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Short Communication

Maternal Periodontal Disease and its Adverse Outcomes

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Abstract

Maternal periodontal disease is a serious health risk to both the mother and the fetus, as there is growing evidence linking it to adverse pregnancy outcomes (APOs) such as low birth weight (LBW) and preterm birth (PTB). APOs are still common throughout the world despite improvements in prenatal care. Research indicates that hormonal changes during pregnancy can exacerbate gingival inflammation, which in turn can exacerbate periodontitis and other pregnancy-related issues. An important reason for comprehensive programs integrating oral health into prenatal care is the constant correlation found in observational research between increased APO risk and maternal periodontitis. Mechanistic discoveries point to microbial spread and systemic inflammation as possible routes that connect APOs and periodontal disease. Public health initiatives that emphasize oral health awareness and access to dental care during pregnancy emphasize the need of early detection and intervention. Even if there are still difficulties, addressing periodontal health in prenatal care has the potential to improve outcomes for mothers and newborns everywhere. To clarify the mechanisms at work and assess the effectiveness of periodontal therapies, more investigation is required.

Keywords: Adverse Outcomes; Maternal; Periodontal Disease

Introduction

Maternal and fetal health professionals are becoming increasingly interested in the problem of maternal periodontal disease, which is defined by persistent inflammation of the tissues surrounding the teeth. Maternal periodontitis may be associated with adverse pregnancy outcomes (APOs) such as preterm birth (PTB), low birth weight (LBW), pre-eclampsia, gestational diabetes mellitus (GDM), miscarriage/stillbirth, and preterm birth (PTB), according to accumulating research over the past few decades. Even with improvements in prenatal care and heightened public awareness, APOs continue to provide significant worldwide challenges. The World Health Organization (WHO) reports that preterm birth affects roughly 10.6% of pregnancies globally, accounting for 4.6% of pregnancies that result in pre-eclampsia and 23.4% of low birth weight babies [1]. According to Bobetsis., *et al.* long-term health consequences for the offspring, including respiratory discomfort, cognitive impairment, and metabolic disorders, in addition to increasing maternal and newborn morbidity and mortality [2]. The goal of research has shifted to better understand how maternal periodontal disease may contribute to APOs. Due to its effects on inflammation throughout the body, periodontitis has been linked to unfavorable pregnancy outcomes. Due to hormonal changes that encourage gingival inflammation, the condition-which is characterized by persistent inflammation and tissue loss in the periodontium-may worsen during pregnancy [3]. Offenbacher., *et al.* groundbreaking study from 1996, when they first suggested a potential connection between maternal periodontitis and preterm birth, served as the catalyst for early inquiries into the relationship between periodontal disease and unfavorable pregnancy outcomes [4].

Numerous observational and interventional studies that have been conducted since then have examined this relationship and provided insight into possible processes that may underlie the association. Interventional trials assessing the effect of periodontal therapy on pregnancy outcomes have produced mixed results, despite observational research showing correlations between maternal periodontal disease and unfavorable pregnancy outcomes, such as PTB and LBW. Moreover, different routes by which inflammatory mediators and periodontal pathogens may impact fetal-placental health have been suggested by mechanistic studies. The goal of this article is to present a thorough summary of what is currently

known about the relationship between maternal periodontal disease and unfavorable pregnancy outcomes. We want to clarify the possible contribution of periodontitis to APOs and highlight implications for clinical treatment and public health measures by combining findings from observational research, interventional trials, and mechanistic investigations. We hope to offer insights into future paths for clinical management techniques and research aimed at reducing the impact of maternal periodontal disease on pregnancy outcomes through a critical study of the body of current knowledge and the identification of research gaps. By tackling these issues, we want to lessen the burden of unfavorable pregnancy outcomes worldwide and enhance mother and newborn health outcomes.

