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Periodontal Disease and Adverse Pregnancy Outcomes: Treatment Recommendations for the Pregnant Patient

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Periodontal Disease and Adverse Pregnancy Outcomes:

Treatment Recommendations for the Pregnant Woman

By **Tabitha Price, RDH, BSDH, MPH**

Introduction

Maternal periodontal disease has been implicated as a risk factor for preterm birth and delivery of low birth weight babies. In recent years, there have been many studies conducted to determine the association between these conditions, with conflicting results. Some of the conflicting results could be due to differences in the criteria used to diagnose periodontal disease in each study. This article will examine the research on this topic, and discuss treatment of the pregnant dental patient.

Prevention of preterm birth and low birth weight infants is a major public health concern.^{1,2} Preterm birth is defined as delivery that occurs at less than 37 weeks of gestation, and low birth weight is said to occur when an infant weighs less than 2,500 grams.² Each year, over 400,000 infants are born prematurely, and preterm birth affects 11 percent of all live births in the United States. It is the leading cause of death in neonates in this country.¹ Almost half of all cases of congenital neurological disability, including cerebral palsy, are caused by preterm birth.^{1,3}

Maternal infections are a risk factor for adverse pregnancy outcomes. In fact, 30 percent to 50 percent of preterm births are possibly caused by maternal infection.³ Most commonly implicated are intrauterine infection and bacterial vaginosis.¹ However, it is important to remember that there are many other risk factors associated with preterm birth, such as alcohol use, smoking or drug use during pregnancy, high or low maternal age, African American ancestry, low socioeconomic status, inadequate prenatal care, low maternal body mass index, hypertension, diabetes, stress and multiple pregnancies.⁴ All of these conditions must be considered as possible confounding factors when examining research of periodontal disease and adverse pregnancy outcomes.

When maternal infection is present, bacteria activate cell-mediated immunological responses, leading to the production of inflammatory mediators, which may lead in turn to preterm labor if they reach the fetoplacental unit.³ Of particular interest is the role of prostaglandins. Prostaglandins activate the inflammatory response, and as prostaglandin levels rise, labor can be induced.⁵ In fact, prostaglandins can be used intentionally to induce labor.

Discussion of Periodontal Disease

In periodontal health, approximately 75 percent to 80 percent of the bacteria found in the mouth are gram-positive bacteria. However, chronic periodontitis is associated with increased numbers of gram-negative bacteria. In response to these gram-negative bacteria, the human body activates its host immune response, and immune cells secrete inflammatory mediators. Of particular importance in periodontal disease are cytokines, prostaglandins and matrix metalloproteinases.⁶ The destruction of the

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periodontal tissues, including breakdown of the gingival connective tissue and alveolar bone, results mainly from activation of the immune cells.^{1,7}

Inflammatory mediators that have been discussed in relation to preterm birth include cytokines, prostaglandins and matrix metalloproteinases. Therefore, a discussion of these compounds is warranted. There are several cytokines that play an important role in the initiation and progression of periodontal disease. These include interleukin-1 (IL-1), interleukin-6 (IL-6), interleukin-8 (IL-8) and tumor necrosis factor (TNF- α).⁶ Prostaglandins are responsible for most of the alveolar bone destruction observed in periodontal disease, particularly prostaglandin E₂ (PGE₂). Matrix metalloproteinases (MMP) are a family of enzymes that work together to destroy connective tissue.⁶ It is theorized that these inflammatory mediators from subgingival plaque are able to enter the bloodstream and travel to the maternal-fetal interface, thus contributing to preterm labor.⁸ During pregnancy, PGE₂ plays an important role in regulating the onset of labor, contractions and delivery. PGE₂ levels rise throughout gestation, and as a critical threshold level is reached, labor is induced.⁶ PGE₂ can even be used to induce membrane rupture and subsequent labor.⁹ These associations explain the basic theories for the link between the presence of maternal periodontal disease and the risk for adverse pregnancy outcomes.

Incidence of Periodontal Disease

A survey conducted in the United States found that approximately 23 percent of women aged 30 to 54 had periodontitis.¹⁰ Gingival inflammation increases in pregnant women because of an exaggerated response to small amounts of bacterial plaque.⁶ Pregnancy can exacerbate any pre-existing periodontal inflammation.¹¹ Proper oral hygiene practices during pregnancy can prevent inflammation from occurring. When plaque control is meticulous, no increase in gingivitis is usually observed. Offenbacher stated, "any oral disease, from mild gingivitis to severe periodontitis, causes infection and inflammation in the mother."¹² Therefore, early intervention to treat pregnancy-induced inflammation is of extreme importance.

