Section: Obstetrics and Gynaecolcogy

Original Research Article

ASSESSING THE ASSOCIATION BETWEEN PERIODONTITIS IN EARLY PREGNANCY AND PRETERM LABOUR: A PROSPECTIVE CASE CONTROL STUDY

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ABSTRACT

Background: Periodontitis during pregnancy has been proposed as a potential risk factor for adverse pregnancy outcomes, including preterm birth. However, the magnitude of this association remains uncertain and may vary according to population and study design. This study assessed the association between periodontitis diagnosed during early pregnancy and subsequent preterm birth.

Materials and Methods: A prospective cohort study was conducted among antenatal women presenting before 20 weeks of gestation at a tertiary care centre. Participants underwent periodontal assessment during early pregnancy and were followed until delivery. Periodontitis was assessed clinically using probing depth and clinical attachment loss. Pregnancy outcome was categorized as preterm birth when delivery occurred before 37 completed weeks of gestation. Sociodemographic, obstetric, medical and oral-health characteristics were recorded. The association between periodontitis and preterm birth was assessed using a 2×2 contingency table and expressed as a crude odds ratio (OR) with 95% confidence interval (CI).

Results: A total of 303 women were included in the final analysis. Periodontitis was identified in 21 (6.9%) participants, while 282 (93.1%) did not have periodontitis. Preterm birth occurred in 21 (6.9%) women. Among women with periodontitis, 9 of 21 (42.9%) experienced preterm birth compared with 12 of 282 (4.3%) among women without periodontitis. There was a statistically significant association between periodontitis and preterm birth ($\chi^2 = 39.36$, $p < 0.001$). The crude odds ratio for preterm birth among women with periodontitis was 16.88 (95% CI: 5.97–47.74). The large effect estimate should be interpreted cautiously because the numbers of women with periodontitis and preterm births were small. An adjusted multivariable estimate was not available from the current dataset.

Conclusion: Periodontitis diagnosed during early pregnancy was significantly associated with subsequent preterm birth in this study. The observed association was strong, but the wide confidence interval and small number of events indicate that the estimate may be unstable. Larger multicentre prospective studies with adequate adjustment for potential confounding factors are required to confirm the association and determine its clinical significance.

Keywords: Periodontitis; pregnancy; preterm birth; periodontal disease; clinical attachment loss; probing depth; prospective cohort study.

INTRODUCTION

Preterm birth, defined as birth before 37 completed weeks of gestation, is an important cause of neonatal morbidity and mortality worldwide. In 2020, an estimated 13.4 million babies were born preterm, representing approximately one in ten live births. The burden is particularly high in Southern Asia and sub-Saharan Africa.[1]

The causes of preterm birth are multifactorial and include previous preterm birth, multiple pregnancy, maternal infection, hypertensive disorders, diabetes, cervical abnormalities, nutritional factors, and socioeconomic and behavioural determinants. In some women, however, the initiating pathway remains uncertain. Chronic inflammatory conditions at sites distant from the reproductive tract have therefore been investigated as possible contributors to adverse pregnancy outcomes.[2]

Periodontitis is a chronic inflammatory disease characterised by microbial dysbiosis, periodontal tissue destruction, and a sustained host inflammatory response. Pregnancy-related hormonal and immunological changes may influence periodontal health, and periodontal disease may remain clinically under-recognised among pregnant women.[3]

A possible association between periodontitis and adverse pregnancy outcomes has been proposed through microbial and inflammatory pathways. Periodontal organisms or their products may enter the systemic circulation, while inflammatory mediators may contribute to placental inflammation and activation of pathways involved in cervical ripening, membrane weakening, and uterine activity.[4,5]

Observational evidence has generally suggested an association between periodontitis and preterm birth, although the magnitude of the association varies across studies. A systematic review and meta-analysis of 20 analytical studies reported approximately twofold higher odds of preterm birth among women with periodontitis (OR 2.01, 95% CI 1.71–2.36). 6 Other reviews have reported a more modest association, and prospective studies have produced inconsistent results, particularly after adjustment for confounding factors.[7-9]

