Healthy Mouth, Healthy Mom, Healthy Baby: Optimal Oral Health Care Before, During and After Pregnancy

Maria L. Geisinger, DDS, MS
Continuing Education Units: 1 hour


Disclaimer: Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

This continuing education course will review the current scientific evidence about the association between oral health and pregnancy outcomes and to evaluate best practices for optimal dental treatment of women before, during, and following their pregnancies.

Conflict of Interest Disclosure Statement
• The authors report no conflicts of interest associated with this course.

ADA CERP
The Procter & Gamble Company is an ADA CERP Recognized Provider.

ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP does not approve or endorse individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry.

Concerns or complaints about a CE provider may be directed to the provider or to ADA CERP at: http://www.ada.org/cep
In a 2009 national survey of 351 OB/GYNs, 77% reported that some of their patients had been declined dental services due to pregnancy.\(^1\) Additionally, many medical care providers fail to or are unable to accurately check pregnant patients for dental problems and refer them for dental care. At least 40% of pregnant women experience some form of periodontal disease, including gingivitis, periodontitis, or pyogenic granuloma ("pregnancy tumor").\(^1-3\) Additionally, increased carbohydrate consumption and acid exposure secondary to pregnancy related "morning sickness" can increase patients' susceptibility to dental caries.

It is currently the recommendation of the National Maternal and Child Health Resource center at Georgetown University that pregnant patients or those seeking to become pregnant who have not seen a dentist in at least six months should be referred for dental care\(^4\) and the American College of Obstetricians and Gynecologists began advising OB/GYNs to check patients for oral health issues at their first prenatal visit and make the appropriate referrals.\(^4\) Furthermore, routine dental care such as dental cleanings and the administration of local anesthetic medication during pregnancy have not been shown to change rates of miscarriage or birth defects.\(^4,5\) Dental radiographs are also safe, although it has been suggested they should be limited for use in a dental emergency or if there is a need to diagnose a dental problem and the patient should be appropriately protected with a lead drape.\(^4,5\)

This course seeks to discuss the high incidence and etiologies of periodontal diseases during pregnancy and to enable dental practitioners to better identify disease and promote optimal oral health in patients before and during pregnancy.

**Learning Objectives**

**Upon completion of this course, the dental professional should be able to:**

- Understand the current scientific literature about the association between oral health and pregnancy outcomes and discuss the interactions between these two conditions with patients.
- Recognize, assess, treat and prevent oral conditions associated with pregnancy.
- Evaluate patients' risk factors and oral home care practices during pregnancy based upon individualized patient needs.
- Understand the risks and benefits regarding routine, elective, and emergent dental care during pregnancy.
- Discuss with patients the risk factors associated with pregnancy gingivitis and the importance of a healthy mouth in overall maternal and fetal health during pregnancy.
- Use effective behavioral management techniques to improve oral hygiene of patients before, during, and after pregnancy.
- Discuss with interdisciplinary colleagues the importance of and effective methods for seeking dental care during pregnancy.
Course Contents
• Introduction
• Epidemiology and Etiology of Gingivitis and Periodontitis in Pregnant Women
• Epidemiology and Etiology of Preterm Birth and Low Birth Weight
• Identification of At-risk Individuals for Preterm Birth
  ◦ Maternal Risk Factors
  ◦ Pregnancy History
  ◦ Pregnancy Characteristics
  ◦ Maternal Inflammation and/or Infection
  ◦ Biologic and Genetic Markers
  ◦ Oral Maternal Health
• Proposed Mechanisms for Interactions between Oral Inflammation and Preterm Birth
• Standards of Care for Perinatal Dental Treatment
  ◦ Patient Behavioral Management
  ◦ Interdisciplinary Collaboration
• Conclusion
• Course Test
• References
• About the Author

Introduction
Preterm birth is a problem in the United States and throughout the world. It is associated with extensive morbidity, mortality, societal and economic costs.\(^6\)\(^7\) As health care professionals and dental care providers, we must identify and treat those patients who have a high risk of preterm birth to establish optimal oral health and to, as much as possible, decrease the risk for preterm delivery.

