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AN OBSTETRICIAN AND PERIODONTIST TRANSLATE PERIODONTAL-SYSTEMIC RESEARCH TO PRESERVE THE HEALTH OF PREGNANT WOMEN AT RISK FOR ADVERSE PREGNANCY OUTCOMES

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Abstract

No aspect of periodontology is more challenging than translating research relating to the potential relationship of periodontal disease to adverse pregnancy outcomes into clinical practice. While awaiting results of multi-site intervention studies and emergence of a professional consensus on this subject, dental and obstetrical health providers must accept a degree of uncertainty and proceed deliberately yet cautiously in extrapolating research to clinical practice. Most recent research on the treatment of pregnant women in a dental office represents a new paradigm, and in many ways reverses decades of established doctrine. Accumulating evidence suggests that rather than acting as bystanders dental and obstetrical health providers must play active roles in a patient's pregnancy. The relationship between periodontal infection and adverse pregnancy outcomes is a serious topic of investigation. Clearly, clinicians must be confident that interventional therapies are safe and present no threat to the normal development of the fetus.

Both dentists and obstetricians have an obligation to collaborate and coordinate efforts to disseminate new clinical information. Here, to stimulate discussion of medical-dental collaboration in treating pregnant patients with periodontal disease, a periodontist and perinatologist offer their perspectives on the plausibility of a link between periodontal disease and adverse pregnancy outcomes. In addition, clinical protocols and accompanying case studies illustrating efforts to reduce the inflammatory burden and decrease risk of adverse pregnancy are presented.

Introduction

It is widely accepted that periodontal disease extends beyond the oral cavity. The traditional role of the general dentist and periodontist in maintaining health and structure of the masticatory system, while sufficient in itself, is expanding to include systemic disease. Periodontal disease, which represents a chronic, low-grade infection, has been proposed as an independent risk factor in cardiovascular disease (CVD),[1-3] ischemic stroke,[4,5] specific pulmonary disorders,[6] and other multi-factorial chronic diseases/conditions. In addition, sufficient research indicates a bidirectional relationship between inflammatory periodontal disease and diabetes.[7,8] Clearly, the traditional role of the dentist is changing from a reparative model to a medical model with the inherent implications of diagnosis, treatment and appreciation of systemic interactions.

Nowhere is this new obligation more poignant than in diagnosing and treating inflammatory periodontal disease in the context of pregnancy and individuals at risk of having preterm or low birth weight (LBW) babies. In addition to the enormous

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financial burden these outcomes pass on to society and the possibility of long-term disabilities,[9-11] the psychological stress suffered by families of preterm and LBW babies is significant. The contrast between the joys of giving birth to a healthy versus a dangerously premature child is heart-wrenching. Anyone who has witnessed a newborn, sometimes small enough to be held in the palm of a hand, whisked from its mother to a neonatal intensive care unit understands the gravity of the situation. A few more weeks in the mother's womb could have enabled a happier outcome.[12]

An obstetrician's perspective on the potential of periodontal infection to trigger adverse pregnancy outcomes

Successful pregnancy, and obstetric practice in general, has a major impact on a nation's health. Beyond the negative impact on the immediate family, adverse pregnancy outcomes have an effect on society. There is a high incidence of neurological sequelae associated with prematurity and an increase in commensurate healthcare costs, in addition to the potential loss of earning ability in this population. In recognition of these issues, the U.S. Public Health Service included obstetrical indicators in programs reported in *Healthy People 2000,* and *Healthy People 2010.*[13,14] The major goals of both programs are to increase the span of healthy life, reduce health disparities between individuals and improve access to preventive services.[13,14] Preventive medicine for obstetrics figures prominently within this plan, and 3 out of 18 indicators selected to assess community health address obstetrical care.[13,14] These obstetric indicators are as follows: infant mortality, LBW deliveries, and starting prenatal care in the first trimester of pregnancy.[13,14] A specific goal of the program is to increase significantly the number of primary care providers offering preconceptional counseling and prenatal care.[13,14]

