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Prevention and Clinical Management of Periodontal Health in Pregnancy

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Abstract:
Pregnancy induces significant hormonal and immunological changes that increase susceptibility to gingival inflammation and may exacerbate existing periodontal conditions. Emerging evidence also suggests a potential association between periodontal disease and adverse pregnancy outcomes, including preterm birth and low birth weight. This review aims to synthesize current evidence on the pathophysiology of periodontal disease during pregnancy, its potential link to adverse pregnancy outcomes, and approaches to prevention and clinical management. A comprehensive literature search was conducted using PubMed, Scopus, and ScienceDirect for studies published between 2014 and 2025. The search strategy incorporated terms related to pregnancy, periodontal disease, periodontal therapy, and adverse pregnancy outcomes. Eligible studies included systematic reviews, meta-analyses, randomized controlled trials, and high-quality cohort studies published in English. Physiological increases in estrogen and progesterone during pregnancy enhance vascular permeability and modulate immune responses, thereby amplifying gingival inflammation even in the presence of minimal plaque accumulation. Furthermore, the translocation of periodontal pathogens and pro-inflammatory mediators—such as interleukin-1β (IL-1β), tumor necrosis factor-alpha (TNF-α), and prostaglandin E2 (PGE2)—into the systemic circulation and placental tissues provides biological plausibility for adverse pregnancy outcomes. Non-surgical periodontal therapy, particularly scaling and root planing (SRP), has been shown to improve maternal periodontal health and is considered safe, especially during the second trimester. However, its impact on pregnancy outcomes remains inconclusive due to heterogeneity among studies. Preventive strategies, including oral hygiene promotion and routine periodontal care, are consistently supported as effective and essential. Although a definitive causal relationship between periodontal disease and adverse pregnancy outcomes has not been established, maintaining periodontal health during pregnancy represents a safe and evidence-based component of comprehensive prenatal care. Future well-designed studies are needed to determine the optimal timing of interventions and the long-term maternal and fetal benefits.

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INTRODUCTION

Pregnancy is characterized by profound endocrinological, immunological, and vascular changes that can significantly influence oral health, particularly periodontal tissues. These physiological alterations may exacerbate gingival inflammation, even in the presence of minimal local irritants (Varsha et al., 2025). Periodontal disease, a chronic inflammatory condition initiated by bacterial biofilm, remains one of the most prevalent oral health problems worldwide and continues to pose a substantial public health burden (Lasica et al., 2024; Hashim et al., 2025). Consequently,

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understanding periodontal health during pregnancy has become increasingly important in maternal healthcare.

In recent decades, growing attention has been directed toward the potential association between periodontal disease and adverse pregnancy outcomes, including preterm birth, low birth weight, and preeclampsia (Wen et al., 2023; Padilla-Cáceres et al., 2023). Although epidemiological studies suggest a possible link, the strength and causality of this relationship remain inconclusive. Variability in study designs, populations, and diagnostic criteria has contributed to inconsistent findings, highlighting the need for a more integrated and critical appraisal of existing evidence (Alnasser et al., 2023).

Elevated levels of estrogen and progesterone largely drive the biological mechanisms underlying periodontal changes during pregnancy. These hormonal fluctuations increase vascular permeability and modulate immune responses, thereby enhancing gingival inflammation and susceptibility to conditions such as pregnancy gingivitis and pyogenic granuloma (Sachelarie et al., 2024). In addition, periodontal inflammation may contribute to systemic inflammation by disseminating pro-inflammatory mediators, including interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and prostaglandin E2 (PGE2), which may influence placental function and pregnancy outcomes (Nannan et al., 2022).

From a clinical perspective, previous studies have focused on two key domains: the pathophysiological mechanisms of pregnancy-related periodontal changes and the association between periodontitis and adverse pregnancy outcomes (Imansyah et al., 2025; Jawed & Jawed, 2025). Non-surgical periodontal therapy, particularly scaling and root planing, has been widely reported as safe during pregnancy—especially in the second trimester—and effective in improving periodontal health (Alkhurayji et al., 2024; Valentine et al., 2023). However, evidence regarding its effectiveness in reducing adverse pregnancy outcomes remains inconsistent, and standardized preventive strategies are not uniformly implemented in clinical practice.

Despite the growing body of literature, a critical gap persists: many studies address biological mechanisms and clinical outcomes in isolation rather than integrating them into a comprehensive care framework. Therefore, this narrative review aims to (1) synthesize current evidence on the hormonal and immunological mechanisms underlying periodontal changes during pregnancy and their potential association with adverse pregnancy outcomes, based on studies published between 2014 and 2025, and (2) propose an integrated framework for preventive and clinical management of periodontal health in pregnant women. By bridging the gap between pathophysiological insights and clinical application, this review aims to support the development of evidence-based strategies to improve maternal oral and overall health.