A 2026 systematic review and meta-analysis reported an overall OR of 2.38 (95% CI 1.78–3.18), while noting moderate certainty of evidence and attenuation after adjustment for important confounders.[10]

Because periodontal disease is clinically assessable and potentially modifiable, its relationship with preterm birth remains relevant to antenatal care. However, evidence that periodontal treatment prevents preterm birth remains inconclusive.[11,12] The present study therefore assessed whether periodontitis diagnosed before 20 weeks of gestation was associated with subsequent preterm birth among pregnant women followed until delivery.

Objectives:

Primary Objective: To assess the association between periodontitis diagnosed during early pregnancy and subsequent preterm labour/preterm birth among pregnant women.

Secondary Objectives:

1. To determine the prevalence and severity of periodontitis among pregnant women attending the antenatal clinic before 20 weeks of gestation.
2. To compare periodontal parameters, including probing depth (PD), clinical attachment loss (CAL), and bleeding on probing (BOP), between women who subsequently developed preterm labour and those who delivered at term.
3. To identify maternal and obstetric factors associated with preterm labour among the study participants.
4. To estimate the crude and adjusted odds ratios for the association between periodontitis and preterm birth after accounting for potential confounding factors.
5. To assess the potential utility of periodontal assessment during early pregnancy as a screening approach for identifying women at increased risk of preterm birth.

MATERIALS AND METHODS

Study design: A prospective cohort study was conducted to assess the association between periodontitis diagnosed during early pregnancy and subsequent preterm birth. Pregnant women fulfilling the eligibility criteria and presenting before 20 weeks of gestation were enrolled after written informed consent. Periodontal status was assessed at enrolment, before the pregnancy outcome was known, and participants were followed prospectively until delivery. Women who delivered before 37 completed weeks were classified as having preterm birth, while those delivering at or after 37 completed weeks were classified as having term birth.

Study setting: The study was conducted in the Department of Obstetrics and Gynaecology, Sri Madhusudan Sai Institute of Medical Sciences and Research, Chikkaballapura, Karnataka, in collaboration with the Department of Dentistry. Institutional Ethics Committee approval was obtained before initiation of the study, and written informed consent was obtained from all participants.

Study period and population: The study was conducted over 10 months. The study population consisted of antenatal women below 20 weeks of gestation attending the Department of Obstetrics and Gynaecology during the study period.

Sampling and sample size: Eligible women were recruited during the study period. The final analysis included 303 women. The original manuscript does not provide a formal a priori sample-size calculation or the numbers screened, excluded, lost to follow-up, and analyzed. These details should be added from the study records before journal submission rather than estimated retrospectively.

Recommended participant flow for completion before submission: women assessed for eligibility →

excluded with reasons → enrolled → lost to follow-up → included in final analysis (n=303).

Eligibility criteria: Inclusion criteria were: willingness to provide written informed consent; booked antenatal care at the study institution; gestational age below 20 weeks at enrolment; and singleton pregnancy.

Exclusion criteria were: pre-existing pregnancy-induced gingival hypertrophy; traumatic gingival recession; cervical dental caries; gingival recession due to tooth malposition; previous preterm delivery; multiple pregnancy; preeclampsia, gestational diabetes mellitus, cardiac disease, renal disease or uterine abnormalities; infections during pregnancy; and clinical, radiological or biochemical predictors of preterm birth.

Data collection: A structured proforma was used to record demographic, clinical, obstetric and periodontal information. A detailed history and general and systemic examination were performed. Oral hygiene practices and smoking or tobacco habits were also recorded.

Periodontal examination: Periodontal examination was performed using a Williams graduated periodontal probe. Dental examiners underwent calibration before commencement of the study. Standardisation included probe design, probing technique, probing force, probe angulation, identification of the cemento-enamel junction, probing-depth measurement and clinical-attachment-loss measurement.