Prenatal care: the cornerstone of contemporary obstetrics

Currently over 90% of white women and only 78% of African-American or Hispanic women start prenatal care during the first trimester of pregnancy, shortly after monitoring 1 or 2 missed menstrual periods.[15] It is the practice of this physician co-author to conduct a complete physical exam, obtain a complete blood count (CBC), blood type, Rh-immune globin (RH) type, rubella, venereal disease research laboratory (VDRL), hepatitis and human immunodeficiency virus (HIV) status and review the patient's personal and family history during the first prenatal visit. If the patient is unsure of her last menstrual period or has an irregular menstrual period, or if uterine size is not consistent with the patient's menstrual age, an ultrasound exam is performed to establish the age of pregnancy.

Timing of subsequent prenatal examinations should be based on the patient's risk status. For low risk patients, visits at 4-6 week intervals until 34 weeks and weekly visits after 36 weeks gestation are appropriate. Patients at risk for adverse pregnancy outcomes are seen at closer intervals for observation and fetal testing. At each return visit maternal and fetal well-being is assessed. These parameters can include maternal blood pressure measurements, monitoring weight gain, uterine analysis, measuring uterine size and checking for potential edema.[16-18]

Specific symptoms, e.g., headaches and/or blurred vision, abdominal pain, contractions, pelvic pressure, leakage of fluid from vagina or vaginal bleeding, should be investigated and call for thorough evaluation, including ultrasound exams, cervical length measurements and biochemical testing. The latter can include specific cervical cultures or monitoring levels of cervical fibronectin or systemic inflammatory cytokines.

As new risk factors for adverse pregnancy outcomes are defined, the format and content of prenatal care will change accordingly. At this time, considering the potential association between inflammatory periodontal disease and preterm birth (PTB) rates, it is imperative that oral health is considered during the first prenatal visit. For obstetric patients who have not had a dental evaluation in the preceding 6 months, steps should be undertaken to complete that evaluation as soon as possible.[19]

The importance of preconceptional care/counseling in the prenatal period

An important component of prenatal care is preventive care prior to conception, commonly referred to as preconceptional care and counseling. In a 1989 report, the U.S. Public Health Service expert panel on the content of prenatal care stated, "The preconceptional visit may be the single most important healthcare visit when viewed in the context of its effect on pregnancy outcome".[14] Preconceptional sessions address both maternal and fetal risks, such as the incidence of congenital anomalies, intrauterine growth restriction (IUGR) and premature birth. For patients with known pre-existing complications like diabetes mellitus, high blood pressure, cardiac disease, pulmonary disease, prenatal disease, lupus, clotting disorders, or epilepsy, potential interactions between physiologic changes associated with pregnancy and their disease status must be thoroughly evaluated. Some individuals will require adjustment or discontinuation of medications prior to conception. For example, improving glycemic control for diabetic subjects, changing anti-seizure medication, changing anti-hypertension medication or changing from oral anticoagulants to heparin therapy could significantly decrease the incidence of fetal congenital anomalies. Other individuals may require more

intensive medical or surgical therapy prior to conception. Such changes must be implemented as early as possible, since by the time of the first prenatal visit, which normally occurs at 6-10 weeks gestation, fetal development could already be compromised.[20-29]

In addition to targeting individuals with pre-existing conditions, expanding preconceptional counseling to all women of childbearing age who are considering a future pregnancy, including those without known medical conditions, would be valuable. A personal history and a full medical evaluation during that visit could identify medical conditions (e.g., hypertension) or lifestyles that should be addressed prior to conception.

Significant fetal risks are associated with alcohol, smoking and/or recreational drug use. Alcohol abuse, particularly in early gestation, leads to mental retardation and a series of dysmorphic facial features known as fetal alcohol syndrome.[30-32] Smoking and use of street drugs are associated with poor fetal growth (intrauterine growth retardation), premature placenta separation (abruptio placenta), PTB, and behavioral and learning disabilities.[33-35] Clearly, modifying patient behaviors and lifestyle prior to conception would drastically decrease the impact these risk factors had on pregnancy outcome.