Epidemiology and Etiology of Gingivitis and Periodontitis in Pregnant Women
Pregnancy gingivitis has been extensively described in the literature.\(^8\)\(^11\) Previous work demonstrates a progressive increase in gingival inflammation throughout pregnancy independent of bacterial plaque accumulation and a return to baseline levels postpartum. Plaque-induced gingivitis is the most common form of periodontal disease in pregnant women affecting 36%-100% of pregnant subjects.\(^8\)\(^12\)\(^13\) Clinical characteristics of pregnancy-associated gingivitis clearly show a tendency toward more severe inflammation.\(^14\)\(^17\) The severity of gingival inflammation observed has been correlated with sex steroid hormone levels, both of estrogen and progesterone, during pregnancy.\(^6\)\(^10\)\(^18\)\(^19\) This indicates a possible dose-dependent influence of female sex hormone secretions on inflammation, which increases to high levels from 16-40 weeks and then decreases after parturition. Cross-sectional and cohort studies have demonstrated increased prevalence and severity of gingivitis in pregnant women compared to their non-pregnant female controls, despite similar plaque scores.\(^20\)\(^21\) Other reports have demonstrated altered immunoreactivity to putative periodontal pathogens during pregnancy.\(^22\)\(^23\) In the absence of oral hygiene measures, all individuals develop gingivitis; in healthy individuals a meticulous regimen of daily plaque removal can prevent the onset of gingivitis and effective oral hygiene can effect a cure.\(^24\)

Epidemiology and Etiology of Preterm Birth and Low Birth Weight
While treating gingivitis in pregnant women is of concern for optimal oral health, there is evidence gingivitis may influence pregnancy outcomes, which makes intervention of interest from a public health standpoint and gives further weight to effecting a cure.\(^25\)\(^26\) Periodontal disease has been identified as a risk factor for adverse pregnancy outcome,\(^27\)\(^28\) but the efficacy of periodontal treatment on birth outcomes has been inconsistent.\(^25\)\(^26\)\(^29\)\(^32\)

Preterm birth is defined as those deliveries that occur at less than 37 weeks of gestational age and account for 75% of perinatal mortality and half of the long-term morbidity.\(^33\) The overall rate of preterm birth in the United States was 9.4% in 2014 (Figure 1).\(^7\) Additionally, preterm birth rates among ethnic minorities demonstrate a wide disparity in maternity outcomes with Black and Native Americans having the highest preterm birth rates at 13.4% and 10.4%, respectively.\(^7\) Only four states in the U.S. (Washington, Oregon, Idaho, and Vermont) achieved rates of preterm birth in 2014 at or below the March of Dimes target of 8.1%.\(^7\)

Preterm birth may be due to (1) medical indication for maternal or fetal health, (2) spontaneous preterm labor with intact membranes, or (3) preterm premature rupture of the membranes (PPROM).\(^34\) Approximately 30-35% of preterm births are indicated, 40-45% follow spontaneous preterm labor, and 25-30% occur after PPROM.\(^34\) About 5% of preterm births occur at less than 28 weeks of gestation (extreme prematurity), about 20% at 32-33 weeks of gestation (moderate prematurity) and 60-70% occur after 34 weeks
of gestation (late prematurity). Increasingly early prematurity is also associated with higher rates of morbidity and mortality.34

Preterm labor is thought to be initiated by myriad mechanisms including infection or inflammation, uteroplacental ischemia or hemorrhage, uterine overdistension, stress, maternal risk factors, and other immunologically mediated processes.35

Most cases of preterm birth are unexplained, but it has been postulated that many of these cases are mediated by immunoinflammatory processes including periodontal inflammation.36 It is critical to identify at-risk individuals for preterm birth so interventions can be targeted at the most vulnerable populations to reap the most benefits.37

**Identification of At-risk Individuals for Preterm Birth**

There are many maternal and fetal characteristics that are associated with an increased risk of preterm birth, including maternal demographics, nutritional status, plural gestation, pregnancy history, present pregnancy characteristics, health-adverse behaviors, infection, uterine contractions and cervical length, and biologic and genetic markers.37

**Maternal Risk Factors**

In the US, women classified as black, African American, and Afro-Caribbean are consistently reported to be at higher risk of preterm delivery (Figure 2). Black women have the highest rates of preterm birth among any racial or ethnic group in the U.S. at 13.4%.7 This high preterm birth rate among black women and the relatively stable discrepancy between black women and other racial and ethnic groups both accounts for the overall high rate of prematurity in the US and contributes to a cycle of reproductive disadvantage with far-reaching social and medical consequences.38

