RESEARCH PAPER

Pregnancy-Associated Hormonal Changes and Their Oral Manifestations: An Interdisciplinary Review of Clinical and Gynecologic Findings

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ABSTRACT

Pregnancy brings about significant hormonal and immunological changes that have a profound impact on a woman's oral health. These changes, particularly involving estrogen, progesterone, human chorionic gonadotropin (hCG), and relaxin, can influence the vascular, immune, and microbial environments of the oral cavity, resulting in various clinical manifestations. This review explores the most common oral conditions associated with pregnancy, including pregnancy gingivitis, periodontitis, pyogenic granulomas (pregnancy tumors), xerostomia, enamel erosion, and dental caries. These conditions not only affect maternal quality of life but may also contribute to adverse obstetric outcomes such as preterm birth, low birth weight, gestational diabetes, and preeclampsia. Emphasis is placed on the importance of accurate diagnosis, safe clinical practices, and the appropriate timing of dental care throughout pregnancy. The review also highlights the role of interprofessional collaboration between dental and obstetric care providers in delivering comprehensive prenatal health services. Preventive strategies, patient education, and behavior modification are identified as essential components of care. Additionally, the review outlines current gaps in policy, practice, and research, and calls for stronger integration of oral health into maternal care frameworks. By advancing interdisciplinary understanding and promoting evidence-based collaboration, oral healthcare can be effectively incorporated into routine prenatal care, leading to better outcomes for both mothers and their infants.

Keywords: Pregnancy gingivitis, Periodontitis, Hormonal changes, Maternal oral health, Interdisciplinary care

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INTRODUCTION

Pregnancy is a dynamic and complex physiological phenomenon involving deep systemic adaptations to support fetal growth and assure maternal health[1]. These alterations span cardiovascular, immunologic, metabolic, and endocrine systems—most extreme in hormonal alterations. Estrogen and progesterone concentrations rise exponentially during pregnancy, regulating vascular permeability, connective tissue restructuring, and inflammatory responses[2]. While such endocrine changes are necessary for successful pregnancy, they do also impact homeostasis of other organ systems, such as the oral cavity.

Dental health is an important but often overlooked aspect of antenatal health. The oral cavity is highly sensitive to systemic alterations, and pregnancy is often associated with a wide range of oral manifestations of hormonal and immunologic changes[3]. Some of these include pregnancy gingivitis, periodontal infection, pyogenic granuloma (pregnancy tumor), xerostomia, changes in taste, and increased susceptibility to dental caries and enamel erosions. These conditions, if untreated or unrecognized, can not only affect the quality of life of mothers but also potentially pose dangers to obstetric outcomes[4]. Cumulative evidence supports the association between maternal periodontal status and unfavorable obstetric outcome events, such as preterm delivery, low birth weight, and preeclampsia, making integrated care clinically meaningful[5].

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Also, these oral presentations are not only a local response but can be representative of systemic inflammatory changes prompted by hormonal activity. For example, heightened estrogen and progesterone levels can heighten vascular permeability in gingival tissues as well as affect the oral microbiome to cause heightened susceptibility to plaque-induced inflammation. The pregnancy hormones induce immunosuppression that also underlies alterations in host response, allowing for the proliferating opportunistic pathogens in the oral cavity[6]. These physiological processes stress the importance of having clinicians view oral observations not as singular states but as components of an overarching gestational physiology. From a public health perspective, the integration of oral health into prenatal consultations remains to be maximally utilized in the majority of healthcare centers, particularly in low- and middle-income countries where dental consultations might not be easily accessible. Understanding the routine clinical roles of these workers will facilitate early identification, timely intervention, and preventive education, ultimately improving pregnancy outcomes and reducing healthcare disparities[7].

This review attempts to critically evaluate pregnancy's hormonal changes and their oral consequences. From syntheses of dental and gynecologic literature, the intention is to emphasize key oral findings such as gingival inflammation, periodontal disease, and pregnancy tumors, and examine their respective hormonal basis. The article also seeks to promote interdisciplinary awareness and interdisciplinary collaborative care models in order to encourage both obstetric and dental professionals to recognize oral health as an essential component of comprehensive prenatal care.

Hormonal Changes During Pregnancy

Pregnancy leads to a dramatic reorientation of the maternal endocrine system for fetal development, maintenance of gestational homeostasis, and preparation for parturition and lactation. Changes in hormones affect nearly every organ system, such as the oral cavity. Understanding the role and interplay of the primary hormones of pregnancy is necessary for the interpretation of the physiologic and pathologic effects seen in obstetric and dental practices.