Preconceptional counseling should also address environmental exposure for individuals working in specific high-risk professions. Infectious exposure is important for healthcare providers with a high risk of contracting viral induced infections, e.g., cytomegalovirus,[36,37] varicella,[38,39] or parvovirus.[40,41] Individuals working in such environments should have their immune status (antibody titers to specific infectious agents) tested to assess the risk of exposure during a future pregnancy.

PTB

One of the most important obstetrical complications leading to long-term sequelae is PTB. Prematurity accounts for almost 75% of perinatal mortality and over 50% of neurological morbidity[42] and is by far the largest contributor to cerebral palsy. More importantly, despite advances in diagnosing and managing preterm labor, the rate of PTBs is rising. Based on the March of Dimes report in 2003, prematurity rates in the U.S. are over 11%[43] with significant differences between races.[44] Most neonatal deaths and long-term morbidity come from the 2% of infants born before 32 weeks gestation and weighing less than 1500 grams.[12]

The primary complications leading to PTB are: 1) indicated preterm delivery; 2) premature labor; 3) preterm rupture of membranes; and 4) cervical incompetence.[45] Several medical and obstetrical complications can place

the well-being of the mother or fetus in jeopardy and justify a decision to deliver a fetus prematurely to improve maternal or fetal outcome. Some of these are: severe hypertension, cardiac disease, lupus, anti-phospholipids syndrome and long-standing diabetes. Obstetrical complications include preclampsia, fetal IUGR or placental abnormalities such as placenta previa and abruptio placenta.[46] All of these complications place the unborn fetus and sometimes the mother at considerable risk, making even premature delivery the only option for a reasonable perinatal outcome.

Most PTBs (over 70%), however, result from premature labor, premature rupture of membranes (PROM), cervical incompetence or a combination of these risk factors.[45] There is apparently considerable overlap from a clinical standpoint between patients with cervical incompetence presenting initially with PROM, patients with PROM going into preterm labor, and patients with preterm labor having spontaneous rupture of membranes shortly after the onset of contractions.[47,48] While the specific etiology of these conditions has not been fully elucidated, it is likely that a common trigger leading to PTB is responsible for many of these processes. One extensively investigated potential trigger is the association between local or distant infection and premature labor/preterm rupture of membranes.[49-52] Bacterial invasion of amniotic fluid (AF) has been documented by positive AF cultures in 10-25% of all patients with premature labor and intact membranes.[53] Among individuals with PROM, the incidence of a positive AF culture can be as high as 40%.[54] Many patients, however, show pathological evidence of inflammatory changes, but their bacterial cultures remain negative.[55] This observation supports the hypothesis that the onset of preterm contractions, PROM or cervical changes can result from an inflammatory response to a distant infectious stimulus. Infection upregulates production of cytokines, which in turn stimulate the immune response leading to physiological and biochemical changes.[56,57]

Proinflammatory cytokines in turn increase the production of prostaglandins, which are potent stimulators of uterine contractions.[58-60] Furthermore, specific pro-inflammatory cytokines, such as interleukin-1 (IL-1), IL-6, IL-8 and tumor necrosis factor-alpha (TNF-α) stimulate synthesis of matrix metalloproteinases (MMPs),[61,62] enzymes that can remodel collagen leading to softening and weakening of the uterine cervix and fetal membranes. The net result of these changes is a significant increase in the risk of premature cervical effacement, cervical dilation, PROM, preterm contraction and eventually PTB.[63]

