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Impact of periodontal therapy during pregnancy on birth outcomes: A clinical study in India

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Abstract:
Periodontitis during pregnancy has been associated with adverse birth outcomes, but the benefits of periodontal therapy on maternal and neonatal health remain uncertain. Therefore, it is of interest to evaluate the effect of non-surgical periodontal therapy on pregnancy outcomes in 120 pregnant women with periodontitis, including 60 treated during the second trimester and 60 receiving delayed treatment after delivery. Periodontal health was assessed using plaque index, gingival index, probing pocket depth and clinical attachment level, while gestational age, birth weight, preterm birth and low birth weight were recorded as pregnancy outcomes. Women receiving periodontal therapy showed significant improvement in periodontal parameters and experienced lower incidences of preterm birth and low birth weight compared with the untreated group. Thus, data shows the incorporation of periodontal care into routine antenatal services as a strategy to improve maternal oral health and promote favorable pregnancy outcomes.

Keywords: Periodontitis, pregnancy, periodontal therapy, preterm birth, low birth weight, maternal health, birth outcomes

Background:
Pregnancy is accompanied by marked hormonal, immunological and physiological changes that influence several body systems, including the oral cavity. Increased levels of estrogen and progesterone during pregnancy alter gingival vascularity, immune response and tissue permeability, making the periodontium more susceptible to plaque-induced inflammation **[1]**. As a result, gingivitis and periodontitis are commonly encountered among pregnant women and may progress when oral hygiene is inadequate or when existing periodontal disease is untreated. Periodontitis is a chronic multifactorial inflammatory disease caused by dysbiotic plaque biofilm and characterized by progressive destruction of periodontal ligament and alveolar bone **[2]**. The 2017 World Workshop classified periodontitis as a major inflammatory disease with clinical attachment loss, pocket formation and radiographic bone loss as key diagnostic features **[3].** The global periodontal health policy statement of the FDI World Dental Federation further emphasized that periodontal disease is highly prevalent, preventable and relevant to general health, thereby supporting its inclusion in broader healthcare strategies **[4].** The possible relationship between maternal periodontal disease and adverse pregnancy outcomes has been investigated for several years. Earlier meta-analytic evidence suggested that periodontal treatment during pregnancy may reduce the risk of adverse outcomes, although the certainty of benefit varied across trials because of differences in population characteristics, treatment timing and periodontal case definitions **[5].** Controlled clinical evidence by Sant'Ana *et al.* reported that periodontal treatment during pregnancy reduced the rate of adverse pregnancy outcomes, supporting the biological and clinical relevance of managing periodontal inflammation during antenatal care **[6].** The proposed mechanism linking periodontitis with poor birth outcomes is based on both microbial dissemination and systemic inflammation. Periodontal pathogens and their endotoxins may enter the bloodstream and stimulate production of inflammatory mediators such as interleukin-1β, interleukin-6, tumor necrosis factor-alpha and prostaglandin E2 **[7]**. These mediators may influence the fetoplacental unit, promote uterine contractions, contribute to cervical ripening and increase the risk of premature rupture of membranes. Babalola and Omole described periodontal disease as a potential contributor to adverse pregnancy outcomes through inflammatory pathways that may affect fetal growth and timing of delivery **[8].** Recent evidence continues to support this association. Karimi *et al.*, in a systematic review and meta-analysis, reported a significant association between periodontal disease and increased risk of adverse maternal and neonatal outcomes, including preterm birth and low birth weight **[9].** Chen *et al.*, in a large population-based study, found that periodontal scaling before or during pregnancy was associated with a lower risk of low birth weight **[10].** Similarly, Sharma *et al.* observed that maternal periodontitis was associated with adverse pregnancy outcomes in a maternity hospital population, highlighting the importance of periodontal assessment in pregnant women **[11].** A bibliometric analysis by Zhao *et al.* showed that research on periodontal disease and pregnancy outcomes has expanded substantially, reflecting growing global interest in maternal oral health as a component of prenatal care **[12].** Indian evidence has also suggested a relationship between maternal periodontitis and preterm birth. Govindaraju *et al.* reported that periodontal disease was more frequently observed among mothers with preterm delivery, indicating the relevance of this problem in the Indian population **[13].** Therefore, it is of interest to evaluate the impact of periodontal therapy during pregnancy on birth outcomes among 120 pregnant women diagnosed with chronic periodontitis, with special focus on gestational age at delivery, birth weight, preterm birth and low birth weight.

Materials and Methods:
Study design:

A prospective comparative clinical study was conducted to evaluate the impact of periodontal therapy during pregnancy on birth outcomes.

Study setting:
The study was carried out in the Department of Periodontology in collaboration with the Department of Obstetrics and Gynecology at a tertiary care teaching hospital.