Bleeding on probing (BOP), probing depth (PD), and clinical attachment loss (CAL) were assessed at six sites per tooth: buccal-mesial, mid-buccal, buccal-distal, lingual-mesial, mid-lingual and lingual-distal. PD was measured from the gingival margin to the base of the periodontal pocket. CAL was determined according to the relationship between the gingival margin and cemento-enamel junction. Attachment loss attributable to traumatic recession, cervical caries or tooth malposition was excluded from the periodontal diagnosis.

Definition of periodontitis: In the present study, periodontitis was defined clinically as a probing depth >3 mm together with interdental CAL ≥2 mm and/or buccal/oral CAL ≥3 mm, after excluding attachment loss attributable to non-periodontal causes. The original study records did not provide a separate staging or grading system; therefore, no severity category has been added to the revised Results. If severity data were recorded, they should be incorporated using the classification specified in the study protocol and supported by an appropriate periodontal-classification reference.

Pregnancy outcome: Participants were followed until delivery. Gestational age at delivery, mode of delivery, birth weight, premature rupture of membranes, relevant maternal complications and neonatal outcome, where available, were recorded. Preterm birth was defined as delivery before 37 completed weeks of gestation.

Blinding and quality control: Periodontal examination was performed by trained dental examiners who were not involved in determining pregnancy outcome. Examiners were blinded, as far as practically feasible, to the eventual pregnancy outcome. Standardised examination procedures were followed throughout the study.

Statistical analysis: Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 22.0. Categorical variables were summarized as frequencies and percentages. Continuous variables were summarized as mean ± standard deviation for normally distributed variables and median with interquartile range for non-normally distributed variables. Categorical variables were compared using the Chi-square test or Fisher's exact test, as appropriate. Normally distributed continuous variables were compared using the independent-samples t-test and non-normally distributed variables using the Mann–Whitney U test.

The association between periodontitis and preterm birth was assessed using crude odds ratios (ORs) with 95% confidence intervals (CIs). Multivariable logistic regression was planned to estimate adjusted ORs after accounting for clinically relevant confounding variables. The final adjusted model, including the variables entered and the method used for variable selection, should be reported only after verification from the original statistical output. Given that only 21 preterm births occurred, the number of predictors in any multivariable model should be restricted to avoid overfitting. A two-sided p-value <0.05 was considered statistically significant.



RESULTS

Table 1: Distribution of study participants according to age (n=303)

Age group (years)	Frequency	Percentage
≤20	46	15.2
21–25	143	47.2
26–30	80	26.4
>30	34	11.2
Total	303	100

The age of the study participants ranged from 18 to 38 years. Nearly half of the antenatal women (47.2%) belonged to the 21–25 years age group, followed by 26.4% in the 26–30 years age group. Women aged ≤20 years constituted 15.2% of the study population, while only 11.2% were older than 30 years.

Table 2: Distribution according to gravidity (n=303)

Gravidity	Frequency	Percentage
G1	144	47.5
G2	88	29
G3	33	10.9
G4 and above	38	12.6
Total	303	100

Almost half of the participants (47.5%) were primigravidae. Second gravida women constituted 29.0% of the study population, whereas 10.9% and 12.6% were gravida three and gravida four or more, respectively. This indicates that the majority of the study participants were experiencing their first or second pregnancy.

Table 3: Distribution according to obstetric complications

Complication	Frequency	Percentage
No complication	193	63.7
Previous LSCS	55	18.2
Hypothyroidism	23	7.6
Rh-negative pregnancy	7	2.3
Others	25	8.2
Total	303	100

Most women (63.7%) had no significant obstetric complications during pregnancy. Previous lower segment caesarean section was the commonest complication (18.2%), followed by hypothyroidism (7.6%). Rh-negative pregnancy and other obstetric conditions together accounted for less than one-tenth of the study population.