Other maternal demographic characteristics associated with preterm birth include low socioeconomic and educational status, low and high maternal ages, and single marital status.39-41 These may represent markers of access to healthcare and overall health status in the U.S., but the exact mechanisms by which these maternal demographic characteristics are related to preterm birth are unknown. While the data are somewhat equivocal, overall results from observational studies seem to indicate that stressful working environments, long working hours, and
associated with preterm birth include low levels of micronutrients, reduced blood volume and uterine blood flow, and increased maternal infections.\textsuperscript{47,48}

Pregnancy History

The recurrence risk for preterm birth ranges from 15-50\% and is related to the number and gestational age of previous preterm deliveries.\textsuperscript{49} It has been assessed that women with previous preterm deliveries demonstrated a 2.5-fold increased risk for preterm birth in their next pregnancy.\textsuperscript{49} Women with early spontaneous preterm births are far more likely 

Maternal body mass index (BMI) is also associated with preterm birth rates. A low pre pregnancy BMI is associated with an increased risk of spontaneous preterm birth, whereas obesity can be protective against preterm birth.\textsuperscript{45} Obese women have a higher rate of indicated preterm delivery associated with gestational diabetes and pre-eclampsia (Figure 3).\textsuperscript{46} The potential mechanisms for low BMI to be 

undertaking hard physical labor at work are associated with an increase in preterm birth.\textsuperscript{42-44}

Figure 2. Prematurity by Race and Ethnicity in the United States.\textsuperscript{7}


Figure 3. Spontaneous and Indicated Preterm Birth by Maternal BMI.\textsuperscript{45}
to have subsequent preterm births, and it has been postulated this may be due to underlying genetic or health causes that persist between pregnancies and/or persistent or recurrent intrauterine infections. Furthermore, an inter pregnancy interval of 6 months or less is associated with more than two times greater risk for preterm birth after adjustment for confounders. This may be related to lack of time for the uterus to return to previous size and form and/or maternal micronutrient depletion.

**Pregnancy Characteristics**

Plural gestations, which account for 2-3% of all live births, carry a considerable risk for preterm birth and account for 15-20% of all preterm births. Nearly 60% of twins are born preterm with 40% of twins experiencing spontaneous preterm birth or PPROM before 37 weeks of gestation. In the case of twins and higher order plural gestations, uterine overdistension, resulting in contractions and PPROM is thought to be the most frequent cause of spontaneous preterm delivery. Placental abruption and/or placental previa as well as unrelated vaginal bleeding earlier in pregnancy is associated with higher rates of preterm birth. Extremes in the volume of amniotic fluid—either polyhydramnios or oligohydramnios—are associated with preterm labor and PPROM. Finally, uterine or cervical anatomical anomalies, such as uterine septa and/or bicornuate uterus, are associated with higher rates of preterm delivery.

**Maternal Inflammation and/or Infection**

Both maternal psychological stress and smoking habits are associated with increased levels of inflammatory mediators. Pregnant women experiencing psychosocial stress have demonstrated an increase (usually less than 2-fold) in preterm birth rates and demonstrate increased levels of corticotropin releasing hormone as well as C-reactive protein (CRP). Smoking is similarly associated with a significant increase in the systemic inflammatory response and has been proposed to increase preterm birth through that pathway.

Maternal infections have also been demonstrated to increase the maternal inflammatory response and affect preterm birth. Microorganisms are recognized by immune cell receptors, which in turn release inflammatory chemokines and cytokines, such as interleukin-8 (IL-8), interleukin-1beta (IL-1beta), and tumor necrosis factor-alpha (TNF-alpha). These pro inflammatory cytokines and microbial endotoxins stimulate the production of prostaglandins, other inflammatory mediators, and matrix-degrading enzymes. Prostaglandins, in turn, stimulate uterine contractility and degradation of the extracellular matrix within the uterine environment and can lead to PPROM.

