

Management of Pregnant Patient in Dentistry

Sophia Kurien¹, Vivekanand S Kattimani², Roopa Rani Sriram³, Sanjay Krishna Sriram⁴, Prabhakara Rao V K⁵, Anitha Bhupathi⁶, Rupa Rani Bodduru⁷, Namrata N Patil⁸

¹Professor, New Horizon Dental College & Hospital, Department of Oral Medicine and Radiology, Chattisgarh, India; ²Assistant Professor, S D Dental College and Hospital, Department of Oral and Maxillofacial Surgery, Maharashtra, India; ³Assistant Professor, Department of Oral and Maxillofacial Surgery, Mansarovar Dental College, Bhopal (M.P.), India; ⁴Assistant Professor, Department of Conservative and Endodontics, Mansarovar Dental College, Bhopal (M.P.), India; ⁵Professor, GITAM Dental College and Hospital, Department of Periodontics, Andhra Pradesh, India; ^{6,7}Assistant Professor, S D Dental College and Hospital, Parbhani, Department of Periodontics, Maharashtra, India; ⁸Assistant Professor, S D Dental College and Hospital, Parbhani, Department of Oral Pathology, Maharashtra, India.

ABSTRACT

The purpose of this article is to update general dentists and maxillofacial surgeons in the perioperative management of the pregnant patient. Pregnancy results in physiologic changes in almost all organ systems in the body mediated mainly by hormones; which influences the treatment schedule. Understanding these normal changes is essential for providing quality care for pregnant women.

The general principles that apply in this situation are discussed, followed by the relevant physiologic changes and their treatment implications, the risks of various medications to the mother and fetus, the management of concomitant medical problems in the pregnant patient, appropriate timing of oral and maxillofacial surgery during pregnancy, and management of emergencies during pregnancy. Information about the compatibility, complications, and excretion of the common drugs during pregnancy is provided. Guidelines for the management of a pregnant patient in the dental office are summarized.

Keywords: pregnant patient, physiology of pregnancy, treatment considerations.

How to cite this article: Kurien S, Kattimani V S, Sriram R, Sriram S K, Prabhakar Rao V K, Bhupathi A, Bodduru R, Patil N N. Management of Pregnant Patient in Dentistry. *J Int Oral Health* 2013; 5(1):88-97.

Source of Support: Nil

Conflict of Interest: None Declared

Received: 7th November 2012

Reviewed: 10th December 2012

Accepted: 02nd January 2013

Address for Correspondence: Dr Vivekanand S Kattimani, Assistant Professor, S D Dental College and Hospital, Parbhani, Department of Oral and Maxillofacial Surgery, Maharashtra, India. Mobile: 09689742418, Email: drvivekanandsk@gmail.com

Introduction

Pregnancy causes many changes in the physiology of the female patient. These alterations are sometimes subtle but can lead to disastrous complications if proper precautions are not taken during dental treatment. Physiologically, changes occur in the cardiovascular, hematologic, respiratory, gastrointestinal, genitourinary, endocrine, and oro-facial systems (Table 1). The changes that occur are the result of increasing maternal and fetal requirements for the growth of the fetus and the preparation of the mother for delivery. Increased hormonal secretion and fetal

growth induce several systemic, as well as local physiologic and physical changes in a pregnant woman. Local physical changes occur in different parts of the body, including the oral cavity. These collective changes may pose various challenges in providing dental care for the pregnant patient. Treatment of the pregnant patient has the potential to affect the lives of two individuals (the mother and the unborn fetus). Certain principles must be considered in the treatment of the pregnant patients so that, it benefits to the mother while minimizing the risk to the fetus.

Physiology of pregnancy and its considerations in the management:

Cardio Vascular System and its implications:

Compared with the non pregnant patient, the pregnant patient shows significant changes in blood volume and cardiac output and changes in systemic vascular resistance, decrease in blood pressure, and the potential occurrence of the supine hypotensive syndrome.¹⁻⁸ Cardiac output increases 30% to 50% during pregnancy, secondary to a 20% to 30% increase in heart rate as well as a 20% to 50% increase in stroke volume.^{7,9} These changes produce a functional heart murmur and tachycardia in 90% of women, which disappears shortly after delivery.¹⁰

During the second and third trimesters, a decrease in blood pressure and cardiac output can occur while the patient is in a supine position. It is due to the decreased venous return to the heart from the compression of the inferior vena cava by the gravid uterus, which can result in a 14% reduction in cardiac output.^{11,12} Current data implicate various mediators like progesterone, prostaglandins, and nitric oxide for causing peripheral vasodilatation and venodilation^{6,8,13} Hypotension, bradycardia, and syncope characterize supine hypotension syndrome.¹³ The resulting decrease in the stroke volume stimulates the baroreceptors as a normal compensatory mechanism to maintain cardiac output. This leads to hypotension, nausea, dizziness, and fainting. To prevent supine hypotensive syndrome in the dental chair, the pregnant woman should have the right hip elevated 10 to 12 cm or placing the patient in a 5% to 15% tilt on her left side can relieve pressure on the inferior vena cava. If hypotension is still not relieved, a full left lateral position may be needed.⁸

Respiratory system changes and its implications:

The respiratory changes occurring during pregnancy are to accommodate the increasing size

of the developing fetus and the maternal-fetal oxygen requirements. Enlarged fetus pushes the diaphragm up by 3 to 4 cm causing an increase in intra thoracic pressure. This leads to an increase in chest circumference that results in out flaring of the ribs.¹⁵ The diaphragmatic displacement leads to a 15% to 20% reduction in functional residual capacity.