METHOD

Study Design

This study was designed as a structured narrative review conducted in accordance with best-practice recommendations for narrative synthesis. Although it does not follow a fully systematic review methodology, efforts were made to ensure transparency, reproducibility, and methodological rigor throughout the review process.

Search Strategy

A comprehensive literature search was performed using three electronic databases: PubMed, Scopus, and ScienceDirect. The search covered publications from January 2014 to December 2025. A combination of Medical Subject Headings (MeSH) and free-text terms was used, applying Boolean

operators as follows: (“periodontal disease” OR periodontitis OR gingivitis) AND (pregnancy OR pregnant) AND (therapy OR prevention OR “adverse pregnancy outcomes” OR “preterm birth” OR “low birth weight” OR “oral hygiene”). This strategy was designed to capture relevant studies addressing periodontal health, pregnancy, and associated clinical and preventive aspects.

Study Selection Process

The initial search identified 124 records. After removing duplicates, 78 unique articles remained and were screened based on titles and abstracts. Subsequently, 42 articles were selected for full-text assessment. After applying the eligibility criteria, 15 studies were included in the final synthesis. The study selection process is summarized in a PRISMA-inspired flow diagram.

Eligibility Criteria

Studies were included if they met the following criteria: (1) systematic reviews, meta-analyses, randomized controlled trials, prospective cohort studies, or clinical guidelines; and (2) relevance to periodontal changes during pregnancy, including pathophysiology, prevention, clinical management, and/or associations with pregnancy outcomes. Exclusion criteria comprised non-English publications, case reports, studies lacking a relevant clinical or preventive focus, and narrative reviews without sufficient scientific rigor. Additionally, reference lists of selected articles were manually screened to identify further relevant studies.

Data Synthesis and Analysis

Data were synthesized using a descriptive and thematic approach. The findings were organized into four key domains: (1) pathophysiological mechanisms, (2) association with adverse pregnancy outcomes, (3) preventive strategies, and (4) clinical management and therapeutic efficacy. Due to the narrative nature of the review, formal risk-of-bias assessment tools were not applied. Instead, the strength of evidence was evaluated based on the hierarchy of study designs and the overall methodological quality of the included studies.

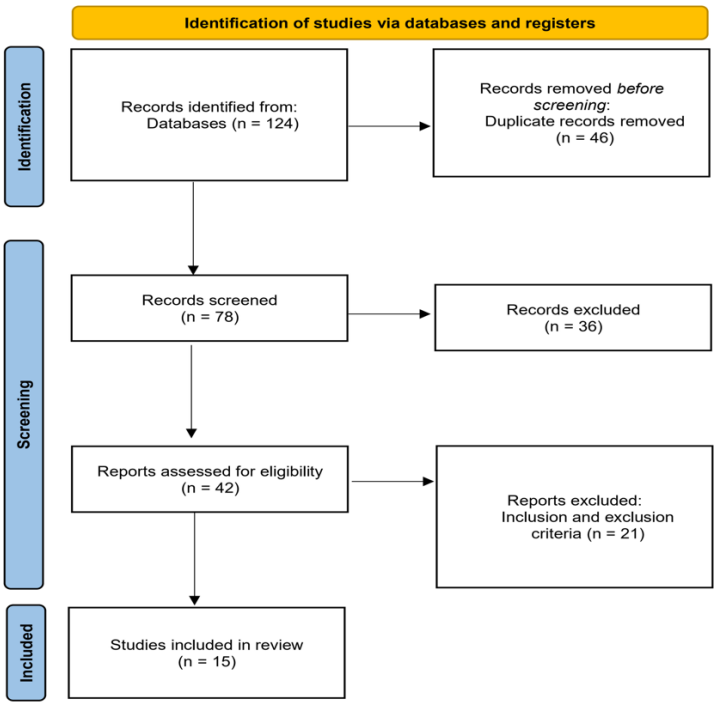

Figure 1. PRISMA 2020 flow diagram

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RESULT

Hormonal and Immunologic Changes in Periodontal Tissues

Pregnancy has been associated with various hormonal and immunological alterations, which directly affect periodontal tissues. An increase in estrogen and progesterone levels has been associated with increased vascular permeability and altered immune response, leading to an exaggerated inflammatory response in gingival tissues, even in the presence of minimal plaque formation (Wu et al., 2015). Clinical studies have also shown that gingival bleeding, edema, and inflammation are commonly seen during pregnancy, especially during the second and third trimesters, and decrease after parturition (Wu et al., 2016). This supports the idea that gingivitis during pregnancy is caused by an altered immune response and not by plaque levels.

