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ORIGINAL ARTICLE

Periodontal therapy and risk for adverse pregnancy outcomes

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Abstract Periodontitis has been associated with adverse pregnancy outcomes. Results from intervention studies are few and controversial. The present study assessed the effects of non-surgical periodontal treatment in the occurrence of adverse pregnancy outcomes. Two hundred forty-six eligible women were randomly divided into two groups: periodontitis intervention (n=122; undergoing non-surgical treatment during gestation) and periodontitis control (n=124; not treated during gestation). Univariate analysis was performed and estimates of relative risk were reported. Data from 225 women were analyzed. No differences for preterm birth (p=0.721), low birth weight (p=0.198), and preterm low birth weight (p=0.732) rates were observed. Relative risk estimates for preterm birth, low birth weight, and preterm low birth weight in the periodontitis intervention group were 0.915 (95% CI 0.561–1.493), 0.735 (95% CI 0.459–1.179), and 0.927 (0.601–1.431), respectively. Non-surgical periodontal treatment during the second semester of gestation did not reduce the risk for preterm birth, low birth weight, and preterm low birth weight.

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Introduction

Studies have suggested that periodontal disease could be a risk factor for preterm birth (PTB), low birth weight (LBW), and preterm low birth weight (PTLBW), due to its inflammatory infectious nature [1, 2].

Observational studies have showed conflicting findings. Some case–control and prospective studies reported a significant association between periodontitis and PTLBW [3–8], while other studies failed to demonstrate such association [9–11].

Some animal studies have revealed that the inoculation of periodontal pathogens induced a significant reduction of birth weight [12] and a significant increase in the occurrence of intrauterine growth restriction [13]. It was also demonstrated that the lethality rate was 3.9 times higher after 1 week postpartum [14].

Novak et al. [11] showed that non-surgical periodontal therapy significantly reduced levels of periodontal pathogens in pregnant women. However, changes in these bacteria resulting from therapy were not associated with preterm birth.

Some authors have verified the beneficial effects of mechanical debridement on maternal periodontal status followed by a reduction in the occurrence of PTLBW [15–18]. Although findings reported by Mitchell-Lewis et al. [9], Jeffcoat et al. [19], and Michalowicz et al. [20] demonstrated an improvement in maternal periodontal status after periodontal treatment, no effects on PTLBW were verified. Since findings are contradictory, there is the need for further investigations [21].

In this manner, the aim of the present study was to evaluate the effects of non-surgical periodontal treatment during the second trimester of gestation in the occurrence rates of PTB, LBW, and PTLBW.

Methods

Study sample

Sample consisted of women from a low socioeconomic class from prenatal care programs at two public hospitals in Belo Horizonte, Brazil. During the period of data collection, 737 women were determined to be eligible for the study. After having applied some exclusion and inclusion criteria, 439 women were selected for periodontal examination. Final sample consisted of 246 women diagnosed with periodontitis. Sample was then randomly divided in two groups: periodontitis intervention (PI) (n=122) and periodontitis control (PC) (n=124) (Fig. 1).

The present study received approval from the Ethics Research Committee from the Federal University of Minas Gerais and by the Review Board of Ethics from the municipal government of Belo Horizonte.

Inclusion and exclusion criteria

Medical records and prenatal forms from the hospital units were examined in an attempt to determine eligibility for the study. The inclusion criteria included healthy pregnant women aged 18–35 years, gestational period between 12 and 20 weeks, current single gestation, a minimum of 20 natural teeth, and the presence of periodontitis. The exclusion criteria included current genitourinary infection, chronic hypertension, diabetes, human immunodeficiency virus infection and/or acquired immunodeficiency syndrome, current use of tobacco (smoking), alcohol and/or illicit drug use, and any medical condition requiring antibiotic prophylaxis for dental treatment. In addition, women under the use of any antibiotic or non-steroid anti-inflammatory agents, antiseptic mouthwashes, and drugs that can induce gingival overgrowth, as well as those under current periodontal treatment, were excluded from the sample.

Data collection

During prenatal visits, women were selected and invited to participate in the study. At that time, participants were informed of the aims of the study and were provided with a written informed consent. Data were systematically obtained through patient questionnaires and included previous gestations, previous abortions, previous preterm births, stillbirths, number of live children, multiple gestations, ethnicity, marital status, age, maternal weight, and education level.