Hyperventilation begins in the first trimester and may increase up to 42% in late pregnancy. Approximately 50% of pregnant women complained of dyspnea by gestation week 19, which increased to 75% by 31 weeks. Pregnant patients (25%) develop moderate hypoxemia and some develop an abnormal alveolar-arterial oxygen gradient when placed in the supine position^{1,19}. Ventilation patterns and patient position must be adjusted for the pregnant patient so as to avoid hypoxemia^{1,20}.

The mucosa of the upper airways has a tendency to become friable and edematous due to increased serum estrogen concentrations in pregnant women². Up to one third of pregnant women experience severe rhinitis, which predisposes them to frequent nosebleeds and upper respiratory tract infections^{1,2}.

Circulatory system changes and its implications:

In pregnancy, changes will include increase in the number of erythrocytes and leukocytes, erythrocyte sedimentation rate, and most of the clotting factors, causing a hypercoagulable state.^{2,10} Disproportionate rise in red blood cell mass accounts for the "hemodilution" or physiologic anemia of pregnancy that is maximal by approximately 30 to 32 week's gestation.¹ These changes will protect the mother from volume depletion due to excessive peripartum hemorrhage and to lessen the chance of thrombotic event occurrence.

Increased levels of circulating catecholamines and cortisol contribute to the leukocytosis seen in

pregnancy.^{2,22} Clotting factors VII-X are increased and anti clotting factors XI and XIII are decreased. Therefore, pregnancy is considered to be a hyper coagulable state, increasing the risk for thromboembolism.¹⁷ Pregnant women have a fivefold increase in the likelihood of thromboembolic events, compared with non-pregnant patients.^{1,25} Acute thromboembolism during pregnancy requires intravenous anticoagulation for 5 to 10 days, followed every 8 to 12 hours by subcutaneous injections to prolong the partial thromboplastin time at least to 1.5 times control throughout the dosing interval. Treatment with heparin, aspirin, or intravenous immunoglobulin's decreased the fetal loss rate²⁶ and heparin is preferred because it does not cross the placenta, has a much more predictable dose response because of low protein-binding (unlike unfractionated heparin), and has been demonstrated to be more effective than heparin for prophylaxis and less likely to cause major spontaneous bleeding.^{1,27}

Gastrointestinal System changes and its implications:

The main GI changes are nausea, vomiting, and heartburn which are due to mechanical changes resulting from an enlarging fetus, in combination with hormonal changes. Two thirds of pregnant patients complain of nausea and vomiting, with the peak frequency at the end of the first trimester.¹ Pyrosis (heartburn) occurs in approximately 30% to 50% of pregnant women. Reflux occurs as a result of an increased intra gastric pressure due to the enlarging fetus, slow gastric emptying rate, and decreased resting pressure of the lower gastroesophageal sphincter.^{27,31} Pathophysiology of nausea and vomiting during pregnancy is thought to be due to the hormonal effects of estrogen and progesterone.³² Other changes include hepatic dysfunction and iron deficiency.

Liver dysfunction may lead to preeclampsia (a placental-induced triad of hypertension, proteinuria, and edema), HELLP syndrome (hemolysis, elevated liver enzymes, low platelets), obstructive cholestasis, and acute fatty liver of pregnancy.³⁵ The exact cause of preeclampsia has not been identified. Pregnant women with elevated blood pressure should be referred to the primary physician or obstetrician to be evaluated for possible developing preeclampsia.

For pregnant women with hyperemesis morning appointments should be avoided. They should be advised to avoid citrus drinks or fatty foods as they may cause gastric upset or delay gastric emptying. Pregnant women should be advised to sip small volumes of salty liquids such as sports beverages to prevent dehydration due to recurrent vomiting. During dental procedures, pregnant patients should be seated in a semi supine or comfortable position. The procedure should be stopped immediately if patient experiences nausea and the chair should be repositioned upright. Increased episodes of gastric reflux and regurgitation warrant special consideration, because they can lead to aspiration of gastric contents and, in some cases, death.¹ Additional supplements like Iron is required for fetal erythropoiesis and folic acid for amino acid and nucleic acid synthesis.^{38,39}

Renal and genitourinary changes and its implications:

The principal renal and genitourinary changes in pregnant patients are increased glomerular filtration rate (GFR), biochemical changes in the urine and blood, urinate more frequently and have a greater risk of urinary tract infections.^{1,2,40,41} The most significant physiologic urinary tract change is ureteral dilation. Hydroureter is found in almost 90% of pregnancies by the third trimester. The relative urinary stasis may account for the higher incidences of pyelonephritis during pregnancy.

