comprised 146 pregnant women with a mean age of 31.7 years (range: 18-45 years). More than half were between 26 and 35 years old. As regards schooling, 53.4% of participants had completed secondary school, 39.7% university and 6.9% primary school. Other data recorded, including marital status, body mass index or toxic habits, are shown in Table 1. The differences between the groups for these values were not statistically significant.

In all, 56.8% of the women were primiparous and 34.2% secundiparous. Only 10% presented high blood pressure (values> 140 mmHg or> 90mmHg). The majority of deliveries were spontaneous (78.1%), 13.7% were forceps-assisted, and the remaining 8.2% were by caesarean section.

As regards oral hygiene habits, 81.5% of patients brushed their two or three times a day, 16.4% once and 2.1% never or only occasionally. On oral examination, 54.1% had varying degrees of gingivitis (22.6% mild, 24% moderate and 7.5% severe). Gingival bleeding on probing was found in 21.9% of the sample (n = 32); it was

slightly more frequent in mothers of PB babies than in TD group, although the differences were not statistically significant (p = 0.290, OR = 1.35) (Table 2, 3).

Using the EM criteria, 25.4% of the overall sample presented periodontitis. The rates were considerably higher with the other indices: 52.1% with the EFP criteria, 43.8% with the AAP criteria, and 44.5% according to WW17 (Table 2). Using the EM values, 46.7% of PB group presented periodontitis compared with 10.5% of TD group, a statistically significant difference (p <0.01); using the EFP, AAP, and WW17 criteria, rates of periodontitis were also higher in mothers of premature children, but the differences only reached significance when the AAP criteria were applied (Table 3).

Other adverse events included premature rupture of membranes (PROM) which occurred in 37.7% of the sample (n = 55), and low birth weight (LBW) (≤ 2500grs), recorded in 28.1% (n = 41). Periodontitis was recorded in 54.1% of mothers with PROM and in 51.4% of mothers with LBW children; the differences with respect to those without these adverse events were significant (p = 0.017) (p <0.001) (Table 4). Thus, with regard to adverse pregnancy outcomes, women with periodontitis according to the EM criteria had a higher risk of presenting PB (OR: 7.49), LBW newborn (OR: 4.13) and PROM (OR: 2.49).In addition, a logistic regression model was carried out according to EM criteria adjusted for potential confounder variables (BMI, high blood pressure, smoking, alcohol), and maternal periodontitis was maintained as the main risk factor for PB (OR 8.75, 95% CI: 2.87 -26.7).

Correlating low birth weight with gestational age, 16.6% (n = 24) of the total sample had LBW compared with 21.7% (n = 13) of premature babies. Relating LBW adjusted for gestational age with periodontitis in the mothers in the PB group, this event was more frequent in mothers with periodontitis (32.1%), although the differences did not reach significance (p = 0.065 OR = 3.32) (Table 4).

Of the 22 placentas studied, only three presented some type of inflammation: two cases of subchorionitis, and one of chorioamnionitis. Of the two placentas with subchorionitis, both mothers presented periodontitis according to EM criteria.

Discussion

During pregnancy, significant alterations are known to occur in the gums. The increase in vascular permeability, especially in the presence of bacterial plaque, leads to gingivitis; the mildest form of periodontal disease [25]. In addition to these

vascular alterations, changes in the immune system to allow tolerance of the fetus may also influence the periodontium, reducing its resistance to bacterial aggression [26]. Changes are also observed in the bacterial composition of the biofilm, with the growth of certain species of periodontopathogens. All these physiological events are directly related to the increase in gingival inflammation; this explains why more than half of the pregnant women in our sample had some degree of gingivitis, and indeed other authors have recorded gingivitis in between 30 and 75% of this population [26].

In the literature, the prevalence of periodontitis in pregnant women in industrialized regions is estimated to be between 20 and 50%. In our sample the rate was 25.4% according to Gomes-Filho et al.'s EM criteria, but higher if the AAP, EFP and WW17 criteria were applied [1, 3, 27]. The heterogeneity of the criteria used for the clinical diagnosis of periodontitis is a controversial issue that may lead to errors when examining relations between periodontal disease and specific systemic pathologies. Nevertheless it appears clear that the more rigorous the criterion for defining periodontal disease, the lower the frequency of this disease [14]. In our study we used Gomes-Filho et al's Exposure Measurements (EM) criteria for the definition of periodontitis which, in our view, are the most restrictive: for instance, the EM criteria require four affected teeth while the WW17 criteria require only two. The EM criteria also attach particular importance to bleeding on probing as an indication of active periodontal disease [28]. Besides, the EM gradation facilitates recording; it applies a set of criteria which were carefully assessed and chosen by Gomes-Filho et al based on previous studies carried out by other researchers [14].