Estrogen and Progesterone

Estrogen and progesterone are the two principal pregnancy steroid hormones, whose titers rise steadily over the course of the three trimesters. Estrogen, primarily estriol during pregnancy, is synthesized by the placenta in increasingly large amounts. It plays a significant role in uterine development, control of blood flow, and the development of secondary sexual characteristics necessary for pregnancy[8]. Progesterone, secreted initially by the corpus luteum and subsequently by the placenta, plays a key role in sustaining the lining of the uterus, suppressing uterine contractions, and controlling maternal immune responses to allow for the fetus. Both hormones exert deep effects on connective tissues as well as vascular structures[9]. In the oral cavity, high levels of estrogen and progesterone are responsible for heightened vascular permeability and capillary fragility in the gingiva and predisposing tissues to inflammation and bleeding[10]. Progesterone actually enhances production of prostaglandins and reduces the effectiveness of neutrophils, interfering with the host response to bacterial plaque. Thus, even mild irritants can elicit exaggerated gingival responses. These hormone-mediated alterations account for the increased incidence and severity of pregnancy gingivitis and other periodontal illnesses that occur during pregnancy[11].

Human Chorionic Gonadotropin (hCG)

Human chorionic gonadotropin is the first hormone to increase dramatically after conception, secreted by the trophoblast shortly after implantation of the embryo. It is merely called the biological marker for early pregnancy detection. hCG maintains the corpus luteum during the first trimester, with ongoing progesterone secretion until placental hormone production is adequate[12]. Although endocrine maintenance of early pregnancy is the primary function of hCG, systemic and indirect oral effects exist. It may lead to morning sickness and hyperemesis gravidarum, by which repeated vomiting may result in enamel loss, mucosal inflammation of the mouth, and increased vulnerability to dental caries. In addition, nausea and altered appetite may reduce oral hygiene practices, complicating pregnancy-associated oral conditions[13].

Prolactin, Relaxin, and Other Endocrine Factors

Prolactin, released by the anterior pituitary, increases progressively throughout pregnancy and stimulates the breasts for milk production. Not directly involved with the oral changes, immunomodulation by prolactin might indirectly influence the oral reaction to pathogens. Prolactin is thought to cause some degree of fluid retention and alter the demeanor of mucosal tissue, but much more needs to be discovered in order to establish a definite connection[14]. Relaxin, secreted by corpus luteum and placenta, is best known for its capacity to relax the cervix and relax pelvic ligaments in anticipation of labor. It also influences the metabolism of connective tissue, which can extend to the temporomandibular joint and the periodontal ligament, causing increased tooth mobility or pain during pregnancy[15]. Other hormones that are involved are cortisol, thyroid hormones, and insulin. Cortisol production during pregnancy is increased and may influence immune function and wound healing, including in oral tissues[16]. Metabolism of the thyroid, often altered during pregnancy, can influence total metabolism, energy level, and homeostasis in the body, with indirect impacts on oral health as shown in Table 1. Increased resistance to insulin in late pregnancy, especially in gestational diabetes, also alters the host

immune defense and oral microbial ecology and makes them vulnerable to periodontal disease [17].

Table 1. Hormonal Changes During Pregnancy and Their Oral Implications

Hormone	Primary Role in Pregnancy	Oral Manifestations / Effects	References
Estrogen (primarily estriol)	-Promotes uterine development - Enhances blood flow - Develops secondary pregnancy traits	- Increases gingival vascular permeability - Contributes to capillary fragility - Promotes exaggerated inflammatory response to plaque	[8], [9], [10]
Progesterone	- Maintains endometrial lining - Inhibits uterine contractions - Modulates immune tolerance to fetus	- Increases prostaglandin synthesis - Suppresses neutrophil function - Enhances inflammation and bleeding in gingival tissues - Aggravates gingivitis	[9], [10], [11]
hCG (Human Chorionic Gonadotropin)	- Maintains corpus luteum in early pregnancy - Ensures progesterone production in first trimester	- Triggers nausea, vomiting (hyperemesis gravidarum) - Leads to enamel erosion - Causes mucosal irritation - Reduces oral hygiene compliance	[12], [13]
Prolactin	- Stimulates milk production - Regulates immune responses	- Indirectly modulates oral immune response - May cause mucosal fluid retention or subtle soft tissue changes	[14]
Relaxin	- Relaxes pelvic ligaments and cervix - Prepares body for childbirth	- Alters connective tissue metabolism - May cause increased tooth mobility - Could affect temporomandibular joint function	[15]
Cortisol	- Rises progressively - Supports fetal development and metabolism	- Impacts immune function - May impair wound healing in gingival tissues	[16]
Thyroid hormones	- Modulate energy metabolism - Maintain systemic homeostasis	- Indirectly influence oral tissues via altered metabolism - May affect salivary gland function or tissue healing	[16]
Insulin (via gestational resistance)	- Manages glucose metabolism - Resistance increases in late pregnancy	- Alters oral microbial composition - Weakens immune defenses - Increases risk of periodontitis, especially in gestational diabetes	[17]