A recent National Institute of Health sponsored Preterm Prediction Study[64] compared 194 women who had experienced a single spontaneous birth to an equal number of

subjects who delivered at term. Plasma was collected at 24 weeks gestation to measure levels of the pro-inflammatory cytokine granulocyte colony-stimulation factor (GCSF). GCSF levels were highly correlated with the risk of spontaneous delivery at <32 weeks gestation. GCSF values over the 75th percentile were seen among 50% of preterm deliveries compared with 14% of controls. It is important to note that none of these patients had symptoms indicative of preterm labor at the time that blood samples were obtained. In a second study[65] of patients with preterm labor, AF analysis showed elevated IL-6 levels in 88% of subjects that went on to deliver prematurely compared with 12% of those who stopped contracting and went to term. In this study, levels of cytokines Il-6, IL-1 and TNF-α in AF were all positively correlated with histologic evidence of chorioamnionitis. Finally, it has been reported that cervical IL-6 concentrations at 24 weeks gestation are significantly higher in women who subsequently had a PTB secondary to premature labor compared with those who delivered at term.[66] Collectively, all of these studies suggest that early spontaneous PTB is associated with an inflammatory process manifested by the presence of specific cytokines in maternal plasma several weeks before the PTB event.

Until recently, the cervical/vaginal area was considered the only infectious source capable of triggering an inflammatory reaction leading to PTB. Data now supports the hypothesis that an inflammatory response to a distant infectious source, like periodontal disease, also constitutes a risk factor for PTB.[67,68] Periodontitis is a chronic bacterial condition that serves as a reservoir for gram-negative microbes and a source of pro-inflammatory mediators, particularly during periods of disease exacerbation. Indeed, serum levels of 1L-1, TNF-α, 1L-6, and C-reactive protein (CRP) have all been shown to be elevated in individuals with periodontitis.[69] These cytokines stimulate the inflammatory process, indirectly facilitate prostaglandin production and increase MMP production, which collectively promotes preterm labor, PROM and eventually PTB.[70]

These findings, as well as the long-term benefits of oral health, indicate that it is in a patient's best interest to include periodontal evaluation in obstetrical and prenatal care. Individuals with significant pathology could then be offered treatment likely to reduce the incidence of pregnancy complications.[71,72] This initiative requires a broad educational effort by both the obstetrical and dental communities. Furthermore, oral health evaluation should also be included in preconceptional counseling so that women can begin pregnancy with minimal risk of PTB.

A periodontist's perspective on the potential of periodontal infection to trigger adverse pregnancy outcomes

It is not surprising that periodontal infection can promote systemic sequelae. It has been estimated that the surface area of the periodontal pocket epithelium exposed to bacterial insult is 20 cm^2 (assuming 6 mm probing depths and 28 teeth), comprising a significant potential infectious load.[73] In contrast to other transcutaneous appendages, i.e., nail beds where thick keratinized tissue forms a virtually impenetrable barrier, the body is protected from a very harsh oral environment by a precariously fragile epithelial layer. The epithelial barrier protecting the subjacent connective tissues and alveolar bone (pocket and junctional epithelium) can be as thin as a few cell layers, is void of a stratum granulosum and stratum corneum and lacks immune surveillance cells (Langerhans cells).[74] The occurrence of micro-ulcerations in this epithelial barrier is one of the early events in pathogenesis of periodontal disease.[75] The presence of such ulcerations explains how local infection can have distant ramifications.[76-79] The periodontal pocket is host to very large quantities of gram-negative bacteria.[80] Each gram (wet weight) of plaque, composed of 1.0×10^{11} organisms, presents a continuous challenge or infectious burden.[80] Transient bacteremias occur during mastication, tooth brushing, and various dental procedures.[81-83] One study determined that bacteremia has a 1,000-fold greater chance of occurring for physiologic reasons (i.e., tooth brushing and mastication) than from dental extraction.[84] A direct relationship between periodontal inflammation and incidence of bacteremia has also been reported.[81] Periodontal disease is extraordinarily prevalent. The results of epidemiologic studies vary with how clinical parameters are measured. Such studies, however, indicate prevalence in the U.S. ranging from approximately 27 to 78 million adults.[85] Collectively, the 5 most recent epidemiologic studies indicate that an average of 58 million U.S. adults has moderate to severe periodontal disease.[85]

While it is crucial that oral care providers be aware of accumulating evidence relating oral bacteria and inflammation to adverse pregnancy outcomes, it is obvious that obstetrical colleagues are the pivotal point for implementation of this science in clinical practice. As evidence for this link increases, it is imperative that dental providers raise awareness of this relationship within the medical community.