Periodontitis has been associated with adverse pregnancy outcomes such as low birth weight, preterm birth, premature rupture of membranes and pre-eclampsia. In addition, periodontal bacteria have been isolated in the amniotic fluid in pregnant women, and certain periodontopathogens have been associated with adverse pregnancy outcomes. [25] In a sample of 57 placentas, Blanc et al. (2015) found a greater presence of *Fusobacterium Nucleatum* in placentas of mothers with periodontitis and in premature or low-weight births [5].

The combination of the spread of bacteria through the bloodstream and of inflammatory mediators originating in periodontal tissues appears to be the mechanism that eventually compromises the fetus-placental unit, and is a risk factor for certain adverse pregnancy outcomes [30].

The WHO estimates that some 15 million premature children are born every year in the world, and this figure continues to rise. About 30-35% of premature births are indicated for medical or obstetric complications, 40-45% are spontaneous, and 25-30% are due to PROM [31]. In this regard, our results indicate that maternal periodontitis defined according to the EM and AAP criteria is a potential risk indicator for PB and PROM; however, this is not the case if the criteria of EFP or WW17 are applied. In a sample of 84 cases and 345 controls, Martínez de Tejada et al (2012)'s study in Switzerland compared cases of periodontitis defined according to the criteria of the American and European consensuses. These authors concluded that early preterm delivery was associated with periodontitis when the AAP definitions are used, but that the European definitions proved inadequate for the study population because of the lack of discriminatory power [32]. In the study by Gesase et al (2017) in Tanzania, with a sample of 1117 participants and a prevalence of periodontal disease of 14.2%, the authors concluded that maternal periodontal disease is a potential independent risk factor for pre-eclampsia (OR: 4.12), low birth weight (OR: 2.41) and preterm birth (OR: 2.32) [33]. In that study no association with PROM was observed, in agreement with Abati et al. (2013)'s study of 230 premature babies and 520 controls in Italy [2]. In a multicenter case-control study comprising 1108 women with preterm births and 1094 with term deliveries at six centers in France, Nabet et al. (2010) did not find a correlation between periodontitis and any adverse pregnancy outcome [34]; however, Radochova et al. (2019) found that women with PROM had higher plaque indices and higher values for CAL and probing depth, and concluded that pregnant women with PROM had poorer periodontal health than women with uncomplicated pregnancies [35].

A systematic review by Madianos et al. (2002) observed a significant association between periodontitis and preterm birth along with low birth weight [36]. More recently, Daalderop et al. (2018) also showed associations between periodontal disease and PB (RR: 1.6), LBW (RR: 1.7), preeclampsia (OR: 2.2) and preterm LBW (RR: 3.4). In that study, the estimated population-attributable fractions for periodontitis were 5% to 38% for preterm birth, 6% to 41% for low birth weight, and 10% to 55% for preeclampsia [37]. These results coincide with some of our findings; in our study, pregnant women suffering from periodontitis according to EM criteria presented a higher risk of adverse pregnancy outcomes: PB (OR: 7.49), preterm LBW (OR: 4.13) and PROM (OR: 2.49).

In a study of 96 pregnant women, Moreu et al. (2005) took periodontal records during the first, second and third trimesters and concluded that periodontal disease was a risk factor for newborn LBW (OR 1st trimester: 0.81; OR 2nd trimester: 1.08; OR 3rd trimester: 1.99) [38]. In our study, LBW was previously adjusted for the corresponding gestational age in the 10th percentile, and was found to be 16.6% for the overall sample. Therefore, although periodontitis was a potential risk indicator for LBW in our sample, after adjusting for gestational age the results for this adverse outcome were not statistically significant.

In 2009, Katz et al. detected *Porphyromonas gingivalis* antigens in normal and asymptomatic human placenta. The authors indicated that *P. gingivalis* bacteremia spreads to the placenta and that disease occurs when there was a change in the overall host-microbe balance, much as in periodontal disease [39]. In addition, a study conducted by Nadal et al. of 50 placentas included in the study by Gesase et al. found a higher presence of chorioamnionitis (defined according to the Amsterdam Placental Workshop Group Consensus Statement) in patients presenting periodontal disease [40]. In our sample, however, we did not find an increased presence of chorioamnionitis or subchorionitis in the placentas of mothers with premature births.