Table 4: Distribution according to oral hygiene status

Oral hygiene status	Frequency	Percentage
Normal (NAD)	165	54.5
Dental deposits/calculus/gingivitis and other abnormalities	138	45.5
Total	303	100

More than half of the study participants (54.5%) had clinically normal oral hygiene, while 45.5% had evidence of dental deposits, calculus, gingivitis, or other periodontal abnormalities. This demonstrates that poor oral hygiene was relatively common among the pregnant women included in the study.

Table 5: Distribution according to plaque score

Plaque score	Frequency	Percentage
0	95	31.4
1	98	32.3
2	86	28.4
≥3	24	7.9
Total	303	100

Plaque score of 1 was the most frequently observed finding (32.3%), followed closely by a score of 0 (31.4%) and score of 2 (28.4%). Only 7.9% of women had plaque scores of 3 or more, indicating that severe plaque accumulation was relatively uncommon.

Table 6: Distribution according to gingival index

Gingival index	Frequency	Percentage
0	193	63.7
1	79	26.1
2	31	10.2
Total	303	100

Approximately two-thirds (63.7%) of the participants had a gingival index of zero, indicating healthy gingiva. Mild gingival inflammation (score 1) was observed in 26.1% of women, while moderate gingival inflammation (score 2) was present in 10.2% of participants.

Table 7: Distribution according to probing depth

Probing depth	Frequency	Percentage
0 mm	18	5.9
2 mm	265	87.5
4 mm	20	6.6
Total	303	100

The majority of antenatal women (87.5%) demonstrated a probing depth of 2 mm, suggesting normal periodontal status. Only 6.6% had a probing depth of 4 mm, whereas 5.9% showed no measurable periodontal pocket.

Table 8: Distribution according to periodontitis

Periodontitis	Frequency	Percentage
Present	21	6.9
Absent	282	93.1
Total	303	100

Periodontitis was diagnosed in 21 women, corresponding to a prevalence of 6.9%. The remaining 93.1% of participants did not meet the diagnostic criteria for periodontitis, indicating a relatively low prevalence within the study population.

Table 9: Distribution according to preterm delivery

Preterm delivery	Frequency	Percentage
Yes	21	6.9
No	282	93.1
Total	303	100

Among the 303 enrolled women, 21 (6.9%) experienced preterm delivery, whereas 282 (93.1%) delivered at term. Thus, the incidence of preterm birth in the present study was 6.9%.

Table 10: Association between periodontitis and preterm delivery

Periodontitis	Preterm (Yes)	Preterm (No)	Total
Present	9	12	21
Absent	12	270	282
Total	21	282	303

A significantly higher proportion of women with periodontitis experienced preterm delivery compared to those without periodontitis. Chi-square analysis demonstrated a highly statistically significant association between maternal periodontitis and preterm labour ($\chi^2 = 39.36$, $p < 0.001$). These findings suggest that periodontitis during early pregnancy is significantly associated with an increased risk of preterm birth.

Table 11: Association between periodontitis and preterm delivery estimates

Exposure/outcome	Estimate	95% CI	p-value
Periodontitis and preterm birth: crude OR	16.88	5.97–47.74	<0.001

DISCUSSION

This prospective cohort study evaluated the association between periodontitis diagnosed before 20 weeks of gestation and subsequent preterm birth among 303 pregnant women. Periodontitis was identified in 21 (6.9%) participants, and 21 (6.9%) women subsequently delivered preterm. Preterm birth occurred in 9 of 21 women with periodontitis (42.9%) compared with 12 of 282 women without periodontitis (4.3%). The crude association was statistically significant (χ^2=39.36, p<0.001), with an OR of 16.88 (95% CI 5.97–47.74).