Oral Manifestations of Pregnancy

The oral cavity undergoes numerous physiological and pathological changes during pregnancy due to the influence of elevated sex hormones and altered immune responses. These manifestations may range from mild gingival inflammation to significant periodontal deterioration and benign oral tumors. Understanding these changes is vital for both dental and obstetric care providers, as some oral conditions have been implicated in adverse pregnancy outcomes.

Pregnancy Gingivitis

Pregnancy gingivitis is the most common oral manifestation among pregnant women, and it affects particularly in the second trimester. Clinically, it appears as friable, inflamed, tender gingiva that bleeds upon brushing or flossing. While inadequate oral hygiene and plaque retention are primary etiologic factors, hormonal effects are a critical potentiating mechanism[18]. Progesterone increases vasodilation and permeability of the vessels, making the gingiva more susceptible. Simultaneously, estrogen modulates fibroblast activity and governs keratinocyte turnover, both culminating in increased tissue reactivity. Hormonal activity blunts neutrophil chemotaxis and phagocytosis, decreasing host defense against plaque biofilm. Pregnant women thus characteristically exhibit an exaggerated gingival response to minimal irritants in the face of unchanged

plaque levels from pre-pregnancy baselines. Histologically, pregnancy gingivitis is evidenced by increased vascular proliferation, edema, and infiltrate with plasma cells and lymphocytes. Microbiologically, it is evidenced by the presence of a high rise in anaerobic bacteria, e.g., *Prevotella intermedia* that acts on steroid hormones as growth factors and is also responsible for worsening the inflammation further[19]. Early diagnosis and increased plaque control will reverse the process and reduce the chances of further progression to periodontitis.

Pregnancy Tumor (Pyogenic Granuloma)

Also known as a pregnancy epulis or lobular capillary hemangioma, the pregnancy tumor is a benign hyperplastic lesion that occurs most frequently in the second or third trimester. It typically arises as a response to local irritation or trauma, facilitated by hormonal changes[20]. The pathogenesis occurs as a consequence of a multifactorial interaction between increased levels of progesterone and heightened inflammatory response to low-grade trauma or chronic irritation, such as plaque or calculus. The lesion is a pedunculated red to purple soft tissue mass that bleeds readily and may be tender or cause interference with mastication and oral hygiene[21]. Management is normally conservative. The majority of lesions will settle spontaneously postpartum without intervention. Excision is warranted, however, if the tumor is associated with a functional deficit, producing profuse bleeding, or failing to resolve after delivery. Preventive dental treatment and improved oral hygiene in early pregnancy have been documented to reduce occurrence and severity.

Periodontitis and Pregnancy

Periodontitis, a chronic inflammatory disease marked by periodontium destruction, may be aggravated during pregnancy or develop in pregnant females with pre-existing gingivitis. It has a multifactorial pathophysiology, depending on the host immune response to bacterial biofilms but influenced by hormonal factors. Pregnancy-associated periodontitis also has local oral health as well as systemic effects[22]. Several epidemiological investigations have cited a correlation between maternal periodontal infection and unfavorable pregnancy outcomes, including preterm delivery, low birth weight, and preeclampsia. The proposed mechanism is translocation of oral pathogens or systemic dissemination of inflammatory cytokines (e.g., IL-6, TNF-α, prostaglandins), which may result in uterine contraction or placental inflammation[23]. While causality remains disputable, the possible public health impact is significant. Routine visits of periodontal screening and treatment during pregnancy, particularly in the second trimester, are essential to minimize both oral and systemic risk. Non-surgical periodontal therapy has been successful in reducing inflammatory markers and improving clinical effectiveness without affecting the fetus[24].

Xerostomia, Ptyalism, and Taste Alterations

Dry mouth or xerostomia is a frequent complaint in pregnancy, but with varying prevalence. Hormonal changes, particularly increased estrogen, can affect the functioning of the salivary glands such that salivary flow is decreased. Less saliva is not only disagreeable but also diminishes buffering capacity, which can lead to caries and mucosal infection[25]. However, certain pregnant women develop sialorrhea or ptyalism, or excess salivation, especially during the first trimester. This may be related to nausea and increased parasympathetic tone, but not hypersalivation. Ptyalism may be inconvenient and socially inconvenient, typically stops as pregnancy progresses[26]. Taste alterations (dysgeusia) are common and result from hormonal changes, particularly in estrogen, that affect the sensitivity of the taste receptors. Some women develop a metallic sensation in their mouths or aversion to specific flavors, which influences food selection and adherence to oral hygiene[27].