Therefore, the key question is why some women develop an intra-amniotic infection and others do not. It seems that the answer is related to the microbiological ecosystem. This means that we need to examine the microbial ecology and the genetic factors that control the predisposition to infection and the inflammatory response, in order to understand the interactions between genes and the environment that predispose to preterm birth [41]. It has been observed that the placental microbiome differs in patients with PB [42,43]. The new techniques of mass sequencing and metagenomic analysis have revealed the existence of a maternal microbiome in a wide variety of locations including the mouth, vagina, bowel, womb and even the placenta, and have shown that this microbiome determines pregnancy outcomes, including PB [44, 45].

Several researchers agree that one of the most important limitations of studies relating periodontal disease to pregnancy complications is the heterogeneity of the clinical criteria applied to define the condition [9, 32, 46]. Our study clearly demonstrates this variability. Clinical experience with periodontal probing and with the criteria used to diagnose periodontitis may alter the correlation rate between maternal periodontitis and certain adverse pregnancy outcomes. However, it seems

reasonable to assume that in correlational research, the more restrictive the clinical diagnosis criteria when defining periodontal disease, the more robust the association obtained. Based on our findings, in future studies this clinical approach should be complemented with microbiological analyses of periodontal pathogens and inflammatory mediators derived from periodontitis, and attempts to detect other biomolecular products characteristic of periodontal disease in the fetus or placenta.

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Conflict of Interest

The authors have no conflicts of interest to declare.

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Figure 1

EM (Gomes-Filho et al.)	
1	≥1 site with CAL≥3mm
2	≥1 site with PD≥4mm
3	≥4 teeth with ≥ 1 site with PD≥4mm and CAL≥3mm
4	≥4 teeth with ≥ 1 site with PD≥4mm and CAL≥3mm + bleeding

EFP (European Federation of Periodontology)	
Incipient	Proximal CAL≥3mm in ≥2 non-adjacent teeth
Severe	Proximal CAL≥5mm in ≥30% of teeth

AAP (American Academy of Periodontology)	
Moderate	CAL≥4mm in ≥2 interproximal sites or PD ≥5mm in ≥2 interproximal sites
Severe	CAL≥6mm in ≥2 interproximal sites and PD ≥5mm in ≥1 interproximal sites

WW17 (World Workshop 2017)
. Interdental CAL at ≥2 non-adjacent teeth or
. Buccal or oral CAL ≥3 mm with pocketing >3 mm at ≥2 teeth

Figure 1. Diagnostic clinical criteria for periodontitis.
(CAL= Clinical attachment loss; PD= Probing depth)

Table 1

Variable	n	(%)	Control n (%)	Case n (%)
Age (years)				
≤ 25	26	(17.8)	14 (16.3)	12 (20.0)
26-35	78	(53.4)	47 (54.7)	31 (51.7)
≥ 36	42	(28.8)	25 (29.0)	17 (28.3)
Level of education				
Primary education	8	(6.9)	1 (1.5)	7 (14.0)
High school	62	(53.4)	35 (53.0)	27 (54.0)
University	46	(39.7)	30 (4.5)	16 (32.0)
Marital status				
Married/couple	86	(90.5)	49 (94.2)	37 (86.0)
Single mother	9	(9.5)	3 (5.8)	6 (14.0)
Number of living children				
0	83	(56.8)	52 (60.5)	31 (51.7)
1	50	(34.2)	29 (33.7)	21 (35.0)
2	6	(4.1)	2 (2.3)	4 (6.7)
3	4	(2.7)	2 (2.3)	2 (3.3)
4	3	(2.1)	1 (1.2)	2 (3.3)
Body Mass Index (BMI)				
Underweight (<18.5)	0	(0)	0 (0)	0 (0)
Normal (18.5-24.9)	32	(21.9)	16 (18.6)	16 (26.7)
Overweight (25-29.9)	74	(50.7)	41 (47.7)	33 (55.0)
Obese (>30)	40	(27.4)	29 (33.7)	11 (18.3)
Blood pressure				
Normal	131	(89.7)	73 (84.9)	58 (96.7)
High	15	(10.3)	13 (15.1)	2 (3.3)
Alcohol consumption				
No	142	(97.3)	83 (96.5)	59 (98.3)
Yes	4	(2.7)	3 (3.5)	1 (1.7)
Tobacco consumption				
No	122	(83.6)	76 (88.4)	46 (76.7)
Yes	24	(16.4)	10 (11.6)	14 (23.3)
Type of delivery				
Vaginal	114	(78.1)	69 (80.2)	45 (75.0)
Forceps	20	(13.7)	17 (19.8)	3 (5.0)
Caesarean	12	(8.2)	0	12 (20.0)
Tooth brushing				
3 times a day	44	(30.1)	28 (32.5)	16 (26.7)
Twice a day	75	(51.4)	43 (50.0)	32 (53.3)
Once a day	24	(16.4)	14 (16.3)	10 (16.7)
Occasionally/Never	3	(2.1)	1 (1,2)	2 (3.3)