Dental health care personnel were trained and calibrated to improve understanding of medical records and prenatal forms and to settle into the hospital routine before data collection.

Prenatal visits were scheduled monthly up to 34 weeks of gestation and every 2 weeks until parturition. Periodontal examination and periodontal procedures were scheduled according to this routine.

Periodontal assessment

A complete periodontal examination was performed. Probing depth (PD), clinical attachment level (CAL), and bleeding on probing (BOP) measurements were performed at six sites per tooth using a manual periodontal probe UNC15 (Hu-Friedy, Chicago, IL, USA). All teeth were evaluated, not including those with incomplete eruptive processes.

Intra-examiner agreement

All women in the sample were examined by one trained and calibrated periodontist (AMSDO). The calibration process included two periodontal examinations for the same subject, performed in two consecutive weeks on a total of ten women. Kappa scores were calculated for PD (k=0.82) and CAL (k=0.80). All k scores were considered to be satisfactory.

Criteria for periodontitis definition

Periodontitis was determined by the presence of four or more teeth with one or more sites with PD≥4 mm and CAL≥3 m [15].

Periodontal therapy

One group received non-surgical periodontal treatment during the gestation period (PI group), while one group did not receive periodontal treatment during gestation (PC group) (Fig. 1). The periodontist examiner (AMSDO) was blinded to the location of each subject within the groups.

All women were informed of their periodontal status and received a kit containing tooth brushes, dental floss, and toothpastes. Women from the PI group received oral hygiene instructions, plaque index evaluations, dental prophylaxis, and mechanical debridement, when necessary, under local anesthesia on all affected sites each month during the second trimester of gestation. Periodontal final