The prevalence of periodontitis in the present study was 6.9%. Differences from previous studies may reflect variation in diagnostic criteria, timing of periodontal assessment, periodontal examination methods, population characteristics and disease severity. The present study assessed women during early pregnancy and used clinical probing depth and attachment-loss criteria, which may identify established periodontal disease rather than gingivitis or nonspecific oral abnormalities.

The observed association is directionally consistent with previous evidence. Manrique-Corredor et al. reported approximately twofold higher odds of preterm birth among women with periodontitis (OR 2.01, 95% CI 1.71–2.36).[6] Other evidences have reported more modest associations, while prospective studies have shown variable results after adjustment for confounding. 7-9 A 2026 systematic review reported an OR of 2.38 (95% CI 1.78–3.18), with moderate certainty of evidence and attenuation after adjustment.[10]

The considerably larger crude OR observed in the present study should therefore be interpreted

cautiously. Only 21 women had periodontitis and only 21 women experienced preterm birth, with nine women belonging to both groups. Small cell counts can produce unstable effect estimates and wide confidence intervals. Residual confounding may also contribute to the observed association. An adjusted analysis based on a parsimonious model is therefore important before drawing conclusions regarding an independent association.

A biologically plausible relationship has been proposed through microbial and inflammatory pathways. Periodontal microorganisms or their products may enter the circulation, while systemic inflammatory mediators may contribute to placental and membrane inflammation and pathways involved in cervical ripening and uterine activity.[4,5] These mechanisms provide biological plausibility but do not establish causality in an observational study.

The study has several strengths. Periodontal status was assessed before pregnancy outcome, participants were followed until delivery, and the periodontal examination was standardized with examiner calibration. The prospective design establishes temporal sequence between periodontal exposure and subsequent pregnancy outcome. The study also attempted to reduce the influence of major obstetric and medical conditions through predefined eligibility criteria.

Several limitations should be considered. First, the number of participants with periodontitis and the number of preterm births were small, limiting statistical precision and increasing the risk of an unstable effect estimate. Second, the study was conducted at a single institution, which may limit generalizability. Third, residual confounding by socioeconomic status, oral hygiene, nutrition, smoking or tobacco exposure and other behavioural or clinical factors cannot be excluded. Fourth, the current manuscript does not provide the participant screening and follow-up flow, a formal a priori sample-size calculation, or the final adjusted regression output. These items should be completed from the original study records before submission. Finally, the study did not validate periodontal assessment as a prediction or screening tool; therefore, the findings should not be interpreted as establishing a screening test for preterm birth.

The findings support further investigation of the relationship between maternal periodontal health and preterm birth. Larger multicentre prospective studies with standardized periodontal definitions, adequate sample size and prespecified adjustment for important confounders are needed to determine whether the association persists after adjustment and whether periodontal assessment has clinically useful predictive value.

CONCLUSION

The present prospective case-control study demonstrated a significant association between periodontitis diagnosed during early pregnancy and subsequent preterm delivery. Periodontitis was identified in 6.9% of the study participants, and the overall incidence of preterm delivery was also 6.9%. Notably, 42.9% of women with periodontitis experienced preterm delivery compared with only 4.3% of women without periodontitis. The association was statistically highly significant (χ^2=39.36, p<0.001), with a crude odds ratio of approximately 16.88, indicating substantially higher odds of preterm delivery among women with periodontitis.

These findings support the hypothesis that maternal periodontal inflammation may have an important role in adverse pregnancy outcomes. Early periodontal assessment during antenatal care may therefore help identify women who could benefit from appropriate dental evaluation and preventive oral-health measures. However, the magnitude of association observed in the present study should be interpreted cautiously because of the relatively small number of periodontitis and preterm-delivery cases.

Larger, multicentric prospective studies with adequate adjustment for socioeconomic, behavioural, obstetric and medical confounding factors are warranted to confirm the independent association between periodontitis and preterm birth. Further research is also required to determine whether systematic periodontal screening and treatment during pregnancy can reduce the incidence of preterm delivery.

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