Association Between Periodontal Disease and Adverse Pregnancy Outcomes

However, several epidemiological findings indicate a possible link between maternal periodontal disease and pregnancy outcomes (Starzyńska et al., 2022). Systematic reviews and meta-analyses have shown a possible link between periodontal disease and the risk of preterm birth and low birth weight (Choi et al., 2021; Karimi et al., 2023). Moreover, case-control and cohort study findings suggest a possible link between periodontal disease and preeclampsia (Ganesh et al., 2025). Nevertheless, a review of systematic reviews reveals considerable variation in study findings, making it difficult to establish a definitive link between periodontal disease and pregnancy outcomes (Coppeta et al., 2025). This implies the presence of confounding factors, such as the mother's and the baby's socioeconomic and health conditions.

Biological Mechanisms Linking Periodontal Disease and Pregnancy Outcomes

The biological plausibility of the link between the two conditions is further supported by mechanistic evidence of the potential of periodontal pathogens and inflammatory mediators to spread systemically (Tattar et al., 2025). Indeed, periodontal infection can cause transient bacteremia, and the aforementioned microbial components and pro-inflammatory cytokines, including interleukin-1β (IL-1β), tumor necrosis factor-α (TNF-α), and prostaglandin E_2 (PGE_2), can reach the fetoplacental unit (Bobetsis et al., 2020). This can potentially disrupt fetal development by causing placental inflammation, oxidative stress, and vascular dysfunction (Uriza et al., 2018). The aforesaid potential pathways of the interaction between the two conditions are presented in Figure 1, which summarizes the current evidence on the periodontal-systemic mechanisms during pregnancy.

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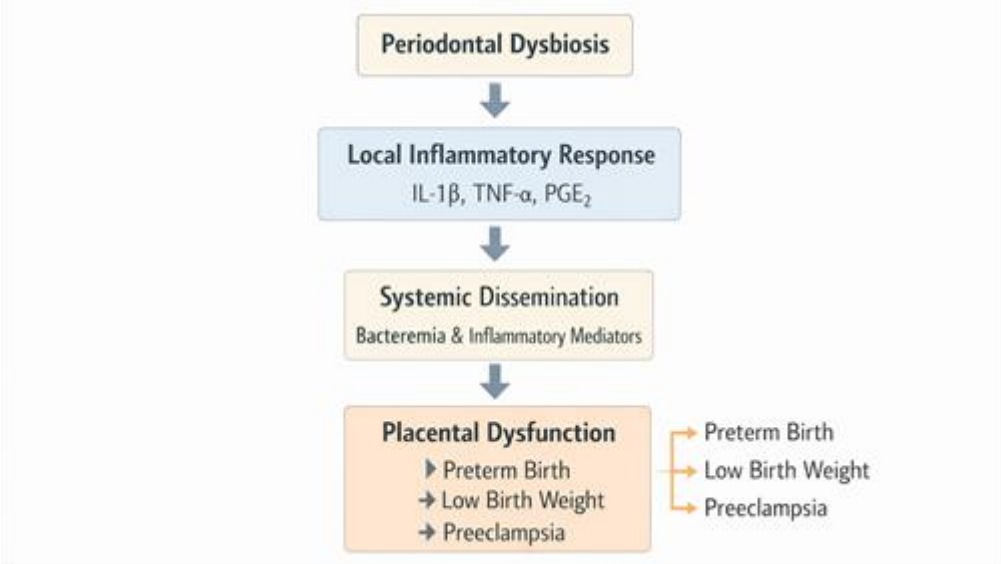

Figure 2. Proposed mechanistic pathways linking periodontal disease and adverse pregnancy outcomes.

Efficacy and Safety of Periodontal Therapy

Evidence from clinical trials and systematic reviews clearly shows that non-surgical periodontal therapy, especially scaling and root planing, is safe and effective in improving the periodontal health status of pregnant women (Govindasamy et al., 2020). According to the Cochrane systematic review, which included 15 randomized controlled trials, periodontal therapy is effective in improving periodontal parameters, although its effect on reducing pregnancy complications remains questionable (Iheozor-Ejiofor et al., 2017). Similarly, randomized clinical trials have shown improvements in periodontal health status, although the reductions in preterm births and low birth weight remain questionable (Vega et al., 2024). However, the therapy is effective in controlling local infection, although its systemic effects are questionable, depending on the timing and severity of the disease (Guo et al., 2025).