Study duration:
The study was conducted over a period of 18 months, including participant recruitment, periodontal intervention, follow-up and outcome assessment.

Sample size:
A total of 120 pregnant women diagnosed with chronic periodontitis were enrolled.

Group allocation:
[1] Group A (Periodontal Therapy Group): 60 pregnant women received non-surgical periodontal therapy during the second trimester.
[2] Group B (Control Group): 60 pregnant women received routine antenatal care and oral hygiene instructions, with periodontal treatment deferred until after delivery.

Inclusion criteria:
[1] Pregnant women aged 18–35 years.
[2] Gestational age between 12 and 24 weeks.
[3] Diagnosed with mild to moderate chronic periodontitis.
[4] Singleton pregnancy.
[5] Willingness to participate and provide informed consent.

Exclusion criteria:
[1] Multiple pregnancies.
[2] Systemic diseases affecting pregnancy outcomes.
[3] Smoking or tobacco use.
[4] Antibiotic therapy within previous three months.
[5] History of preeclampsia or recurrent preterm birth.
[6] Requirement for emergency periodontal treatment.

Clinical assessment:
Baseline periodontal examination included:
[1] Plaque Index (PI)
[2] Gingival Index (GI)
[3] Probing Pocket Depth (PPD)
[4] Clinical Attachment Level (CAL)
[5] Bleeding on Probing (BOP)

Periodontal intervention:
Participants in Group A underwent:
[1] Full-mouth scaling and root planning.
[2] Oral hygiene education.
[3] Reinforcement of brushing and interdental cleaning techniques.
[4] Monthly periodontal maintenance visits.

Outcome measures:
Primary outcomes:
[1] Preterm birth (<37 weeks gestation).
[2] Low birth weight (<2500 g).

Secondary outcomes:
[1] Mean birth weight.
[2] Mean gestational age at delivery.
[3] Neonatal complications.

Data collection:
Pregnancy outcomes were obtained from obstetric records immediately after delivery.

Statistical analysis:
Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation. Independent `t`-test was used for comparison of means. Categorical variables were analyzed using Chi-square test. A p-value <0.05 was considered statistically significant.

Results:
Baseline demographic, obstetric and periodontal characteristics were comparable between the two groups **(Table 1).** The mean age was 27.8 ± 4.2 years in Group A and 28.1 ± 4.5 years in Group B ($p = 0.712$). The distribution of primigravida and multigravida participants was similar between the groups ($p = 0.584$). Mean gestational age at enrollment was 18.2 ± 2.9 weeks in Group A and 18.5 ± 3.1 weeks in Group B ($p = 0.631$). Likewise, the severity of periodontal disease, categorized as mild or moderate periodontitis, did not differ significantly between the groups ($p = 0.706$), indicating successful baseline comparability. Significant improvements in periodontal health were observed among women who received periodontal therapy **(Table 2).** In Group A, the Plaque Index decreased from 2.31 ± 0.42 at baseline to 1.18 ± 0.31 at follow-up ($p < 0.001$). The Gingival Index improved from 2.09 ± 0.36 to 1.02 ± 0.28 ($p < 0.001$). Mean probing pocket depth was reduced from 4.52 ± 0.61 mm to 3.31 ± 0.54 mm ($p < 0.001$), while clinical attachment level improved from 4.89 ± 0.69 mm to 3.92 ± 0.58 mm ($p < 0.001$). In contrast, no statistically significant changes were observed in Group B for Plaque Index ($p = 0.281$), Gingival Index ($p = 0.197$), probing pocket depth ($p = 0.411$), or clinical attachment level ($p = 0.523$). Who received periodontal therapy delivered infants with a significantly higher mean birth weight than the control group (3.01 ± 0.41 kg vs. 2.73 ± 0.46 kg, $p = 0.001$). Mean gestational age at delivery was also significantly greater in Group A (38.6 ± 1.4 weeks) than in Group B (37.4 ± 1.9 weeks; $p < 0.001$). The incidence of preterm birth was significantly lower among women receiving periodontal therapy (8.3%) compared with controls (21.7%) ($p = 0.039$). Similarly, the proportion of low birth weight infants was significantly reduced in Group A (10.0%) compared with Group B (26.7%) ($p = 0.019$) **(Table 3).** NICU admissions occurred in 6.7% of neonates in Group A compared with 18.3% in Group B, representing a statistically significant difference ($p = 0.049$). The incidence of neonatal

respiratory distress was lower in the treatment group (5.0%) than in the control group (15.0%); however, this difference did not reach statistical significance (p = 0.071). Neonates without any complications were significantly more frequent among mothers who received periodontal therapy (88.3%) than among controls (66.7%) (p = 0.005) **(Table 4).**