Microbiologic studies suggest that intrauterine infections may account for 25-40% of preterm births, however, this may be an underestimate as intrauterine infection is difficult to detect with conventional culture techniques. Early preterm births are most highly associated with intrauterine infections when compared to late preterm births. A variety of microorganisms have been associated with intrauterine infection, and these infections have been found to be most often of a chronic nature. Microorganisms can gain access to the intrauterine environment through a variety of means: (1) ascending through the genitourinary tract from the vagina, (2) bloodborne organisms traveling through the placenta, (3) accidental introduction at the time of invasive procedures, and (4) retrograde spread through the fallopian tubes. Bacterial vaginosis, which has been shown to ascend into the uterus, has been associated with a 1.5 to 3-fold increase in preterm birth rates.

**Biologic and Genetic Markers**

Fetal fibronectin present in cervicovaginal fluids is currently the most powerful biochemical marker of preterm birth. Pregnant women who test positive for fetal fibronectin between 24-26 weeks of gestation are at a substantial increased risk for preterm birth. There also has been a proposed genetic component to preterm birth. Women who have had sisters who gave birth preterm have an 80% higher chance of delivering preterm themselves, and grandparents of women who deliver preterm are more likely to have been preterm as well. Both maternal and fetal genotypes affect the rates of preterm delivery and may interact with environmental factors such as genitourinary infections, smoking or other risk factors.

**Oral Maternal Health**

While genitourinary infections generally garner the most attention with regards to risk for preterm birth, other distant infections have also been
associated with premature delivery, including pyelonephritis, appendicitis, pneumonia, and periodontal disease.\textsuperscript{36,72,73} Periodontal disease has been associated with prematurity in several different patient populations with odds ratios (OR) ranging from 5.28 to 7.9, depending upon the level of prematurity and severity of periodontitis.\textsuperscript{27,73} While some interventional studies have demonstrated a benefit to prematurity rates with treatment of periodontitis,\textsuperscript{29,74-76} others have not demonstrated a notable benefit from periodontal treatment during pregnancy.\textsuperscript{30,77,78}

**Proposed Mechanisms for Interactions between Oral Inflammation and Preterm Birth**

While maternal infections are a known risk for preterm birth, over 50% of spontaneous preterm deliveries are due to unexplained causes. Distant infections and inflammatory processes, including periodontal disease, could be one cause.\textsuperscript{79} The mechanisms of action for the interaction of periodontal disease and preterm birth may occur through two mechanisms.\textsuperscript{80}

Women with periodontitis may experience more frequent bacteremias than periodontally healthy women, thus increasing the chance of periodontal bacteria being transmitted to the uterine environment. Once those bacteria are present within the uterus, they can elicit an immunoinflammatory cascade that may cause preterm birth. Putative periodontal pathogens, including *Porphyromonas gingivalis*, *Tannerella forsythia*, *Campylobacter rectus* and *Fusobacterium nucleatum* have been identified in the amniotic fluid of subjects with preterm birth/low birth weight neonates.\textsuperscript{81-84} It has also been observed bleeding on probing (BOP) has a high association with preterm birth.\textsuperscript{85} Many of these pathogens have also demonstrated fetal growth restriction and spontaneous miscarriage in animal models.\textsuperscript{36,87} Potential for hematological transmission of periopathogenic bacteria from the oral cavity to the placental environment has been proposed.

The second mechanism involves the entrance of proinflammatory cytokines caused by periodontal inflammation into the systemic circulation. These cytokines, in turn, cause systemic inflammation inducing preterm birth. Periodontal disease, including periodontitis and gingivitis, is associated with inflammation both locally and systemically.\textsuperscript{76,88,89} This local and systemic inflammation could increase prostaglandin levels above the threshold for increased uterine contractility and induce preterm birth.

It has been suggested the risk for preterm birth is the highest when both of these proposed mechanisms occur at once and the fetus is exposed to periodontal bacteria and an immune response is generated.\textsuperscript{90} The specific mechanism of interaction is still not full elucidated and requires additional research.

**Standards of Care for Perinatal Dental Treatment**

While interventional studies were equivocal on the benefit of nonsurgical periodontal therapy on preterm birth rates,\textsuperscript{29,30,74-78} all of the studies demonstrated clinical periodontal benefits to periodontal therapy. Furthermore, Michalowicz et al., stated “treatment of periodontitis in pregnant women improves periodontal disease and is safe.”\textsuperscript{30} and later analysis of these data demonstrated periodontal pathogens were decreased in the subgingival plaque of pregnant women who received therapy.\textsuperscript{91} A recent meta-analysis and systematic review of the current literature suggests regardless of the optimal interventional protocol and/or timing of intervention that may improve preterm birth, treatment of periodontal disease during pregnancy will improve oral health.\textsuperscript{92} Furthermore, it has been suggested the establishment and maintenance of optimal periodontal health prior to conception may be critical in the prevention of adverse pregnancy outcomes. Therefore, there may be opportunities to discuss optimal oral health and hygiene as a part of the preconception process for women of child bearing age.