Preventive Approaches and Clinical Integration

Preventive measures are consistently emphasized as a crucial component of care for pregnant women (Javaid et al., 2025). The studies have shown that educating pregnant women about the importance of good oral hygiene, regular dental visits, and early screening for periodontal disease is crucial for reducing inflammation and promoting periodontal health (Sanz et al., 2020). It is recommended that periodontal examination be included in routine prenatal care, underscoring the importance of preventive care for pregnant women's health. However, its effect on pregnancy outcomes remains to be established (Uwambaye & Kanmodi, 2024).

DISCUSSION

Pregnancy induces substantial endocrinological and immunological changes that significantly influence periodontal tissue responses. Elevated levels of estrogen and progesterone increase vascular permeability, alter connective tissue metabolism, and modulate host immune function, resulting in an exaggerated inflammatory response of the gingiva even in the presence of minimal plaque accumulation. Clinically, this is reflected in increased gingival inflammation during the second and third trimesters, with partial resolution observed postpartum. These physiological alterations

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underscore the heightened susceptibility of pregnant women to periodontal changes and the importance of maintaining optimal oral hygiene during this period (Wen et al., 2023).

Plausible mechanistic pathways support the proposed biological link between periodontal disease and adverse pregnancy outcomes. Periodontal dysbiosis promotes the production of pro-inflammatory mediators, including interleukin-1β, tumor necrosis factor-alpha, and prostaglandin E2. These mediators, along with periodontal pathogens, may enter the systemic circulation, leading to transient bacteremia and potential dissemination to the fetoplacental unit. This systemic inflammatory response may influence placental function and fetal development. While such mechanisms provide a strong theoretical basis, they do not establish a direct causal relationship, and the complexity of maternal–fetal interactions necessitates cautious interpretation (AlSharief & Alabdurubalnabi, 2023).

Despite numerous epidemiological studies suggesting an association between maternal periodontal disease and adverse pregnancy outcomes, the overall evidence remains inconsistent. Variability in diagnostic criteria for periodontal disease, differences in study populations, and inadequate control for confounding factors—such as socioeconomic status, smoking, and access to healthcare—limit the comparability of findings. Additionally, the timing of periodontal interventions represents a critical limitation. Many studies initiate treatment during the second trimester, which may be insufficient to influence early inflammatory processes involved in placental development. Differences in disease severity further complicate interpretation, as milder forms of periodontal disease may not produce a sufficient systemic inflammatory burden to impact pregnancy outcomes (Machado et al., 2022).

From a clinical standpoint, maintaining periodontal health during pregnancy is both safe and beneficial, even in the absence of definitive evidence linking treatment to improved obstetric outcomes. Non-surgical periodontal therapies, including scaling and root planing, have consistently been shown to improve periodontal parameters and are considered safe, particularly during the second trimester. However, the limited impact of such interventions on pregnancy outcomes highlights the importance of a preventive approach. An integrated care model that includes early periodontal assessment at the first prenatal visit, continuous oral hygiene reinforcement, professional plaque control, and risk-based follow-up for moderate-to-severe cases may offer greater benefits. Interprofessional collaboration among dental and medical practitioners is essential to ensure comprehensive maternal care (Wu et al., 2024).

This review adopts an integrative perspective, combining current knowledge of pathophysiology, epidemiology, and clinical management into a unified framework. Nevertheless, several limitations should be acknowledged. As a narrative review, the methodology lacks the systematic rigor required to minimize selection bias. The restriction to English-language publications may also introduce language bias, while heterogeneity in study design and quality may affect the robustness of the synthesized findings. Future research should prioritize well-designed longitudinal studies and randomized controlled trials using standardized diagnostic criteria and outcome measures. Greater emphasis on early or preconception periodontal interventions, stratification by disease severity, and the inclusion of microbiological and inflammatory biomarkers may provide deeper insights. Long-term follow-up of maternal and fetal outcomes is also warranted to better understand the broader implications of periodontal health during pregnancy.

CONCLUSION

Hormonal and immunological changes during pregnancy contribute to an increased susceptibility to gingival inflammation and may influence systemic inflammatory pathways implicated

in adverse pregnancy outcomes. Although current evidence supports an association between maternal periodontal disease and conditions such as preterm birth and low birth weight, a definitive causal relationship has not been established. Non-surgical periodontal therapy is considered safe during pregnancy and effectively improves maternal periodontal health; however, its impact on obstetric outcomes remains inconclusive. Given its safety and potential systemic relevance, integrating preventive periodontal care into routine prenatal services through an interprofessional approach is strongly recommended. Future research should focus on well-designed multicenter randomized controlled trials with standardized diagnostic and outcome measures, alongside investigations into oral microbiology and inflammatory mechanisms, to clarify causality and identify optimal timing for interventions that maximize maternal and fetal health benefits.

CONFLICT OF INTEREST

The author declares that there are no conflicts of interest related to the authorship and publication of this article, whether financial or non-financial in nature.

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