Enamel Erosion and Dental Caries

Pregnancy is likely to increase a female's susceptibility to dental caries and enamel erosion. Some causative factors include dietary change, frequent snacking or craving for sweets combined with lowered salivary output and disrupted pH status. In addition, vomiting caused by morning sickness exposes enamel to gastric acid, particularly in the first trimester[28]. The cumulative effect of these risk factors creates softening and demineralization of enamel, especially on palatal surfaces of anterior teeth. Unless controlled, it will escalate to dentin hypersensitivity or overt carious lesions. Pregnant women who are severely nauseated will be most likely avoid brushing due to gag reflex sensitivity, which increases oral hygiene inadequacies[29]. Preventive interventions should include dietary counseling, application of fluoride toothpaste or mouth rinses, and timing toothbrushing in a way that avoids brushing after vomiting. Dental staff should provide anticipatory guidance to avert long-term damage and emphasize the continuation of normal oral hygiene practices during pregnancy as shown in Figure 1.

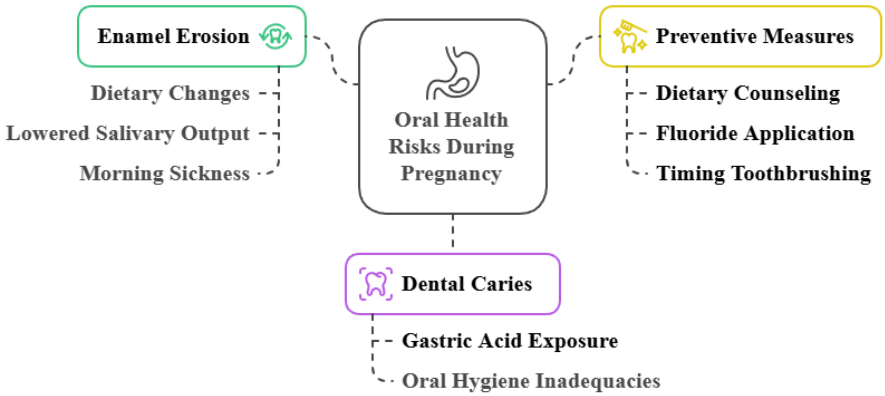

Figure 1. Oral health risks and preventive measures during pregnancy

Gynecologic and Obstetric Correlations

The interplay between oral health and pregnancy is gaining increasing attention in both gynecologic and dental disciplines. Hormonal, immunologic, and inflammatory pathways that regulate gestation also influence oral tissues, making the oral cavity a mirror of systemic pregnancy health. This section explores the bidirectional relationship between oral conditions and obstetric outcomes, emphasizes the clinical relevance of hormone-induced oral changes, and underscores the role of oral health in routine gynecologic care.

Influence of Oral Health on Pregnancy Outcomes

Increasing evidence suggests close association of maternal periodontal disease with preeclampsia, gestational diabetes mellitus (GDM), intrauterine growth restriction (IUGR), and preterm birth[30]. Periodontitis is a microbial biofilm-induced inflammatory infection of progressive loss of tooth-supporting tissues caused by an imbalance host immune response. Pregnancy amplifies this response further with increased estrogen and progesterone levels that can intensify gingival inflammation and result in impaired tissue integrity. Biologically, the validity of such correlation relies on the systemic dissemination of inflammatory mediators such as interleukins (IL-1β, IL-6), tumor necrosis factor-alpha (TNF-α), and prostaglandin E2 (PGE2), which are elevated during periodontal infection. These pro-inflammatory cytokines have been shown to cross the placental barrier and potentially cause placental inflammation, endothelial injury, and uterine contractions. Furthermore, oral pathogens such as *Fusobacterium nucleatum* and *Porphyromonas gingivalis* were isolated from amniotic fluid and placental tissue, indicating hematogenous spread from the oral sources[31]. Periodontal disease also has the potential to cause insulin resistance through the promotion of chronic low-grade systemic inflammation, thereby increasing GDM risk. Although causality is not yet established, there is growing opinion that gestational periodontal health will lower these risks. Regular dental examination and non-surgical periodontal therapy are safe and effective, especially when performed in the second trimester.