The challenge in light of emerging evidence

Clinicians face a challenge in order to change the care of women of childbearing age and those who are pregnant. A Centers for Disease Control and Prevention (CDC) study found that only one-half of women with oral problems made an appointment during pregnancy.[86] The reason most often cited is fear of harming the fetus, and many dentists share this anxiety. It is the experience of these authors that pregnant women may not receive proper oral care. Too often patients are referred from generalist to specialist or placed on antibiotics or pain relievers for too long be-

cause of a reluctance to treat. Obstetrical colleagues need to consider a collaborative approach to educating mutual patients and integrating and coordinating care.

Research in support of guidelines for care of pregnant patients

The following discussion supports guidelines for co-management of pregnant patients at risk for adverse pregnancy as a result of oral inflammation. It is based on reported intervention studies, an understanding of the significance of inflammation and the incidence of pregnancy gingivitis.

Three notable intervention studies — one by Jeffcoat and colleagues[87] and two by Lopez and colleagues[88,89] — collectively indicate that treatment of inflammatory periodontal disease during early stages of pregnancy has beneficial effects. Jeffcoat and colleagues[87] followed 366 patients with periodontitis. In that study the reference group had a preterm delivery of slightly over 6%, and all treatment groups did better. The group that received scaling and root planing had a preterm delivery rate of less than 1%.[87] Lopez[88] and colleagues conducted a randomized, controlled clinical trial involving 400 pregnant women.[88] All women in the treatment group received periodontal care between the 9th and 21st week of gestation. Periodontal treatment consisted of plaque control instruction, scaling and root planing and rinsing with 0.12% chlorhexadine once a day.[88] After active treatment, patients were seen for maintenance every 2 to 3 weeks until delivery.[88] Preterm LBW deliveries in the untreated control group were >10%, while those in the test group (those receiving periodontal therapy) were <2%.[88] Interestingly, in a follow-up study, Lopez and colleagues[89] showed that not only chronic periodontitis but also gingivitis were associated with preterm delivery. Significantly, treating gingivitis during pregnancy reduced preterm delivery from 6.71% to 2.14%.[89] These findings are highly significant given the prevalence of pregnancy gingivitis.

Pregnancy gingivitis should be very familiar to this readership. Occurring in 30-70% of pregnancies,[90,91] it is an acute form of gingivitis characterized by erythema, edema, hyperplasia, increased gingival bleeding, and in many cases, formation of pyogenic granulomas.[92] It begins around the second month of pregnancy and generally exhibits resolution following parturition.[93] For decades, gingivitis during pregnancy was considered little more than a nuisance and treated symptomatically, while assuring the patient that it would improve after delivery.

Given the brief period of time that a woman is pregnant, it is possible that simply having a history of periodontal disease is not enough to guarantee an exposure to the fetus. Gingival inflammatory activity, with or without at-

tachment loss, may be of equal or even greater importance when evaluating the impact of periodontal disease on systemic health.[94]