Dental Care During Pregnancy

It is interesting to note, however, that many women never see a dentist during their pregnancy. In fact, sev-

eral studies have shown that only 35 percent to 50 percent of women seek dental treatment while they are pregnant.¹³ It has been found that women who are made aware of the importance of seeking dental care during pregnancy are more likely to do so; therefore, it is important for dental professionals to educate their patients who may later become pregnant about this issue.¹⁴ This is particularly important because many obstetricians may not be recommending a dental examination as part of prenatal care. One study found that while 84 percent of obstetricians considered periodontal disease to be an important risk factor for preterm birth and/or low birth weight babies, only 51 percent recommended a dental examination to their patients.¹⁵

Evaluation of Research

One of the first studies to report a significant relationship between periodontal disease and preterm birth was a case-control study conducted in 1996 by Offenbacher et al.¹⁶ Many studies have been conducted since that have confirmed these findings.^{4,8,17,18} However, some researchers have failed to find an association between the two conditions.^{19,20,21} Some of these conflicting findings could be the result of the different definitions of periodontal disease used in each study. Some of the studies define periodontal disease by examining clinical attachment level^{4,7} while others define periodontal disease as the presence of periodontal pockets of a certain depth, with bleeding on probing considered as a factor.^{11,22,23} Some other studies test subgingival plaque for the presence of certain bacteria and inflammatory mediators,²⁴ while others use radiographs to determine bone levels.¹⁸

It is important to establish a clear definition of the parameters used to determine the presence of periodontal disease for research. The term "periodontal disease" encompasses a variety of disease entities ranging from gingivitis to periodontitis. Standard diagnostic tools include measurements of pocket depths, measurement of clinical attachment levels, radiographic examination to ascertain bone loss, visible signs of gingival inflammation such as bleeding on probing, presence of suppuration and tooth mobility.²⁵ This information must be considered comprehensively to determine periodontal disease status.

Studies have shown that site-based clinical periodontal information such as bleeding on probing, plaque scores and probing depths have poor predictive values for future clinical attachment loss.²⁶ Bleeding upon probing should not be the definitive indicator used to diagnose periodontal disease; confounding factors, such as probing technique, smoking status, hormonal changes in women, medications, blood disorders, alcoholism, depression and systemic factors should be taken into account to prevent false-positive diagnoses.²⁷ However, the absence of bleeding on probing over time may be a good predictor of stable periodontal conditions.²⁶ Calculating clinical attachment level and examining radiographs for bone loss are very reliable indicators for determining history of disease, but not necessarily an active inflammatory disease process. Therefore, if only radiographs are used, the researchers may classify women as having periodontal disease, when they actually no longer have active disease. A study of pregnant women at Duke University Hospital found that pocket depths and bleeding on probing were the best predictors of periodontal disease progression.¹¹

It is also very important that full-mouth examinations are performed instead of partial-mouth examinations, because periodontitis does not always affect the entire dentition at the same time.⁶ It is critical to carefully evaluate the methods used

by examiners to establish a diagnosis of periodontal disease when comparing research on this topic.

Studies Finding a Positive Association Between Periodontal Disease and Adverse Pregnancy Outcomes

A case-control study conducted in Hungary found that initial chronic localized periodontitis could lead to preterm birth and reduced birth weight.²² In this study, periodontal examinations were completed within three days after delivery. The examiners evaluated "plaque, calculus, recession, tooth mobility, probing depth (PD) and bleeding on probing (BOP)."²² Alveolar bone levels were not examined with radiographs, because the authors stated that probing depth and bleeding on probing are better indicators of the degree of periodontitis present. The participants were diagnosed with periodontal disease if they exhibited probing depths of 4 mm or deeper in at least one site and bleeding on probing for greater than 50 percent of the teeth. This study concluded that these characteristics had a significant relationship with preterm birth and low birth weight and were the best predictors of these conditions.²²