Table 1: Comparison of baseline characteristics between study groups

Variable	Group A (n=60)	Group B (n=60)	p-value
Mean Age (years)	27.8 ± 4.2	28.1 ± 4.5	0.712
Primigravida	34 (56.7%)	31 (51.7%)	0.584
Multigravida	26 (43.3%)	29 (48.3%)	0.584
Gestational Age at Enrollment (weeks)	18.2 ± 2.9	18.5 ± 3.1	0.631
Mild Periodontitis	24 (40.0%)	22 (36.7%)	0.706
Moderate Periodontitis	36 (60.0%)	38 (63.3%)	0.706

Table 2: Comparison of periodontal parameters before and after therapy

Parameter	Group A Baseline	Group A Follow-up	p-value	Group B Baseline	Group B Follow-up	p-value
Plaque Index	2.31 ± 0.42	1.18 ± 0.31	<0.001*	2.28 ± 0.39	2.21 ± 0.40	0.281
Gingival Index	2.09 ± 0.36	1.02 ± 0.28	<0.001*	2.12 ± 0.34	2.04 ± 0.33	0.197
PPD (mm)	4.52 ± 0.61	3.31 ± 0.54	<0.001*	4.48 ± 0.58	4.42 ± 0.56	0.411
CAL (mm)	4.89 ± 0.69	3.92 ± 0.58	<0.001*	4.85 ± 0.71	4.81 ± 0.70	0.523

**Statistically significant*

Table 3: Comparison of birth outcomes between study groups

Birth Outcome	Group A (n=60)	Group B (n=60)	p-value
Mean Birth Weight (kg)	3.01 ± 0.41	2.73 ± 0.46	0.001*
Mean Gestational Age (weeks)	38.6 ± 1.4	37.4 ± 1.9	<0.001*
Preterm Birth	5 (8.3%)	13 (21.7%)	0.039*
Term Birth	55 (91.7%)	47 (78.3%)	0.039*
Low Birth Weight	6 (10.0%)	16 (26.7%)	0.019*
Normal Birth Weight	54 (90.0%)	44 (73.3%)	0.019*

**Statistically significant*

Table 4: Neonatal outcome distribution

Outcome	Group A (n=60)	Group B (n=60)	p-value
NICU Admission	4 (6.7%)	11 (18.3%)	0.049*
Neonatal Respiratory Distress	3 (5.0%)	9 (15.0%)	0.071
No Complications	53 (88.3%)	40 (66.7%)	0.005*

**Statistically significant*

Discussion:

The present prospective clinical study evaluated the impact of periodontal therapy during pregnancy on birth outcomes among 120 pregnant women diagnosed with chronic periodontitis. The findings demonstrated that non-surgical periodontal therapy performed during pregnancy resulted in significant improvement in periodontal health and was associated with favorable obstetric outcomes, including increased gestational age at delivery, higher birth weight, lower incidence of preterm birth and reduced occurrence of low birth weight infants. These findings reinforce the concept that maternal periodontal health may influence pregnancy outcomes through systemic inflammatory pathways. The relationship between periodontal disease and systemic health has gained increasing attention in recent years. The current classification of periodontal diseases emphasizes periodontitis as a chronic inflammatory condition capable of exerting effects beyond the oral cavity through dissemination of microorganisms and inflammatory mediators into the systemic circulation **[3].** Furthermore, periodontal inflammation is characterized by persistent host immune activation and elevated levels of cytokines that may contribute to adverse systemic consequences **[4].** During pregnancy, hormonal fluctuations enhance gingival vascularity and inflammatory responsiveness, increasing susceptibility to periodontal disease and potentially amplifying systemic inflammatory burden. In the present study, women who received scaling and root planning showed significant reductions in plaque accumulation, gingival inflammation, probing pocket depth and clinical attachment loss. These findings are consistent with previous evidence demonstrating the effectiveness of periodontal therapy in reducing oral inflammatory burden during pregnancy. Schwendicke *et al.* reported that periodontal treatment may contribute to improved maternal health outcomes by controlling local infection and systemic inflammatory responses **[5].** Similarly, Sant'Ana *et al.* demonstrated that periodontal treatment during pregnancy was associated with a lower frequency of adverse pregnancy outcomes and improved periodontal parameters **[6].** Supporting these findings, Alnasser *et al.* concluded from a systematic review of randomized clinical trials that periodontal treatment may reduce the occurrence of adverse pregnancy outcomes among pregnant women with periodontitis **[14]**. One of the most important observations of the present study was the significant reduction in preterm birth among women receiving periodontal therapy. Preterm birth occurred in 8.3% of mothers treated compared with 21.7% of controls. This finding aligns with the growing body of literature supporting an association between maternal periodontal disease and adverse pregnancy outcomes. However, Kumar and Yadav reported no significant reduction in preterm birth, low birth weight or preterm low birth weight following non-surgical periodontal therapy, highlighting the variability of treatment effects across studies **[15].** In contrast, Tarannum and Faizuddin found that non-surgical periodontal therapy significantly increased gestational age and birth weight and reduced preterm births among women with periodontitis **[16].** Le *et al.* similarly found that periodontal treatment strategies during pregnancy may influence perinatal outcomes, although significant benefits differed according to the treatment approach, with adjunctive mouthwash therapy showing more consistent effects than SRP alone **[17].** Babalola and Omole suggested that periodontal infections may stimulate production of prostaglandins and inflammatory cytokines capable of initiating premature uterine