A 2006 study by Offenbacher[95] and colleagues in the *Journal of Obstetrics and Gynecology* is illuminating. In this prospective study, 1,020 women received both antepartum and postpartum periodontal examination. The authors found that women with clinically active and progressive periodontal disease were at significant risk for delivery at a gestational age of <32 weeks.[95] The adjusted risk ratio was 2.4. Disease progression in this study was defined as ≥4 sites with ≥2 mm of increased probing depths at each site, with the postpartum probing depth being 4 mm or more.[95] In a typical patient with 28 teeth, 128 sites were measured, that is, 6 sites per tooth.[95] The authors concluded that if a mere 2.3% of recorded pockets progress (e.g., 4 sites), there is a potential danger to the fetus.[95] This data is startling since the mortality rate for neonates born before 35 weeks is 11.4-fold greater than that for babies born after 35 weeks.[95] The rate of morbidity in this group of neonates is higher as well.[96]

Finally, Moss[97] and colleagues described clinical risk factors associated with disease occurrence and progression by following 891 pregnant women prior to 26 weeks of gestation and within 48 hours of delivery.[97] Using the definitions of Offenbacher and colleagues, they showed that having >10% sites with bleeding upon probing and ≥4 sites with a probing depth of ≥4 mm was significantly predictive of disease progression during pregnancy.[97] The study also showed that the number of sites that showed gingivitis/periodontitis incidence/progression (GPIP) was relatively small (1.7%), but the number of patients with progression was significant (46.7%).[97] Most sites that changed were not previously diseased, in that probing depths were 3 mm.[97] This data is plausible given that periodontal disease is relatively uncommon in this age group of women, while the incidence of pregnancy gingivitis is high. The authors noted that GPIP occurred more frequently in premolar and molars than on anterior teeth and was more likely to occur on inter-proximal sites. One-quarter of the patients in this study experienced deteriorated periodontal status.[97] The study identified several non-dental risk factors, including: young age, weight increase above desired limit, African-American racial group, tobacco use, food stamp eligibility and lack of medical insurance.[97]

Both the Offenbacher and Moss studies strongly suggest that clinicians begin developing a scientifically-based program to treat pregnant patients. Risk factors can be identified and a rational treatment plan designed based on those factors and clinical periodontal status. A strong case can be made for treating maternal periodontal disease, and the incidence of gingival inflammation could be a predictor of danger to

Table 1
Signs and symptoms of periodontal disease[99]

- Bleeding gums during brushing
- Red, swollen or tender gums
- Gums that have pulled away from teeth
- Persistent bad breath
- Pus between gums and teeth (leaving bad taste)
- Loose or separating teeth

Table 2
Risk factors for periodontal disease

- Smoking — up to 7 times more likely
- Genetic/family history — 3 to 5 times more likely
- Smokers with a family history of a parent or sibling who lost a tooth at an early age are 10 times more likely to develop periodontal disease
- Diabetes — up to 5 times more likely
- Race — African-Americans show 3 times greater risk
- Socioeconomic issues — low income and education increases risk
- Stress
- Obesity
- Decreased immune response — HIV, immunosuppressant use
- Medications — calcium channel blockers, dilantin, cyclosporin
- Alcohol use

Table 3
Risk factors for preterm delivery

- Previous PTB
- Previous pregnancy losses
- Hypertension
- Other medical complications
- Smoking
- Drug/alcohol abuse
- Low socioeconomic status
- Poor nutrition
- Low initial body mass index
- Race (African-Americans have higher incidence of PTBs)

Table 4
Local and systemic risk factors[101]

- Orthodontic bands and appliances
- Overhanging restorations
- Decay as trap for plaque
- RPD clasps
- Malpositioned teeth
- Partially impacted third molars
- Open contacts
- Tongue rings
- Root concavities
- Food retention areas
- Mobility
- Subgingival margins or margins at gingiva
- Medications — calcium channel blockers, phenytoin, cyclosporin A (hyperplasia)
- Allergies

the fetus.[97] It is therefore logical to develop programs to eliminate or prevent maternal gingival inflammation. The goal should be a "zero tolerance" policy towards inflammation during this very brief period in a woman's life.