A study published in 2005 by Moss, Beck and Offenbacher sought to determine which clinical factors could predict the incidence and progression of periodontal disease in pregnant women.¹¹ Full-mouth periodontal exams were performed at the time of enrollment and within 72 hours of delivery. Information gathered during the examination included a gingival index, a plaque score, periodontal probing depths, gingival recession and bleeding on probing. Women were considered to have incidence/progression of periodontal disease during pregnancy if there were four or more sites with a greater than 2 mm increase in probing depth at the time of delivery. Bleeding on probing at baseline, along with existing pockets of 4 mm or greater, was found to increase the risk of incidence/progression of disease. The researchers concluded that even though this inflammation and bleeding may resolve after delivery, it is important to treat gingival inflammation during pregnancy.¹¹

A prospective study published in 2006 sorted patients into categories of periodontal health, mild periodontitis and moderate/severe periodontitis.²³ "Clinical periodontal status was categorized based on pocket depth and bleeding criteria."²³ The authors found that moderate/severe maternal periodontal disease was a risk factor for the delivery of a small-for-gestational-age infant. They stated, "the correct identification of women with clinically or biologically significant periodontal disease is of paramount importance."²³ Their categories of periodontal disease status were based on the presence of periodontal pockets that can harbor microorganisms, as well as bleeding, which these researchers believed may have systemic effects during pregnancy. They did not include clinical attachment loss as an indicator of periodontal disease.

It is important to note, however, that several studies have found a positive association between periodontal disease and adverse pregnancy outcomes when clinical attachment level or bone levels were the main parameters used for diagnosis. A case-control study published in 2005 used probing depths and clinical attachment loss to define periodontal disease.²⁸ Patients with probing depths greater than or equal to 4 mm and clinical attachment loss greater than or equal to 3 mm were diagnosed as having periodontal disease. Bleeding was not recorded, or used as a factor in diagnosis. The researchers concluded that periodontitis was a risk factor for low birth weight in their sample.

A cohort study conducted in Croatia in 2006 found periodontal disease to be a "strong, independent, and clinically signifi-

cant risk factor" for preterm birth in the studied cohort.⁷ The researchers used clinical attachment loss as the indicator of periodontal disease. They stated that clinical attachment loss "does not yield any data on the activity or the presence of periodontal disease."⁷ However, they felt it was the only value that could be compared with other studies. The authors stated, "the main obstacle in comparison of our results and other studies is highlighted by the variety of protocols and lack of consistency in the use of periodontal indices."⁷ Earlier studies did not use clinical attachment loss as the measure of periodontal destruction, but assessed probing depths instead, thus making it difficult to compare research findings.

A prospective cohort study published in 2008 found a modest association between periodontitis and preterm birth using clinical attachment loss and probing depth as the indicators of periodontal disease.⁴ The researchers defined periodontal disease as the presence of four or more teeth with one or more site with a probing depth of 4 mm or greater, and clinical attachment loss greater than or equal to 3 mm at the same site. Bleeding on probing was recorded but not used to determine a diagnosis of periodontal disease.

A prospective cohort study published in 2008 also found that periodontitis may be an independent risk factor for adverse pregnancy outcomes, specifically when examining middle-class women.¹⁸ The researchers did not perform a periodontal exam, however. A questionnaire was sent to pregnant women in their second trimester. One question asked, "Have you ever been told by a dentist or dental hygienist that you have periodontal disease (gum disease with bone loss)?"¹⁸ Of the 1,666 women who responded, 1,429 reported having dental radiographs taken within the past five years. The researchers were able to obtain radiographs for 354 of the participants. The women who reported a diagnosis of periodontitis had significantly higher mean radiographic bone loss than those who did not. The researchers acknowledged that self-report may not be a true indicator of active disease.¹⁸ Radiographs demonstrate a cumulative measure of periodontal destruction, but do not prove that active disease is present.

Although there are many different definitions and parameters used to diagnose periodontal disease in these studies, there is convincing evidence that there may be an association between periodontal disease and adverse pregnancy outcomes. However, some studies have failed to find an association.

Studies Finding No Association Between Periodontal Disease and Adverse Pregnancy Outcomes

One case-control study that failed to find an association between periodontal disease and preterm birth was conducted by Wood, et al.²⁴ Subjects were examined by a periodontal hygienist between two days and 28 days following delivery. Probing depths and attachment levels were recorded, and a bleeding index and Oral Hygiene Index Simplified were recorded for each subject. Gingival crevicular fluid samples were also obtained to test for the presence of certain periodontal pathogens. The researchers did not find an association between clinical periodontitis measured by attachment loss and preterm birth. The mean level of clinical attachment loss was not significantly greater in the cases than the controls. They did, however, find an association between preterm birth and the presence of gingival crevicular fluid neutrophil elastase, a marker of active periodontal disease. The authors stated that this finding possibly indicates an association between active periodontal disease and preterm

birth. They recommend that future researchers consider measuring markers of active disease.²⁴