Significance of research

Because it may have an impact on unfavorable pregnancy outcomes (APOs), maternal periodontal disease has attracted a lot of attention in the field of mother and child health research. In order to improve maternal and fetal health, public health initiatives, and policy decisions, it is essential to comprehend the importance of this field's research. The significance of studying maternal periodontal disease and its detrimental effects is explained by the paragraphs that follow

- **Public Health Impact:** Worldwide, preterm birth, low birth weight, and pre-eclampsia are major causes of morbidity and mortality among mothers and newborns. Studies suggesting a possible link between APOs and maternal periodontal disease emphasize the necessity of all-encompassing approaches to oral health in the context of prenatal care.
- **Modifiable Risk Factor:** For APOs, maternal periodontal disease is a modifiable risk factor. Pregnancy-related periodontal disease can potentially lower the risk of negative outcomes and enhance mother and child health outcomes if healthcare providers recognize and treat it.
- **Mechanistic Insights:** Investigations have shed light on the processes behind the link between APOs and maternal periodontal disease. Comprehending these pathways is crucial in order to devise focused therapies intended to alleviate the influence of periodontal disease on pregnancy consequences.
- **Clinical Implications:** Research study results highlight how crucial it is to incorporate oral health screenings and treatments into standard prenatal care. In order to improve pregnancy outcomes, healthcare providers can have a significant impact on encouraging maternal dental hygiene and the early detection and treatment of periodontal disease.
- **Global Relevance:** Given that APOs impact women in a variety of regional contexts, research on maternal periodontal disease and its detrimental effects is relevant to people everywhere. Research in different areas, including as low- and middle-income nations, can help shape context-specific strategies to address disparities in maternal oral health and lessen the burden of APOs.

This brief discussion of maternal periodontal disease and its detrimental effects has important health ramifications for both mothers and children. Through increasing our knowledge of the connection between APOs and periodontal disease, researchers can help improve pregnancy outcomes and lower global rates of morbidity and mortality among mothers and newborns.

A Global Perspective of Maternal Periodontal Disease

Recent data from the World Health Organization show stubbornly high rates of adverse pregnancy outcomes (APOs) internationally, despite improvements in prenatal care and raised public awareness. Although a number of risk factors for APOs, such as intrauterine infections, have been found, the cause of over 50% of cases is still unclear [5]. Pregnancy difficulties may be exacerbated by oral infections, especially periodontal illnesses, according to new research. It has been discovered that commensal bacteria from the mouth cavity populate the fetoplacental unit, which may exacerbate inflammation and raise the risk of APOs [6]. APOs may be at risk due to periodontitis, a condition marked by ongoing inflammation and tissue deterioration around the teeth [3]. Pregnancy-related hormonal changes may make gingival inflammation worse, which could result in more issues. Numerous APOs, such as preterm birth, low birth weight, pre-eclampsia, gestational diabetes mellitus, and miscarriage/stillbirth, have been related in studies to maternal periodontitis. Although the amount of research on this subject is increasing, methodological shortcomings still exist, making it difficult to reach firm conclusions. Prenatal dental treatment, however, has demonstrated promise in lowering oral pathogen carriage, which may lessen the chance of APOs [7].

Maternal Periodontal Health and Low Birth Weight in Nepal

With 200 primipara moms ranging in age from 18 to 35, the study's mean maternal age was found to be 23.96 years. The mean weight of newborns was 2703g, with weights ranging from 1000g to 4000g. The mother's BMI, height, and mean weight were 20.12, 1.58 meters, and 50.68 kg, respectively. The findings showed a strong correlation ($P < 0.0001$) between infants with reduced birth weight and periodontitis. This emphasizes how crucial it is to encourage expectant moms to practice proper oral hygiene during routine prenatal visits in order to reduce the risk of preterm low birth weight (PLBW) babies [8].

Both the National Oral Health Policy and the National Strategic Plan for Oral Health in Nepal aim to address the disabilities caused by orofacial deformities such as cleft lips and cleft palates, in addition to lowering dental caries (decay), oral malignancies, and periodontal illnesses. Remarkably, 31% of Nepalis between the ages of 35 and 44 had deep periodontal pockets, ranking Nepal in the top 15% of all countries with this problem in this age range. A number of factors, including inadequate dental hygiene, tobacco use, malnourishment, psychological issues, weakened immune systems, and poverty, can contribute to periodontal disorders. Additionally, periodontal disorders are linked to respiratory infections like TB, chronic bronchitis, pneumonia, and emphysema, as well as unfavorable pregnancy outcomes like low-birth-weight babies and cardiovascular and cerebrovascular issues. The goal of the National Oral Health Policy is to demonstrate the vital role that oral health plays in overall health outcomes by bringing the prevalence of extensive periodontal pocketing in the 35-44 age range down to less than 25% by 2023 [9].