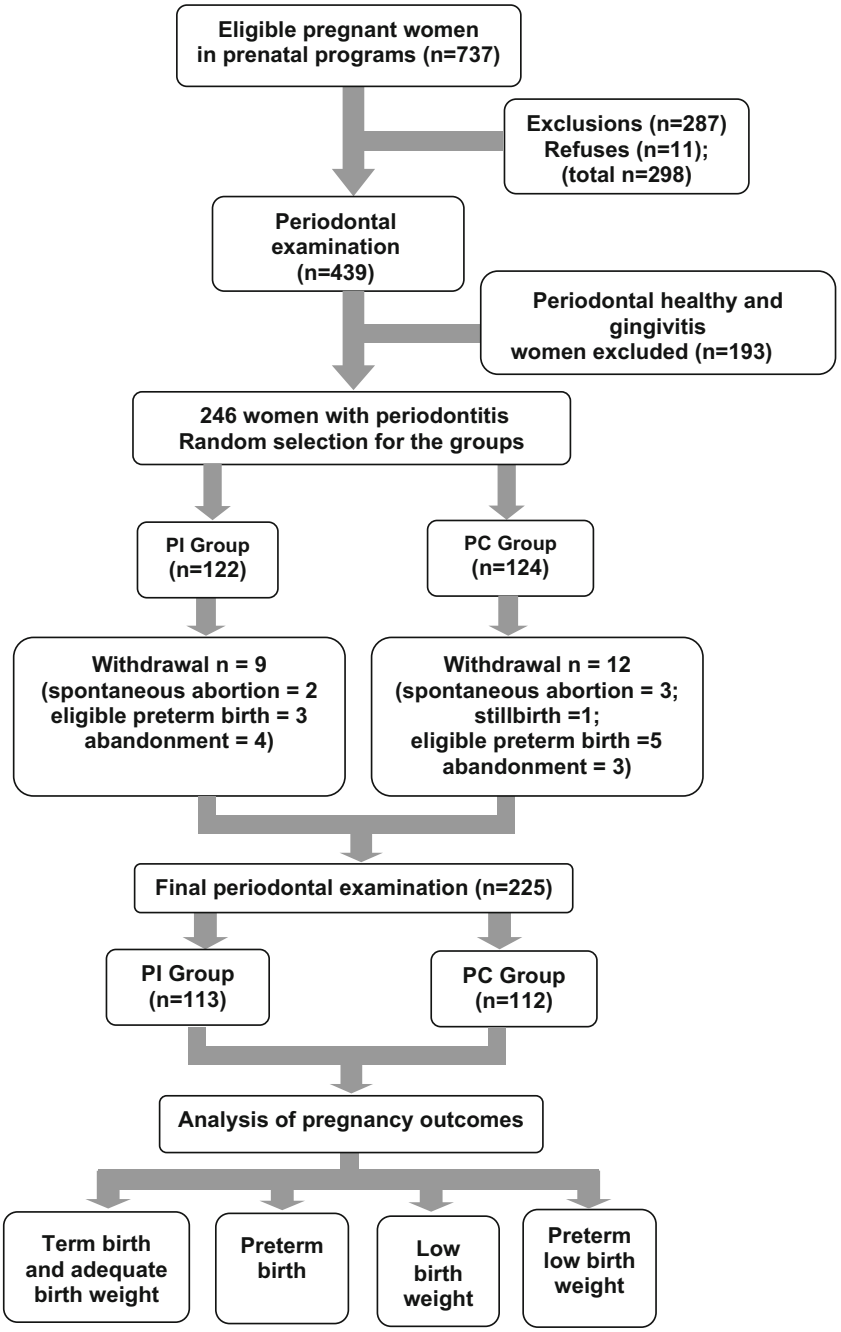

Fig. 1 Study design and sampling strategy

examination was performed 30–40 days after the periodontal intervention phase. Then, women were scheduled for periodontal maintenance visits every 3 weeks until parturition. The personnel who performed the periodontal therapy were trained to each step of periodontal intervention. Women from the PC group were recalled and re-examined during the 30th and 32nd weeks of gestation. This second examination was considered to be the final periodontal examination. At this point, periodontal treatment was offered to these women in postpartum.

Assessment of pregnancy outcomes

Gestational age was determined by obstetric criteria based on the date of the last menstrual period and confirmed through ultrasound performed between the 18th and 22nd week of gestation. After parturition, pregnancy outcomes were determined as follows: (a) preterm birth (less than 37 complete weeks of gestation), (b) low birth weight (less than 2,500 g of birth weight), (c) preterm low birth weight (less than 37 complete weeks of gestation and less than

Table 1 Baseline characteristics of the study patients

Variables	Groups		*p* value
	Intervention PI (*n*=113)	Controls PC (*n*=112)	
Maternal age (mean±SD)	29.96±4.38	26.58±3.96	0.500[a]
18–21 [*n* (%)]	14 (12.39)	17 (15.18)	0.826[b]
22–27 [*n* (%)]	45 (39.82)	44 (39.29)	
28-35 [n (%)]	54 (47.79)	51 (45.54)	
Maternal weight	62.47±9.61	61.90±7.87	0.628[a]
Prenatal visits	7.09±1.83	6.99±1.46	0.657[a]
Marital status [*n* (%)]			
With life partner	60 (53.10)	59 (52.68)	0.950[b]
Without life partner	53 (46.90)	53 (47.32)	
Educational level [*n* (%)]			
≤4 years	18 (15.93)	18 (16.07)	0.933[b]
4≥12 years	91 (80.53)	91 (81.25)	
>12 years	4 (3.54)	3 (2.68)	
Ethnic group [*n* (%)]			
White	38 (33.63)	37 (33.04)	0.870[b]
Black	37 (32.74)	37 (33.04)	
Other	38 (33.63)	38 (33.93)	

[a] Student's *t* test

[b] Chi-squared test

2,500 g of birth weight), and (d) term birth and adequate weight (from 37 to 42 complete weeks of gestation and birth weight greater than 2,500 g) [22].

Statistical analysis

Lilliefors and Bartlett tests were performed to verify normality and homogeneity of parametric data, respectively. In order to test the effects of periodontal status in the occurrence of PTB and/or LBW, Pearson's chi-squared and the Student's *t* tests, as well as the relative risk (RR) calculation, were performed when appropriate. Results were considered significant when $p<0.05$. All tests were performed using statistical software (Statistical Package for Social Science, SPSS; Windows release 12.0, Inc. Chicago, USA).