Cross-referrals gaining traction

Obstetricians and obstetric nurses are the obvious starting points to implement an interdisciplinary protocol to prevent preterm delivery. Among obstetricians, the practice of screening for inflammatory periodontal disease and referring at-risk women to dental care providers has not been widely accepted. The Task Force in Oral Care and Pregnancy for the State of New York[19] and The American Academy of Periodontology[98] recommend that every woman be referred for an oral examination early in pregnancy. This examination would typically occur between 9 and 12 weeks of pregnancy. The obstetrician should question every pregnant woman concerning signs and symptoms of periodontal disease, such as bleeding, red, swollen or tender gums (Table 1). The obstetrician should also know

whether the patient is at risk for periodontal disease because of smoking, family history or a condition such as diabetes (Table 2). Finally, it is the opinion of the co-authors that any patient with a history of preterm delivery or who is at risk for such a condition (Table 3) should be referred for an evaluation of a potential role of oral inflammation in their pregnancy. It is reasonable to ask that general dentists and dental specialists (periodontists) work together to provide optimum care. It is the opinion of the co-authors that patients at minimal risk either for periodontal disease or preterm delivery should be referred to a general dentist. Following evaluation they should be educated concerning the potential role of gingival inflammation on pregnancy and placed on an intensive preventive program as early as possible. It is also the co-authors' opinion that at-risk patients should have periodic preventive treatments, including prophylaxis, and evaluation of oral hygiene effec-

tiveness. Patients who during pregnancy exhibit increased gingival inflammation, evidence of pyogenic granuloma formation, periodontal abscess formation or evidence of bone loss should be considered for referral to a specialist (periodontist).

The severity of inflammatory periodontal disease and the obstetrician's appraisal of preterm delivery risk should determine whether a case is triaged to a generalist or a specialist. Patients at significant risk of periodontal disease (e.g., diabetes patients, smokers, users of anti-seizure medications), those diagnosed with or exhibiting symptoms of periodontal disease or individuals with a history of pregnancy gingivitis should be considered for referral to a periodontist. Detailed examination of hard and soft tissues should be performed, including measuring periodontal pocket depth and evaluation of bleeding on probing, plaque index and clinical attachment loss. The ability of the patient to perform adequate home care should also be assessed, and acute infection should be diagnosed and treated immediately. Local (Table 4) and systemic risk factors for periodontal disease and inflammation should be noted. These could be numerous and require referral back to a general dentist or physician. The following case studies illustrate what the co-authors believe is optimal care of women during childbearing years. These cases represent examples of transdisciplinary interactions. They are not meant to imply that these dental interventions affected pregnancy outcomes or prove a causal relationship.

Case 1

Fig. 1

Case 1. Physician identification and referral to periodontist of a case of pregnancy gingivitis

Case 1 (Figure 1) involves a 32-year-old woman seen for a routine perinatal visit to her obstetrician at the ninth week of pregnancy. The patient had been under the care of a general dentist for several years, and her last visit was one month prior to conception. She believed that her

mouth was in an excellent state of health. Her obstetrician suggested that she have an oral examination performed by her general dentist.

During the second trimester the patient reported gingival pain and bleeding to her obstetrician. The obstetrician then referred the patient to a periodontist. Several interproximal areas exhibited marginal inflammation, tenderness and bleeding on probing. The patient was diagnosed with pregnancy gingivitis. Full mouth x-rays taken prior to conception were provided. Radiographs, an additional intraoral image, and periodontal charts of this case may be accessed for viewing in the *Collateral Case Study Information* section available at ***www.thesystemiclink.com***.

Periodontal inflammation was controlled with scaling and root planing and oral hygiene instruction. Periodontal maintenance was performed on a monthly basis until delivery. After parturition the patient was advised to return to her general dentist for routine dental care.

Case 2

Fig. 2

Case 2. Physician identification and referral of at-risk woman during preconceptional counseling

Case 2 (Figure 2) describes a 35-year-old woman with a history of pregnancy loss as a result of preterm delivery. Her previous pregnancy resulted in PROM, which led to premature labor. Delivery was at 24 weeks, and the baby died. The patient was seen for preconceptional counseling before attempting another pregnancy. The obstetrician noted that the patient had several complaints suggestive of periodontal disease, i.e., persistent bad breath and bad taste. She was referred to a periodontist for an oral health examination.