About three million babies perish within the first 28 days of life every year, and preterm delivery is the leading cause of death in both high- and low-income environments. Nevertheless, there are few preventative measures for preterm delivery, especially in low- and middle-income countries (LMICs), where access to treatment alternatives is frequently restricted. This is especially the case in communities where expert childbirth care is sparse, as those in South Asia. Randomized controlled trials investigating the effect of periodontal therapy on unfavorable pregnancy outcomes have produced conflicting results, despite considerable observational evidence linking periodontal disease in pregnant women to premature birth [10]. One of the main causes of perinatal mortality, morbidity, and different neurological problems is preterm low birth weight, or PLBW. The relationship between low birth weight (LBW) infants and mothers' periodontal health has received more attention lately, especially in Nepal where early pregnancy ultrasound images are not often available. According to research, PLBW may be caused by periodontal disease, which affects 10% to 90% of people [11]. Anaerobic Gram-negative periodontal bacteria may have a deleterious effect on fetal development. Research, such as that of Kunnen et al. and Offenbacher et al., suggests a connection between LBW newborns and severe periodontal disease, which may be brought on by an early rupture of the placental membranes. Understanding the importance of mother periodontal health in LBW is critical, given the increased incidence of preterm birth in Nepal [12].

The association between maternal periodontal health and pregnancy outcomes was clarified by two research carried out in Nepal. The findings indicated that 95.8% of the participants agreed that there was a connection between periodontal disease and pregnancy; 73.8% of them linked it to preterm birth, 60.3% to low birth weight babies, and 38.4% to pre-eclampsia [13]. The study did find, however, that gynecologists are not sufficiently aware of this association, highlighting the necessity of frequent orientation sessions to keep them up to date. In comparison to moms of babies of normal weight, it was discovered that mothers of low birth weight (LBW) infants had a substantial history of prior LBW births and showed worse periodontal health, with more deep pockets and less healthy gingiva. According to Gupta et al., this implies that maternal periodontal disease may be a separate risk factor for LBW babies [14].

Maternal health factors and pregnancy outcomes

Low birth weight (LBW) babies (<2500g) account for a large share of neonatal fatalities, and maternal health problems such maternal vascular disorders, preeclampsia, hypertension, and maternal smoking are linked to poor fetal growth and nutrition [15]. While periodontal disease, which sets off inflammatory pathways, is known to be a risk factor for preterm delivery or low birth weight (LBW), infections-especially ascending vaginal infections-play a role in preterm birth [16-17]. Chronic inflammatory problems associated with periodontal disease can cause vulvovaginitis, premature membrane rupture, and fetal development limitation, among other unfavorable pregnancy outcomes [18]. Research indicates a link between low birth weight and maternal periodontitis, which may be the cause of unfavorable pregnancy outcomes [19]. The high proportion of unneeded cesarean deliveries puts hazards to the health of both mothers and perinatals, even in cases where cesarean sections are necessary for medical reasons. This highlights the significance of giving delivery methods due thought [20].

Results

Association between maternal periodontal disease and adverse pregnancy outcomes

Maternal periodontal disease, characterized by inflammation and infection of the gums and supporting structures of the teeth, has been increasingly recognized as a significant risk factor for adverse pregnancy outcomes. Extensive research has established a strong correlation between maternal periodontal disease and various unfavorable outcomes during pregnancy, including LBW, pre-eclampsia, miscarriage/stillbirth, and PTB. This discussion will delve into the empirical evidence supporting this correlation and explore the implications for maternal and infant health. Before delving into the correlation, it's important to acknowledge the prevalence of the adverse pregnancy outcomes in question. Preterm birth affects ap-

proximately 10.6% of pregnancies globally, posing significant risks to infant health and development. Low birth weight, defined as infants weighing less than 2,500 grams at birth, accounts for 23.4% of births worldwide, contributing to increased morbidity and mortality rates among newborns. Pre-eclampsia, a hypertensive disorder specific to pregnancy, affects around 4.6% of pregnancies, posing serious risks to maternal and fetal health.