Results

During the period of the study, 737 pregnant women were included in prenatal programs in the public hospital units selected for the study. From this total, 287 did not meet the inclusion criteria and 11 refused to participate. Therefore,

Table 2 Periodontal status in the final and baseline examinations

Variables	Baseline		*p* value	Final		*p* value
	Intervention	Controls		Intervention	Controls	
Teeth present (mean)	26.30	25.95		25.80	25.81	
Sites with BOP	41.46	31.08	<0.0001[a]	19.21	34.85	<0.0001[a]
[% (95% CI)]	(40.57–42.35)	(30.24–31.92)		(18.49–19.93)	(33.9–35.72)	
Sites with PD≥4 mm	5.4980	4.7144	0.0071[a]	1.1921	6.3646	<0.0001[a]
[% (95% CI)]	(5.09–5.91)	(4.33–5.10)		(1.00–1.39)	(5.92–6.81)	
Sites with CAL≥3 mm	7.0105	6.2027	0.0141[a]	5.7204	6.5805	0.0069[a]
[% (95% CI)]	(6.55−7.47)	(5.76−6.64)		(5.30−6.14)	(6.13−7.03)	

[a] Chi-squared test

Table 3 Absolute and relative frequencies of adverse pregnancy outcomes in the groups

Groups	PTB		LBW		PTLBW	
	Yes	No	Yes	No	Yes	No
PI	24 (21.24%)	89 (78.76%)	23 (20.35%)	90 (79.65%)	29 (25.66%)	84 (74.34%)
PC	26 (23.21%)	86 (76.79%)	31 (27.68%)	81 (72.32%)	31 (27.68%)	81 (72.32%)
	p=0.722[a]		p=0.198[a]		p=0.733[a]	

[a] Chi- squared test

439 women were determined to be eligible and underwent periodontal examination. Of the 439 subjects enrolled, 193 patients were diagnosed with periodontal health or gingivitis and were excluded. During the study, 9 women from the PI group and 12 women from the PC group were excluded for different reasons: spontaneous abortion (5), stillbirth (1), eligible preterm birth (8), and abandonment (7). Therefore, data from the 225 women present at both the baseline and final examinations were analyzed. A flowchart of sampling strategy is summarized in Fig. 1.

Homoscedasticity of the groups in relation to maternal age, maternal body weight, and newborn birth weight was observed. The Bartlett test showed no significant differences in the variances of these variables (p>0.01). Groups were determined to be homogeneous through Lilliefors test (p>0.05).

Baseline characteristics are detailed in Table 1. The mean age of women in the PI group was 29.96±4.38 years and in the PC group 26.58±3.96 (p=0.500). It was observed that maternal weight (p=0.628), number of prenatal visits (p=0.657), marital status (p=0.950), educational level (p=0.933), and ethnicity (p=0.870) were not significantly different between the groups.

Table 2 shows periodontal variables in the baseline and final examinations. The mean number of teeth was homogeneously distributed among the groups. A higher frequency of sites with BOP, PD≥4 mm, and CAL≥3 mm was verified in the PI group when compared to the PC group in baseline examination. When analyzing periodontal clinical parameters in baseline and final examinations, a worsening in periodontal status of the PC group with an increase in the percentage of sites with BOP, PD, and CAL could be observed. A decrease in the percentage of sites with BOP, PD≥4 mm, and CAL≥3 mm was verified in the PI group.

Table 3 shows the occurrence of pregnancy outcomes within the groups. The occurrence rates of PTB, LBW, and PTLBW in the PI group were not statistically different from the PC group (p=0.722, p=0.198, and p=0.733, respectively).

RR estimates for adverse pregnancy outcomes are displayed in Table 4. RR estimates and 95% CI for PTB, LBW, and PTLBW for the PI group were of 0.915 (0.561–1.493), 0.735 (0.459–1.179), and 0.927 (0.601–1.431), respectively. It is important to note that, although the point estimates of RR for all events were acceptable, the 95% CI included the null. Consequently, these RR estimates were considered not significant.

Discussion

The present study was conducted to evaluate the effects of non-surgical periodontal procedures, performed during the second semester of gestation, on the incidence rates of PTB, LBW, and PTLBW.

It is important to highlight that the study design adopted strict exclusion and inclusion criteria, establishing classic risk factors and confounding variables for the events of interest. As stated by Wimmer and Pihlstrom [23], it is vital that periodontal exposure and adverse birth outcomes be clearly defined and the many potential confounding factors and possible effect modifiers for adverse pregnancy outcome be controlled. In this manner, the present study brings with it a particular contribution in relation to other intervention studies [15, 17, 20, 24, 25].