Hormone-Associated Changes Mimicking Pathology

Pregnancy hormonal changes often produce oral alterations that can mimic disease, leading to potential misdiagnosis or overtreatment. One example is the pregnancy tumor (pyogenic granuloma), a benign vascular lesion that might be mistaken for malignancy due to its rapid growth and tendency to bleed. Similarly, the hyperbolic gingival enlargement can be mistaken for drug-induced gingival overgrowth or neoplastic changes, alarming the unaware practitioner as to its benign, pregnancy-related nature[32]. Additionally, physiologic pigmentation of the mucosa or gingiva, sometimes also referred to as melasma of the oral cavity, can simulate pathologic melanosis or even early melanoma. Hormonal control of melanocyte-stimulating hormone during pregnancy is a recognized etiologic factor for such pigmentary alterations, typically in the second trimester[33]. These physiologic responses induced by hormones need to be differentiated from actual pathologies by an advanced understanding of oral alterations during pregnancy. Invasive treatments and biopsy are postponed in pregnancy without a high index of suspicion for malignancy. Joint dental and obstetric assessment can improve diagnostic accuracy and ensure appropriate, minimally invasive management.

Oral Health in Gynecologic Practice

Despite the strong evidence of an association between oral health and pregnancy outcome, oral screening remains underrepresented in the protocols for routine antenatal care. Obstetricians and gynecologists are typically the first point of contact for pregnant women and are thus well positioned to identify oral health risk and facilitate early dental evaluation[34]. The American College of Obstetricians and Gynecologists (ACOG) and other professional bodies recommend the inclusion of oral health assessment in prenatal care, including patient education regarding oral manifestations of pregnancy, the importance of dental hygiene, and safety of dental treatment[35]. The adherence to such guidelines is inconsistent, however, and is too often thwarted by the absence of interprofessional communication or perceived confusion regarding the safety of dental treatment during pregnancy. Promoting coordination between obstetricians, midwives, hygienists, and

dentists is central to achieving comprehensive prenatal care. Education materials, referral protocols, and electronic health records developed jointly can enable integrated care models. Additionally, training midwives and prenatal nurses to use basic oral screening instruments can close access gaps and allow for early identification of oral disease. The oral health and pregnancy outcomes are mentioned in Table 2.

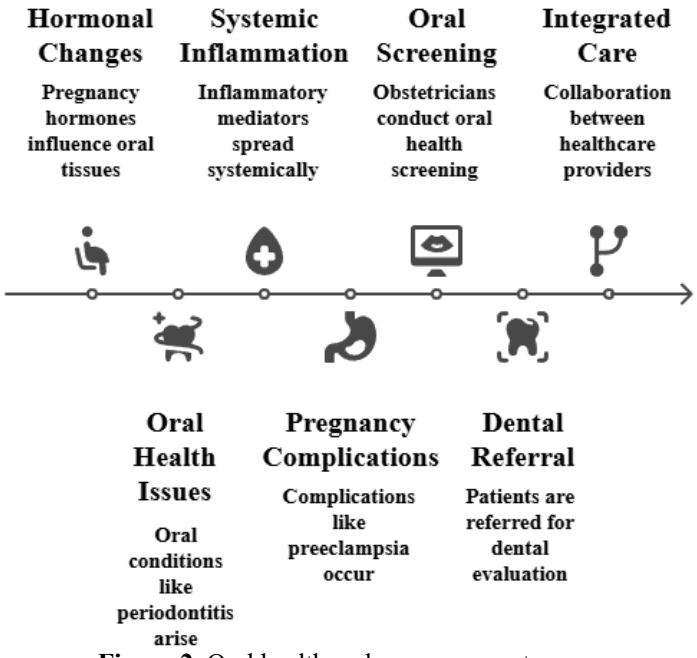

Figure 2. Oral health and pregnancy outcomes

Diagnostic and Clinical Considerations

Providing dental care during pregnancy requires careful consideration of both maternal and fetal safety while ensuring effective treatment. Dental practitioners must be equipped to conduct thorough examinations, manage oral conditions appropriately, and collaborate with obstetric care providers. Misconceptions surrounding the safety of dental procedures during pregnancy often lead to under-treatment, which can increase the risk of complications for both the mother and the fetus.

Clinical Examination Guidelines

Routine dental check-ups are necessary and safe during pregnancy. A comprehensive oral health evaluation should be part of prenatal care, ideally early in the first trimester. When conducting the clinical examination, the practitioner should note gingival health, the presence of dental plaque or calculus, carious lesions, tooth mobility, soft tissue lesions, and signs of periodontal disease. Full periodontal charting can reveal individuals at greater risk for systemic complications such as preterm delivery or preeclampsia[36].