Numerous epidemiological studies and meta-analyses have provided compelling evidence of the association between maternal periodontal disease and adverse pregnancy outcomes. Researchers have consistently found that women with periodontitis are at an increased risk of experiencing complications during pregnancy compared to those with healthy periodontal status. These complications include a higher likelihood of delivering preterm or low birth weight infants and experiencing pre-eclampsia or miscarriage/stillbirth. Importantly, research indicates that the risk of adverse pregnancy outcomes is positively correlated with the severity of maternal periodontal disease. Women with more advanced periodontitis tend to have a greater incidence of unfavorable pregnancy outcomes compared to those with milder forms of the disease. This underscores the importance of identifying and managing periodontal disease early in pregnancy to mitigate risks to maternal and fetal health.

Several mechanisms have been proposed to explain the association between maternal periodontal disease and adverse pregnancy outcomes. Chronic inflammation and bacterial infection in the oral cavity can lead to systemic inflammation, which may contribute to endothelial dysfunction, placental insufficiency, and oxidative stress, all of which are implicated in the pathogenesis of pre-eclampsia and preterm birth. Additionally, periodontal pathogens or their byproducts may enter the bloodstream and reach the placenta, potentially disrupting fetal development and triggering adverse pregnancy outcomes. Given the strong correlation between maternal periodontal disease and unfavorable pregnancy outcomes, there are important clinical implications for prenatal care and oral health management. Integrating dental screenings and periodontal assessments into routine prenatal visits can facilitate early detection and treatment of periodontal disease in pregnant women. Moreover, targeted interventions such as professional dental cleanings, periodontal therapy, and oral hygiene education may help reduce the risk of adverse pregnancy outcomes associated with periodontal disease.

Impact of maternal periodontal disease on pregnancy outcomes

The impact of maternal periodontal disease on pregnancy outcomes is profound, with extensive research highlighting its significance as a modifiable risk factor for adverse outcomes such as PTB and LBW babies. Empirical evidence underscores a strong correlation between the severity of periodontal disease and the likelihood of unfavorable pregnancy outcomes, emphasizing the importance of early detection and intervention. Chronic inflammation and bacterial infection characteristic of periodontitis contribute to systemic inflammatory responses, endothelial dysfunction, and placental insufficiency, all of which are implicated in the pathogenesis of PTB and LBW. Timely integration of dental screenings and periodontal assessments into routine prenatal care, coupled with targeted interventions such as professional dental cleanings and periodontal therapy, are crucial for mitigating the risks posed by maternal periodontal disease. By addressing periodontal disease during pregnancy, healthcare providers can play a pivotal role in improving maternal and infant health outcomes and reducing the burden of adverse pregnancy complications associated with periodontitis.

Global perspective and public health implications

The necessity of integrating oral health assessments and treatments into routine prenatal care is underscored by the global burden of adverse pregnancy outcomes. Research has consistently demonstrated a correlation between periodontal disease and various complications during pregnancy, including preterm birth, low birth weight, pre-eclampsia, and miscarriage. Given the significant impact of these outcomes on maternal and infant health, addressing maternal periodontal disease becomes imperative. Incorporating oral health evaluations and therapies into standard prenatal care can play a crucial role in mitigating the risks associated with periodontal disease. By routinely screening pregnant women for oral health issues, healthcare providers can identify and address periodontal disease early in pregnancy, allowing for timely intervention and management. Moreover, public health programs aimed at enhancing maternal oral health awareness and improving access to dental care can further contribute to reducing the prevalence of adverse pregnancy outcomes linked to periodontal disease. Such initiatives may include educational campaigns emphasizing the importance of oral hygiene during pregnancy, providing financial support or insurance coverage for dental services, and fostering collaboration between obstetric and dental healthcare providers to ensure comprehensive maternal care. By prioritizing maternal oral health within prenatal care frameworks and implementing effec-

tive public health strategies, it is possible to alleviate the burden of adverse pregnancy outcomes associated with periodontal disease and promote better health outcomes for both mothers and infants worldwide.