Another important methodological attribute of the present study is the homoscedasticity of the sample in the groups in relation to maternal age, marital status, educational level, ethnicity, prenatal visits, and maternal body weight.

Upon baseline examination, there was a higher frequency of sites with BOP, PD≥4 mm, and CAL≥3 mm in the PI group when compared to the PC group. In relation to periodontal changes between baseline and final examinations, a worsening in periodontal status in the PC group and an improvement in clinical parameters in the PI group could be observed. In this manner, the benefits of non-surgical

Table 4 Relative risk for the occurrence of PTB, LBW, and PTLBW in the groups

Variables	Groups		
	Intervention	Controls	Relative risk (95% CI)
PTB	24	26	0.915 (0.561–1.493)
LBW	23	31	0.735 (0.459–1.179)
PTLBW	29	31	0.927 (0.601–1.431)

periodontal therapy during pregnancy are clear. This is in accordance with previous reports [15–18, 20, 24, 25].

Regarding the effects of periodontal intervention on pregnancy outcomes, the results did not show a significant reduction in the risk for the occurrence of PTB, LBW, and PTLBW in the intervention group when compared to the control group.

Findings from the present study support previous results from three different studies. Dörtbudak et al. [4], Jeffcoat et al. [19], and Michalowicz et al. [20] also reported a significant improvement in the periodontal status of women who underwent periodontal therapy during gestation. However, no reduction in the occurrence of PTB and LBW was demonstrated.

In contrast, results showing a significant reduction in the occurrence of adverse pregnancy outcomes after periodontal therapy during gestation were reported in the literature [15, 16, 18, 25]. Divergences could be explained by methodological issues among the studies, such as sample composition, periodontitis, and adverse pregnancy outcomes definitions. It is well recognized that these issues can strongly influence the results and must be taken into account when analyzing the results [6, 23, 26–29].

A significant positive effect of non-surgical periodontal treatment on periodontal status and its beneficial impact on pregnancy outcomes in women diagnosed with gingivitis and periodontitis was demonstrated by Lopez et al. [15, 16]. However, it is important to emphasize that women presenting genitourinary infection during the period of the study were medicated with antibiotics. Another significant difference from our study was the use of 0.12% chlorexidine daily mouth rinses during periodontal therapy. Here, the results should be interpreted with caution. This approach can alter clinical response in relation to gingival bleeding.

Preliminary findings from Offenbacher et al. [17] showed that periodontal intervention reduced the incidence of PTLBW by 3.8-fold. Gazolla et al. [18] also demonstrated a significant reduction in the incidence rates of PTLBW among women treated during gestation.

Tarannum and Faizuddin [25] suggested that non-surgical periodontal treatment can significantly reduce the risk of PTLBW among women with periodontitis. Findings from this study showed significant differences between the intervention and control groups in relation to mean gestational age ($p<0.006$) and to birth weight ($p<0.044$).

In the present study, five cases of spontaneous abortion and one case of stillbirth were observed. They were excluded from the analysis since the pregnancy outcomes differ from those that were proposed to be evaluated in the present study (PTB, LBW, and PTLBW). In addition, seven cases of abandonment (women abandon the hospital units of the study with no medical protocol of transference) were observed. It was not possible to analyze these cases due to the absence of final periodontal examinations and records of pregnancy outcome.

The present study, as most studies which have investigated the effects of non-surgical periodontal intervention on pregnancy outcomes, showed an improvement in clinical periodontal status and beneficial effects in oral health. However, we believe that there is no sufficient evidence to state that periodontal therapy during gestation can influence gestational age and birth weight. These findings are in accordance with a recent European consensus (Kinane and Bouchard) [27] that stated that there is no evidence that treating periodontal disease decreases the rate of adverse pregnancy outcomes. Until the present moment, findings from studies in this field are still controversial and point to the need for more intervention studies with adequate design in different populations.

Conclusion

Findings from the present study demonstrated that non-surgical periodontal treatment during the second semester of gestation did not significantly reduce the risk for the occurrence of PTB, LBW, and PTLBW.

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Conflict of interest The authors declare that they have no conflict of interests.

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