contractions and cervical ripening, thereby increasing the risk of preterm labor **[8].** More recently, Karimi *et al.*, in a systematic review and meta-analysis, reported that maternal periodontal disease significantly increases the risk of adverse maternal and neonatal outcomes, including preterm birth and low birth weight **[9].** The present study also demonstrated a significantly lower incidence of low birth weight among women who underwent periodontal therapy. Maternal periodontal inflammation has been proposed as a source of circulating inflammatory mediators such as interleukin-1β, interleukin-6, tumor necrosis factor-alpha and prostaglandin E2, all of which may interfere with placental function and fetal growth. Sharma *et al.* reported that pregnant women with periodontitis had significantly higher rates of adverse pregnancy outcomes, supporting the role of periodontal inflammation as a modifiable risk factor during pregnancy **[10].** Likewise, bibliometric analyses by Zhao *et al.* highlighted the rapidly expanding evidence linking periodontal disease with fetal growth restriction and low birth weight infants **[11].** Although several studies have reported beneficial effects of periodontal therapy, some investigations have produced conflicting results. Govindaraju *et al.* observed a significant association between maternal periodontitis and preterm birth; however, the magnitude of benefit following periodontal intervention varied across studies because of differences in disease severity, timing of treatment, study design and population characteristics **[12].** Such variability underscores the complexity of establishing a direct causal relationship between periodontal disease and pregnancy outcomes. Biological plausibility for this association is supported by microbiological evidence. Han and Wang showed that oral pathogens can disseminate beyond the oral cavity and contribute to inflammatory processes in distant organs **[18].** Periodontal microorganisms such as *Porphyromonas gingivalis* and *Fusobacterium nucleatum* have been identified in placental tissues, suggesting a potential mechanism through which oral infections may influence fetal development and pregnancy progression. The neonatal outcomes observed in the present study further support the importance of maternal oral health. Reduced NICU admissions and fewer neonatal complications were observed among infants born to mothers who received periodontal therapy. These findings are consistent with recent studies emphasizing the role of maternal oral health education and preventive dental care during pregnancy. Aznar-Marín *et al.* reported that maternal awareness regarding oral health significantly influences both maternal and neonatal outcomes **[19].** Similarly, Hu *et al.* showed that structured oral health promotion programs for pregnant women improved oral health behaviors and reduced adverse outcomes **[20].** Current periodontal treatment guidelines strongly advocate early diagnosis and management of periodontal disease as part of comprehensive healthcare. The European Federation of Periodontology clinical practice guidelines support evidence based periodontal therapy for controlling chronic inflammation and preventing systemic complications **[19].** Growing evidence also indicates that periodontal disease may contribute to multiple systemic disorders through inflammatory and immunological pathways **[21, 22].** The strengths of the present study include its prospective design, standardized clinical assessment, complete follow-up until delivery and evaluation of clinically relevant maternal and neonatal outcomes. Nevertheless, certain limitations should be acknowledged. The study was conducted at a single center with a relatively moderate sample size. Additionally, factors such as maternal nutrition, socioeconomic status, stress and genetic predisposition could not be completely controlled. Future multicenter randomized trials involving larger populations are necessary to further clarify the extent to which periodontal therapy directly influences pregnancy outcomes. Recent reviews continue to emphasize the importance of understanding oral-systemic interactions and integrating dental care into routine medical practice, particularly during pregnancy **[23].** Overall, the findings of the present study are consistent with contemporary evidence supporting the role of periodontal health in maternal and neonatal well-being. The results suggest that periodontal therapy during pregnancy may serve as a safe and effective intervention for improving oral health while potentially reducing the risk of adverse birth outcomes. Continued interdisciplinary collaboration between dental professionals and obstetric care providers is essential for promoting comprehensive prenatal healthcare and optimizing pregnancy outcomes **[24, 25].**

Conclusion:

Periodontal therapy during pregnancy significantly improved periodontal health and was associated with favorable birth outcomes. Women receiving non-surgical periodontal treatment showed higher mean birth weight, longer gestational age, lower incidence of preterm birth and low birth weight and fewer neonatal complications. These findings emphasize the importance of incorporating periodontal assessment and treatment into routine antenatal care to enhance both maternal and neonatal health outcomes.

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