Care should be taken with patient comfort and positioning. During the third trimester, the gravid uterus may compress the inferior vena cava when in the supine position, leading to hypotension, dizziness, and fetal compromise. This may be prevented by positioning the patient on a wedge or pillow on a slight left lateral position to move the uterus and improve circulation. Diagnostic radiology remains an essential component of dental care. With modern precautions, radiographs can be ordered when necessary, particularly after the first trimester. Precautions, like lead shielding of the abdomen and thyroid gland, and utilizing fast-speed film or digital technology, greatly reduce radiation exposure. Delaying or withholding radiographs based on unfounded fears can result in failure to diagnose or progress of unknown pathology, which can be more harmful than the radiation itself[37].

Pharmacologically, the selection of safest agents matters and requires knowledge and caution. Common local anesthetics such as lidocaine (Category B) are effective and safe when used in acceptable quantities. Restrict vasoconstrictors to the minimum and refrain from excessive epinephrine administration in patients with prior hypertension or cardiac disease. Of the analgesics, acetaminophen is to be used in pregnancy and NSAIDs are to be avoided especially in the third trimester due to potential ductus arteriosus closure. Safe antibiotics include amoxicillin, clindamycin, and cephalosporins; tetracyclines are contraindicated because they interfere with tooth development in the fetus[38].

Timing of Dental Interventions

The gestational age of the patient is a significant consideration in treatment planning. The second trimester is the most stable period within which to complete both emergent and elective dental treatment. Fetal organogenesis has been finished during this time, and the risk of spontaneous abortion or teratogenicity is very low. Women are also more comfortable physically and more likely to tolerate dental chair time during this

trimester[39]. In the first trimester, although emergency interventions that are absolutely essential cannot be denied, elective care is generally deferred due to the fragile status of early embryonic development and heightened maternal nausea and fatigue. Instruction at this stage is crucially important—patients can be taught oral hygiene measures early and be provided with dietary counseling to prevent future issues.

During the third trimester of pregnancy, increased maternal discomfort, fatigue, and risk of supine hypotensive syndrome warrant modification of treatment. It is a good practice to opt for shorter, upright appointments with frequent breaks. Emotional stress and physical discomfort during lengthy procedures may increase the risk of uterine irritability or premature contractions. Therefore, only procedures with a high level of urgency are to be done, and clinicians should be prepared to make appropriate modifications based on maternal status[40]. Emergency care, regardless of gestational age, cannot be delayed. Acute odontogenic infection, facial cellulitis, and deep periodontal abscesses pose systemic risks that may rapidly deteriorate if left untreated. Close collaboration of the patient's obstetrician is necessary in these cases to help ensure multidisciplinary monitoring and appropriate antibiotic and pain management procedures.

Patient Counseling and Education

Pregnant patients are often unaware of the safety and importance of dental care throughout pregnancy. Misconceptions like the beliefs that dental treatment is best avoided or that it will compromise the fetus are prevalent[41]. Dental practitioners have an obligation to provide brief, evidence-based information on oral hygiene, the safety of dental interventions, and the systemic consequences of untreated oral infection. Visual aids, prenatal oral health brochures, and simple hygiene demonstrations can be extremely effective in reinforcing oral health messages[42]. Educational intervention should also encompass nutrition, with emphasis on reduced sugar intake, fluoride toothpaste usage, and appropriate timing of brushing after vomiting episodes to avert enamel breakdown. Preventive strategies such as chlorhexidine mouthwash and professional cleansing are valuable adjuncts in the maintenance of oral hygiene.

Interprofessional Collaboration and Legal-Ethical Implications

An interprofessional model involving obstetricians, dentists, midwives, and family physicians encourages an overall care system. If providers coordinate care, patients are treated earlier, with fewer complications, and improved pregnancy outcomes. Cross-training, common protocols, and referral processes can bridge knowledge gaps and improve effective patient management. Clinicians also need to be aware of the legal and ethical consequences of treating pregnant patients. Informed consent is essential, particularly if drugs and imaging are involved[43]. The patient needs to be educated about risks and benefits of the available treatments and all decisions need to be recorded according to medical and dental legal guidelines as shown in Table 2.