**Patient Behavioral Management**

Pregnancy has also been identified as a critical time where women are more likely to make behavioral changes for the benefit of their fetus.\textsuperscript{93} Individualized techniques have proved effective in improving patient home care and oral hygiene levels,\textsuperscript{93,94} and motivational interviewing is often used to improve awareness of the importance of plaque control to oral health.\textsuperscript{95} Motivational interviewing is a person-centered, goal-directed method of communication that develops and strengthens a patient’s intrinsic motivation for
positive change. The communication skills are broken down into four core areas: (1) open-ended questions, (2) affirmations, (3) reflections, and (4) summary. These are sometimes referred to by the acronym OARS. Open-ended questions are used to elicit individualized information from patients and typically begin with "How," "What," or a descriptor asking for a patient's description, e.g., "Tell me about..." Reflections serve to prompt further discussion from patients and to clarify a patient's intentions. Affirmations are used to acknowledge and encourage positive health behaviors that patients are already practicing. Finally, summary reiterates the interviewer as an active listener and also sets the stage for change. An example of motivational interviewing might include:

**Dental Practitioner:** How did you feel about your cleaning today? (Open ended question)

**Patient:** Well, I am concerned about the bleeding in my gums that you found.

**Dental Practitioner:** It sounds like you are worried about your bleeding gums. (Reflection)

**Patient:** Yes. I know I have only been flossing a few times a week and I know that I should do it everyday.

**Dental Practitioner:** It's great that you are using the floss a few times a week. (Affirmation) What do you think makes the times that you do use it work for you? (Open ended question)

**Patient:** When I remember to put the floss on the counter when I get out my toothpaste, I am reminded to do it before bed.

**Dental Practitioner:** How do you think that you could prompt yourself to use floss more often?

**Patient:** I think that I could put the floss and toothpaste in a pretty jar on the counter together so that I can see them and see if that helps me remember!

**Dental Practitioner:** So, it sounds like you already have a great start flossing a few times a week, but you are going to try moving your floss to your bathroom counter to serve as a reminder to floss. (Summary) Sounds great!

Motivational interviewing has been shown to be a reliable method to affect change in patients' health behaviors including improved oral hygiene techniques. Even a single session of motivational interviewing has been shown to improve gingival bleeding scores and plaque index. Furthermore, it has been demonstrated dental professionals can be trained in motivational interviewing that affects meaningful change in oral hygiene measures in a relatively short period of time. Motivational interviewing has been shown to impact oral health behaviors associated with reducing plaque and improving gingival and periodontal health, but the training and expertise of dental providers vary widely, making interpretation of results difficult. It has been suggested practitioners interested in motivational interviewing techniques consider a formal training program, such as those identified by the Motivational Interviewing Network of Trainers.

**Interdisciplinary Collaboration**

Because dental care is critical to the overall health of mothers and children, interdisciplinary collaboration between dental care providers and the obstetric caregivers is of paramount importance. An understanding of the importance of the relationship between optimal oral care and pregnancy outcomes as well as a bidirectional referral relationship between perinatal healthcare providers and dental practitioners is critical to improving oral health care in pregnant women. Dental outreach to community OB/GYN and nurse midwife communities to discuss the ACOG recommendations for dental care and establish a referral pattern for patients could result in better health care for pregnant patients.