Table 1. Characteristics of study participants. Overall description of the sample.

Table 2

Variable	n	(%)	Control n (%)	Case n (%)
Gingivitis				
No	67	(45.9)	41 (47.7)	26 (43.3)
Mild	33	(22.6)	21 (24.4)	12 (20.0)
Moderate	35	(24)	21 (24.4)	14 (23.3)
Severe	11	(7.5)	3 (3.5)	8 (13.3)
Gingival bleeding				
Yes	32	(21.9)	17 (19.8)	15 (25.0)
EM (*)				
1 (According to Noack et al.) [17].	60	(41.1)	41 (47.7)	19 (31.7)
2 (According to Hujoel et al.) [18].	49	(36.6)	36 (41.9)	13 (21.7)
3 (According to López et al.) [19,20].	28	(19.2)	8 (9.3)	20 (33.3)
4 (According to Gomes-Filho et al.) [14].	9	(6.2)	1 (1,2)	8 (13.3)
EFP				
Incipient	62	(42.5)	35 (40.7)	27 (45.0)
Severe	14	(9.6)	5 (5.8)	9 (15.0)
AAP				
Moderate	57	(39)	29 (32.6)	28 (46.7)
Severe	7	(4.8)	3 (3.5)	4 (6.7)
WW17				
Yes	65	(44.5)	33 (38.4)	32 (53.3)

Table 2. Characteristics of study participants. Periodontal description of the sample.
(*) EM3 – EM4: Periodontitis

Table 3

Variable		Control	Case		
		n (%)	n (%)	OR (95% CI)	(p-value)
Gingival bleeding					
	No	69 (80.2)	45 (75)		
	Yes	17 (19.8)	15 (25)	1.35 (0.6-3.0)	(0.290)
Periodontitis					
EM	No	77 (89.5)	32 (53.3)		
	Yes	9 (10.5)	28 (46.7)	7.49 (3.2-17.6)	(<0.001)
EFP	No	46 (53.5)	24 (40)		
	Yes	40 (46.5)	36 (60))	1.73 (0.9-3.4)	(0.075)
AAP	No	54 (62.8)	28 (46.7)		
	Yes	32 (37.2)	32 (53.3)	1.93 (1.0-3.8)	(0.039)
WW17	No	53 (61.6)	28 (46.7)		
	Yes	33 (38.4)	32 (53.3)	1.84 (0.9-3.6)	(0.053)

Table 3. Evaluation of gingival bleeding according to group and relation between periodontal disease in the different classifications and preterm birth.

EM=Exposure Measurement; EFP=European Federation of Periodontology; AAP= American Academy of Periodontology; WW17= World Workshop of 2017. Odds Ratio with a Confidence Interval of 95%

Table 4

Adverse events		Periodontitis (EM) No n (%)	Yes n (%)	OR (95% CI)	*p*value
Group/PB	TD	77 (70.6)	9 (24.3)	7.49	
	PB	32 (29.4)	28 (75.7)	(3.2-17.6)	(<0.001)
PROM	No	74 (67.9)	17 (45.9)	2.49	
	Yes	35 (32.1)	20 (54.1)	(1.2-5.3)	(0.017)
LBW	No	86 (79.6)	18 (48.6)	4.13	
	Yes	22 (20.4)	19 (51.4)	(1.9-9.1)	(0.000)
LBW (*)	No	28 (87.5)	19 (67.9)	3.32	
premature	Yes	4 (12.5)	9 (32.1)	(0.9-12.3)	(0.065)

Table 4. Relation between periodontal disease (according to the EM classification) and preterm birth, preterm premature rupture of membranes and low birth weight.

TD= Term delivery; PB= Preterm birth; PROM= Preterm premature rupture of membranes; LBW= Low birth weight).(*) LBW Adjusted for gestational age (percentile <10).