Table 2. Diagnostic and Clinical Considerations in Dental Management During Pregnancy

Area	Key Recommendations	Clinical Relevance	References
Examination	Full oral exam in 1st trimester; assess gums, caries, soft tissues	Early detection prevents complications like preeclampsia	[36]
Positioning	Use left-lateral tilt in 3rd trimester	Avoids supine hypotensive syndrome	[36]
Imaging	Safe with shielding; prefer digital/fast film	Delayed diagnosis is riskier than controlled imaging	[37]
Medications	Lidocaine safe; limit epinephrine Use acetaminophen; avoid NSAIDs late Amoxicillin, clindamycin safe	Ensures maternal-fetal safety during pain or infection control	[38]
Treatment Timing	2nd trimester ideal 1st: urgent care only 3rd: short, modified sessions	Minimizes fetal risk; improves patient comfort	[39], [40]
Emergency Care	Do not delay urgent infections; consult OB	Prevents serious systemic consequences	[40]
Patient Education	Address myths; teach hygiene, diet, fluoride use	Improves compliance and outcomes	[41], [42]
Preventive Care	Recommend brushing post-vomiting; use rinses as needed	Protects enamel, controls bacteria	[42]
Collaboration & Ethics	Coordinate with OB/midwives Obtain informed consent	Enhances care quality; ensures legal documentation	[43]

Preventive and Therapeutic Strategies

Prevention and timely management are foundations of pregnancy oral health. As a result of the multisystem physiological changes with pregnancy, pregnant patients are at higher risk of multiple oral pathologies like gingivitis, periodontal disease, pregnancy tumor, and dental caries. Prevention is not only clinical but also includes patient education, behavior change, and interprofessional collaboration.

Patient Education and Behavior Modification

Educating the patient is an important first step towards the promotion of oral health during pregnancy. Most pregnant women are not adequately informed about the safety of dental care during pregnancy, and some even avoid going to the dentist in anticipation of harming the unborn fetus. The medical and dental communities need to collectively educate patients that preventive, diagnostic, and most restorative procedures are not only safe but will also be beneficial for maternal and fetal health[44]. Educational counseling should begin early in pregnancy, optimally at the initial prenatal visit, and should include hormonal effects on the oral cavity, the importance of maintaining oral hygiene, and the connection between periodontal disease and systemic complications such as preterm delivery. The patients should be instructed to brush the teeth two times a day with fluoride toothpaste, floss, and see the dentist for a check-up during the second trimester, which is the most convenient time for dental procedures[45].

Nutrition education is also crucial. Pregnant women are at higher risk of developing cravings for sugar and over-snacking, which leads to increased risk of caries. Nutrition advice should encourage healthy snack options, elimination of sugary beverages, and consumption of water throughout the day. For patients experiencing morning sickness, education should be provided on how to protect enamel—rinsing with fluoride mouthwash or water after vomiting, and not brushing for 30 minutes. Behavioral alterations such as quitting tobacco and reduction in alcohol intake are equally important. Pregnancy smoking not only jeopardizes the health of the fetus but also aggravates periodontal disease and prevents healing. Dentists as oral health care providers can reinforce public health message and offer brief interventions or refer to cessation programs[46]. In patients who already manifest gingival inflammation or early periodontal disease, education must be accompanied by non-surgical preventive therapy. Professional cleaning, scaling, and root planing, and antimicrobial oral rinses (e.g., chlorhexidine) may be employed without risk to reduce microbial load and halt disease progression. These therapies must be incorporated into a preventive care program and not delayed, as delay in therapy will result in more serious consequences.

COLLABORATIVE CARE MODELS

Optimizing oral health outcomes during pregnancy requires more than individual-level interventions; it necessitates systemic, interdisciplinary coordination between obstetric and dental providers. Integrated models facilitate the ability to enable early detection, treatment, and education through coordinated efforts that eliminate gaps between medical and dental practices[47].

Obstetricians, gynecologists, midwives, and primary care providers play a fundamental role in introducing the subject of oral health into prenatal care. Their endorsement of dental care can reassure patients and reduce resistance, making dental referrals more acceptable. The addition of a basic oral health screening to standard prenatal examinations such as looking for bleeding gums, swelling, or oral lesions can be an effective triage tool. Patients can be sent to dental practitioners for evaluation and treatment if problems are found.

Midwives and community health workers, especially in resource-poor settings, can serve as crucial bridges between pregnant women and oral health care[48]. Training these frontline workers in basic oral health risk assessment and education prepares them to deliver culturally sensitive messages, provide oral hygiene products, and encourage early dental care visits. These types of community-based approaches are especially critical in disadvantaged communities where access to dentists may be limited. Electronic health records (EHRs) can also enable collaborative models through the enhancement of communication and shared documentation between obstetric and dental teams. Interdisciplinary notes, prompts for pending dental evaluations, and standardized oral health checklists can coordinate patient care and ensure no aspect of health is overlooked[49]. Institutional policies integrating oral health into prenatal care guidelines were found to increase utilization of dental care during pregnancy.