Another case-control study published in 2007 failed to find an association between periodontal disease measured by clinical attachment level, and preterm birth.²⁰ A full-mouth periodontal examination was conducted on all cases and controls, recording probing depths and attachment level. Periodontitis was defined as having at least three sites, in different teeth, with three or more millimeters of attachment loss. The authors state that they chose clinical attachment level as their criteria for diagnosis because it is not affected by pregnancy and has a higher sensitivity and specificity than probing depth alone.²⁰ They state that preterm birth is better explained by confounding factors than by periodontal disease status.

A population-based, cross-sectional study conducted in Brazil also found no association between periodontal disease and low birth weight.²⁹ Probing depths were measured, and the presence or absence of bleeding was observed. For this study, the marker of periodontal disease was having four or more sites with a probing depth greater than 3.5 mm. These researchers found that the presence of periodontal pockets was not associated with low birth weight.

A case-control study of women in a Danish maternity ward also found no association between preterm birth and periodontal disease, even when the presence of active periodontal disease was determined.²¹ Twenty-one cases and 33 controls were included in this study. All patients received a periodontal examination from the same clinician. Information recorded included plaque index, probing depths and bleeding on probing. The researchers defined sites with active periodontal disease as having a probing depth of four or more millimeters and bleeding on probing, or else as having a distance of two millimeters or more between the cemento-enamel junction and the crest of the alveolar bone along with bleeding on probing. The study failed to find an association between preterm birth and periodontitis. However, the authors do state that there was a difference in the periodontal microbiota between the cases and controls. They hypothesize that women who experience preterm birth may have higher subgingival loads of periodontal pathogens.

A randomized, treatment-masked, controlled clinical trial published in 2009 examined the effect of nonsurgical periodontal therapy on rates of preterm birth.³⁰ To be eligible for the study, the pregnant women had to have at least 20 teeth and at least three periodontal sites with at least 3 mm of clinical attachment loss. Eligible participants were assigned randomly to receive periodontal treatment either before 23 6/7 weeks of gestational age or after delivery. Participants in the treatment group received up to four sessions of supragingival and subgingival scaling and root planing before delivery. This study found no significant differences when comparing women in the treatment group with those in the control group in regard to preterm birth or low birth weight. The researchers point out that only a small proportion of women in the treatment group achieved periodontal health; these findings suggest that a single treatment of scaling and root planing was not adequate to control gingival inflammation between baseline and delivery. They also stated, "there is not sufficient evidence to determine whether periodontal disease simply does not increase risk for preterm birth or whether it does increase risk but treatment as performed in this study was ineffective in decreasing preterm birth."³⁰

Future researchers should differentiate between patients with active periodontal disease and patients with a history of periodontal destruction when choosing participants for studies. This would enable more accurate comparisons to be made.

Safely Treating the Pregnant Dental Patient

There is some evidence that periodontal treatment in expectant mothers may reduce the incidence of adverse pregnancy outcomes³¹⁻³⁴ while other research finds no benefit.³⁰ Although findings are inconclusive on the issue of whether periodontal therapy is beneficial in preventing adverse pregnancy outcomes, we do know that nonsurgical periodontal therapy is safe for pregnant women. "During pregnancy, dental treatment may be modified but need not be withheld, provided that the risk assessment is made properly for both the patient and the fetus."³⁵ Dental hygiene appointments should be scheduled as early during the pregnancy as possible to assess the gingival tissues, and to treat any existing periodontal conditions.³⁶ Elective dental treatment, however, should be deferred until the second trimester, because the embryo is very susceptible to teratogenic effects during the first trimester. The safest time to provide routine dental care is during the second trimester and into the early part of the third trimester.³⁵

Conclusion

Although there is conflicting research on the association between periodontal disease and adverse pregnancy outcomes, there is some evidence that periodontal treatment may contribute to improvements in birth outcomes. Nonsurgical periodontal therapy is safe during pregnancy and, if indicated, should be initiated as early as possible to reduce inflammation, thus possibly leading to a reduction in adverse pregnancy outcomes. Future research should differentiate between the presence of active periodontal disease and past periodontal destruction so that accurate assessment can be made of the association between periodontal disease and adverse pregnancy outcomes.

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