The patient was diagnosed with chronic periodontitis. Gingival tissues exhibited the cardinal signs of inflammation including friable and rolled marginal tissue, edema,

erythema and bleeding upon gentle probing. A gingival exudate was noted as well as accumulation of bacterial plaque. Radiographs, an additional intraoral image, and periodontal charts of this case may be accessed for viewing in the *Collateral Case Study Information* section available at *www.thesystemiclink.com*.

The periodontist initiated a comprehensive treatment plan. Periodontal inflammation was controlled with standard therapies. Meticulous attention to hygiene was encouraged as well as frequent recalls during her ensuing pregnancy, which was successful.

Case 3

Fig. 3

Case 3. Progressive intervention of periodontal inflammation during pregnancy through obstetrician-dentist collaboration

Case 3 (Figure 3) describes a 27-year-old white female who is pregnant for the first time. The patient sees a dentist only when she has a "problem". When the obstetrician interviewed the patient, she reported no signs or symptoms of periodontal disease, but discussed her mother's recent periodontal surgery. Periodontal records and an additional intraoral image of this case may be accessed for viewing in the *Collateral Case Study Information* section available at *www.thesystemiclink.com*.

At her first prenatal visit at 8 weeks, the obstetrician referred her to a general dentist for an oral examination. The dentist made a diagnosis of gingivitis. The patient was educated about the importance of oral hygiene during pregnancy. The patient responded well to mechanical treatment and oral hygiene instruction. She was placed on a two-month maintenance schedule until 36 weeks.

Case 4 (Figure 4) involves a 27-year-old African-American woman with a history of chronic periodontal disease. Her dentist referred her to a periodontist for periodontal therapy. The periodontist's review of her

Case 4

Fig. 4

Case 4. Periodontal disease and pregnancy loss as incidental findings: cross-referral to an obstetrician

medical history revealed a recent pregnancy loss at 22 weeks. Radiographs, an additional intraoral image, and periodontal charts of this case may be accessed for viewing in the *Collateral Case Study Information* section available at *www.thesystemiclink.com*.

The patient was referred back to her obstetrician who reviewed the possible association between periodontal disease and adverse pregnancy outcomes. The patient and the obstetrician agreed that the periodontal condition should be treated and controlled prior to conception. During an ensuing pregnancy the patient was placed on a strict periodontal maintenance schedule.

Conclusion
During the past decade studies have appeared both in the obstetric and periodontal literature supporting the link between periodontal disease and adverse pregnancy outcome. Dentists and obstetricians now have a unique opportunity to make an impact on this important public health issue. Collaborative, transdisciplinary care, while presenting unique challenges, must be implemented and disseminated. It is imperative that treatment be facilitated by seamless communication between physicians and dentists.[99] Medical and dental providers must work cooperatively to overcome widely held beliefs that dental care during pregnancy harms a fetus. It has been the experience of the co-authors that this collaboration can be effective and beneficial in clinical practice.

Local and state organizations have begun to recognize the importance of oral healthcare during pregnancy. It must be remembered that multi-site, large-scale intervention studies have yet to be reported. The New York State Department of Health[19] has offered guidelines that state,

"Without waiting for the outcome of these clinical trials, healthcare professionals can take actions now to address oral health problems in pregnant women".

The Long Island (NY) Regional Perinatal Forum has identified Oral Health in Pregnancy as a topic worth implementing in a countywide action plan. In addition, at least 1 major health insurance company has begun to recognize periodontal care during pregnancy as a medical necessity.[100]

As governmental and private organizations begin to recognize the importance of oral health in pregnancy, it is the joint responsibility of dental and obstetrical health providers to integrate this new information into the practice of dentistry and obstetrics.

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