Discussion

Mechanistic insights and clinical implications

Mechanistic insights into the relationship between maternal periodontal disease and unfavorable pregnancy outcomes shed light on the pathways through which periodontal disease exerts its impact. Systemic inflammation and microbial dispersion are two key mechanisms implicated in this association. Chronic inflammation characteristic of periodontitis can trigger systemic inflammatory responses, leading to endothelial dysfunction, placental insufficiency, and oxidative stress, all of which contribute to adverse pregnancy outcomes such as preterm birth, low birth weight, and pre-eclampsia. Additionally, periodontal pathogens or their by-products may enter the bloodstream and disseminate systemically, potentially reaching the placenta and amniotic fluid, and directly impacting fetal development. Understanding these mechanistic pathways is critical for elucidating the underlying biology of the association between periodontal disease and pregnancy outcomes.

Clinical implications of these mechanistic insights underscore the importance of integrating oral health screenings and treatments into standard prenatal care. Early detection and management of periodontal disease during pregnancy are essential for reducing the risk of adverse pregnancy outcomes related to periodontal disease. By routinely screening pregnant women for oral health issues, healthcare providers can identify and address periodontal disease promptly, allowing for timely intervention and management. Incorporating dental assessments and treatments into prenatal care protocols ensures comprehensive maternal care and may help mitigate the impact of periodontal disease on pregnancy outcomes. Moreover, educating pregnant women about the importance of oral hygiene and facilitating access to dental care can further enhance maternal oral health and contribute to better pregnancy outcomes.

Challenges and future directions

Challenges persist in effectively translating research findings on the relationship between maternal periodontal disease and pregnancy outcomes into clinical practice, despite significant advancements in understanding this association. One major challenge is the complexity of integrating findings from mechanistic studies into routine clinical settings. While mechanistic insights have elucidated various pathways linking periodontal disease to adverse pregnancy outcomes, translating these findings into actionable clinical strategies poses logistical and practical challenges. Additionally, there is a need for further investigation to clarify the molecular mechanisms underlying this association comprehensively. Despite substantial progress, gaps remain in our understanding of the precise molecular pathways through which periodontal disease influences pregnancy outcomes. Addressing these gaps requires continued research efforts, including studies utilizing advanced molecular techniques and large-scale clinical trials. Furthermore, assessing the effectiveness of periodontal therapies in mitigating the risks associated with maternal periodontal disease is crucial for informing evidence-based clinical practice. Rigorous evaluation of periodontal interventions, such as professional dental cleanings and periodontal therapy, in pregnant women is needed to determine their impact on pregnancy outcomes. Longitudinal studies assessing the efficacy of these interventions in reducing the incidence of preterm birth, low birth weight, and other adverse outcomes are essential for guiding clinical decision-making and improving maternal and infant health. In conclusion, while significant progress has been made in elucidating the link between maternal periodontal disease and pregnancy outcomes, addressing challenges and charting future directions through additional research is essential for effectively translating scientific knowledge into clinical practice and improving maternal-fetal health outcomes.

Conclusion

Preterm birth, low birth weight, and pre-eclampsia are among the unfavorable pregnancy outcomes that are strongly linked to maternal periodontal disease. About 10.6% of pregnancies worldwide end in preterm birth, while 23.4% of newborns have low birth weights. Improving maternal and newborn health outcomes worldwide and lowering the prevalence of unfavorable pregnancy outcomes are two possible benefits of addressing periodontal health during prenatal treatment. To lessen the negative effects of maternal periodontal disease on the course of pregnancy, public health campaigns that encourage oral health awareness and access to dental care are essential. In order to enhance maternal and fetal health outcomes, more research is required to better understand mechanistic processes and create effective therapies.

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