**Conclusion**

Preterm birth during pregnancy may be associated with periodontal health status. Further studies evaluating the mechanism and potential interventions may be beneficial to more fully understanding this interaction. Maternal health and demographics as well as genetic and fetal factors play a role in preterm birth risk. Understanding and identifying patients at high risk for preterm birth and establishing optimal oral health for them may improve not only their oral health but also their risks during pregnancy.
Currently, the science is clear that establishing optimal oral health prior to or during pregnancy is important, and patients should establish a dental home care regimen and continue to receive routine dental care during pregnancy. Furthermore, pregnancy may offer a unique opportunity to influence behavioral changes to improve oral hygiene in patients with a high risk for oral diseases.
Course Test Preview
To receive Continuing Education credit for this course, you must complete the online test. Please go to: www.dentalcare.com/en-US/dental-education/continuing-education/ce505/ce505-test.aspx

1. At least _____% of pregnant women experience some form of periodontal disease.
   a. 20
   b. 40
   c. 60
   d. 80

2. It is currently the recommendation of the National Maternal and Child Health Resource Center that all pregnant patients and those seeking to become pregnant who have not seen a dentist in 6 months should be referred to a dentist.
   a. True
   b. False

3. What is the most common form of periodontal disease in pregnant women?
   a. Pyogenic granuloma
   b. Chronic periodontitis
   c. Non-plaque induced gingivitis
   d. Plaque induced gingivitis

4. The severity of gingival inflammation during pregnancy has been linked to sex steroid secretion and increases as pregnancy progresses.
   a. True
   b. False

5. Preterm birth is defined as delivery at less than __________ of gestational age.
   a. 40 weeks
   b. 37 weeks
   c. 35 weeks
   d. 30 weeks

6. Which of the following states has NOT achieved a preterm birth rate below the March of Dimes target of 8.1%?
   a. Alabama
   b. Idaho
   c. Oregon
   d. Washington
   e. Vermont

7. High pre-pregnancy BMI is a risk factor for preterm birth whereas low pre-pregnancy BMI reduces the risk of preterm birth.
   a. True
   b. False

8. Women with previous preterm births have a ______ increased risk for preterm birth in subsequent pregnancies.
   a. 7-fold
   b. 5-fold
   c. 2.5-fold
   d. 1.5-fold
9. Plural gestations increase the risk of preterm birth. What percentage of twins are born preterm?
   a. 30%
   b. 40%
   c. 50%
   d. 60%

10. Maternal infections can induce the secretion of pro-inflammatory mediators, which in turn
    upregulate prostaglandin release. Prostaglandins can increase uterine contractility and increase
    the risk of spontaneous preterm birth.
    a. True
    b. False

11. Women whose sister(s) had a preterm delivery are _____% more likely to also have a preterm
    delivery.
    a. 50
    b. 60
    c. 70
    d. 80

12. Periodontal disease has been associated with preterm birth with an odds ratios (OR) ranging from
    _______ depending upon the level of prematurity and the definition of periodontal disease.
    a. 2.56-3.78
    b. 4.7-5.1
    c. 5.28-7.9
    d. 6.11-10.1

13. Over _____% of spontaneous preterm births have an unknown cause.
    a. 20
    b. 30
    c. 40
    d. 50

14. Which of the following putative periodontal pathogens have NOT been found in the amniotic fluid
    of subjects with preterm/low birth weight neonates?
    a. Porphyromonas gingivalis (Pg)
    b. Tannerella forsythensia (T.f.)
    c. Fusobacterium nucleatum (F.n.)
    d. Aggregatibacter actinomycetemcomitans (A.a.)

15. Bleeding on probing (BOP) is associated with an increasing risk of preterm birth.
    a. True
    b. False

16. Treatment of periodontal diseases during pregnancy _______ improve periodontal health and is
    a safe therapy for both mother and fetus.
    a. does
    b. does not
References


About the Author

Maria L. Geisinger, DDS, MS

Dr. Geisinger is an Associate Professor at the University of Alabama at Birmingham (UAB) in the Department of Periodontology where she teaches a broad range of classes and serves as the Director of the Advanced Education in Periodontology Program. She received her Bachelor’s of Science in Biology from Duke University graduating cum laude and completed her dental training at Columbia University College of Dental Medicine. She completed her Certificate in Periodontology and Master's of Clinical Science at the University of Texas Health Science Center in San Antonio. Dr. Geisinger is a Diplomate in the American Board of Periodontology. In her role at UAB, she is involved in clinical and translational research examining the interactions between periodontal diseases and systemic health. Her research focuses on periodontal-systemic interactions, periodontal regenerative therapies, implant dentistry, and educational technology. She is a member of the ADA, AAP, SAP, ADEA, AADR/IADR, AAWD, AAUW, and the President-elect of the AAPF.

Email: miagdds@uab.edu