Professional education and cross-education are the keys to teamwork becoming the norm and not an option. Continuing education classes need to emphasize the oral-systemic relationship and promote a team-based model of care. Dentists and dental hygienists must be educated regarding the physiological changes of pregnancy, drugs contraindicated during pregnancy, and treatment guidelines specific to trimesters[50]. Likewise, medical personnel must be educated regarding common oral manifestations of pregnancy and the importance of early referral to the dentist. At the policy level, governments and health systems need to promote integrated maternal care by providing dental cover under prenatal insurance programs, funding community oral health care, and offering incentives for collaborative practice. Public health campaigns making dental visits during pregnancy a socially acceptable norm can also prevent stigma and myths.

FUTURE DIRECTIONS

As understanding of oral-systemic health relationships increases, it is clearer than ever that pregnancy-related oral health deserves more research. Multicenter, longitudinal studies tracing oral health alterations during each of the three trimesters of pregnancy and into the postpartum period are urgently required. Long-term cohort studies might create causal relations between hormonal instability and the development or onset of oral diseases. In addition, mechanistic cellular and molecular research is needed to determine how specific hormones like estrogen, progesterone, and relaxin affect gingival vasculature, immune status, and microbial ecology. Research on differential oral microbiome responses over various stages of pregnancy could

uncover susceptibility pathways for periodontal disease. Determination of the genetic and epigenetic factors that influence individual responses to hormonal changes would also facilitate individualized preventive strategies. In spite of professional association guidelines like the American Dental Association (ADA) and American College of Obstetricians and Gynecologists (ACOG), oral health remains poorly integrated into maternal health policy in the majority of healthcare systems. There are few national prenatal programs that include routine oral health assessment, and there are few others with dental services included as part of universal prenatal care. These policy guidelines are required that integrate oral health into prenatal care. These must include universal oral screening tools in prenatal clinics, routine dental referrals by obstetricians and midwives, and recording oral health status during pregnancy as a required element. Public health interventions must also address inequities of access by extending services to the underserved through mobile clinics, tele-dentistry, and community outreach.

Biomarker diagnostics, which emerged in recent years, opens up promising possibilities for the diagnosis of early oral disease in pregnancy. The inflammatory cytokines (IL-1β, IL-6), matrix metalloproteinases (MMPs), and bacterial DNA signatures in saliva are potential salivary biomarkers that may serve as non-invasive markers of oral health, disease activity, and risk prediction. Further research is needed to validate these biomarkers in pregnant populations and integrate them into clinical settings. Other technologies such as AI-driven diagnosis platforms, tele-dentistry, and mHealth apps could also facilitate remote monitoring, customized education, and timely referral. These apps are particularly convenient in low-resource or rural settings where access to in-person dental care might be limited. With evolving technology, oral health monitoring can be integrated with prenatal digital platforms to bridge the care continuity.

CONCLUSION

Pregnancy is a unique physiological period of profound physiological hormonal changes that significantly affect oral health. As the current review shows, elevated levels of progesterone, estrogen, and other endocrine controllers alter vascular permeability, immune reactions, and oral health microbial ecology, leading to a broad range of manifestations from gingivitis and periodontitis to pregnancy tumors, xerostomia, and enamel loss. These conditions are more than localized inflammation but may also be involved in systemic inflammation, and there is growing evidence that they are linked to complications of pregnancy such as preeclampsia, gestational diabetes, and preterm labor. Despite strong evidence for the bidirectional connection between oral and systemic health during pregnancy, oral care remains underintegrated into routine prenatal care. The barriers include patient lack of awareness, inconsistent advice from practitioners, and inadequate interprofessional coordination. An effective strategy to bridge these gaps should employ a mix of patient education, early diagnosis, timely and safe intervention, and structured interdisciplinary coordination between obstetric and dental professionals. Preventative interventions aimed at behavior guidance, diet, and preservation of oral hygiene must be emphasized during prenatal care. Clinical practice should prioritize the use of non-surgical interventions and treatment planning in concordance with the period of gestation. Future activities should aim at strengthening health policies tending to provide universal access to dental care throughout pregnancy, as well as towards augmenting diagnostic innovations such as salivary biomarkers and mHealth technologies. Ultimately, knowledge of oral health as a key component of maternal health can serve both mother and child. With education across disciplines, evidence-based practice, closure of research and policy, healthcare systems can integrate oral health into comprehensive prenatal care, bringing benefits that extend well beyond the duration of pregnancy.

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