Asymptomatic bacteriuria in the pregnant patient can progress to urinary tract infection and eventually pyelonephritis if untreated.¹

As a result of the increased filtration, clearance of creatinine, uric acid, and urea is increased, which results in a decline in serum creatinine and blood urea nitrogen. When drugs with renal clearance are used in pregnancy, their doses may need to be increased to account for their more rapid clearance. Ask the patient to empty the bladder just prior to starting the dental procedure.

Endocrine changes and its implications:

Hormones are responsible for most of the physiologic changes during pregnancy those are the female sex hormones (estrogen, progesterone, and human gonadotrophin) and secreted primarily by the placenta. In addition, there is also an increase in thyroxine, steroids, and insulin

levels. About 45% of pregnant women are unable to produce sufficient amounts of insulin to overcome the antagonistic action of estrogen and progesterone, and as a result develop gestational diabetes. Women who are obese and with a positive family history of Type II diabetes mellitus have a higher risk of developing gestational diabetes.¹¹ Estrogen and progesterone are insulin antagonists and the increased levels of these hormones lead to insulin resistance, thus insulin levels are elevated in pregnant women to compensate for this resistance.

Oro-facial changes and its importance:

Oral changes include gingivitis, gingival hyperplasia, pyogenic granuloma, and salivary changes. Increased facial pigmentation is also seen. Elevated circulating estrogen, which causes increased capillary permeability, predisposes

Table 1: Summary of Physiologic Changes During Pregnancy

Cardiovascular	Increased uterine mass causes compression of IVC leads to venous stasis and increased risk for deep venous thrombosis, Decreased amplitude of T-waves on electrocardiogram, Extra heart sounds / systolic S3 murmur.
Hematologic	Hypercoagulable state leads to increased risk for thrombosis/embolism, Leukocytosis, Physiologic anemia due to increased circulating volume, Generalized immunosuppression.
Respiratory	Increased mucosal fragility / increased risk of airway edema, epistaxis with manipulation of nasal airway, Decreased PaO ₂ while supine leads to increased risk of hypoxia, decreased functional residual capacity, progesterone-induced hyperventilation.
Gastrointestinal	Loss of lower esophageal sphincter tone leads to increased risk of reflux disease, Decreased gastric motility, Increased intragastric pressure.
Genitourinary	Loss of intravascular protein causes decreased oncotic pressure leads to peripheral edema, Increased glomerular filtration rate Urinary stasis leads to increased risk of urinary tract infections.
Endocrine	Increase in Estrogen ,progesterone, thyroxine, steroids, insulin levels and increase in the circulating 1,25, dihydroxy-cholecalciferol.

Table 2: Pregnancy Risk Categories for Pharmacologic Agents.

US FDA category	Explanation
Category A	Controlled human studies indicate no apparent risk to the fetus. The possibility of risk to the fetus is remote.
Category B	Animal studies do not indicate fetal risk. Well-controlled human studies have failed to demonstrate a risk
Category C	Animal studies show an adverse effect on the fetus but there are no controlled studies in humans. The benefits from use of such drugs may be acceptable.
Category D	Evidence of human risk, but in certain circumstances the use of such a drug may be acceptable in pregnant women despite its potential risk.
Category X	Risk of use in pregnant women clearly outweighs possible benefits.

pregnant women to gingivitis and gingival hyperplasia.⁴³ Pregnancy does not cause periodontal disease but does worsen an existing condition. Increased angiogenesis, due to sex hormones coupled with gingival irritation by local factors such as plaque, is believed to cause pyogenic granuloma in 1%-5% of patients, which occurs during the first and the second trimesters and may regress after the child's birth. The change in composition includes a decrease in sodium and pH, and an increase in potassium, protein, and estrogen levels. Due to increase in salivary estrogen the proliferation and desquamation of the oral mucosal cells provide a suitable environment for bacterial growth which predisposes the pregnant woman to dental caries. Good oral hygiene will help to prevent or reduce the severity of the hormone-mediated inflammatory oral changes.

Facial changes as "mask of pregnancy," appearing as bilateral brown patches in the mid-face begin during the first trimester and are seen in up to 73% of pregnant women. Melasma usually resolves after parturition. Preterm low birth weight baby reported with periodontal disease. It seems to be an independent risk factor and was decreased by good oral hygiene and periodontal treatment.

Pharmacotherapy in pregnancy:

Higher volume of drug distribution, lower maximum plasma concentration, lower plasma half-life, higher lipid solubility, and a higher clearance of the drugs is seen in pregnancy. Certain drugs are known to cause miscarriage, teratogenicity, and low birth weight of the fetus. Most drugs are excreted in breast milk, exposing the newborn to the drugs. toxicity to new born depends on the chemical properties, dose, frequency, duration of exposure to the drugs, and amount of milk consumed. The FDA has categorized teratogenic drugs which cause birth defects and provided the definitive guidelines for prescribing drugs during pregnancy. They are as follows (Table -2). Understanding the safety aspects of commonly used and prescribed medications minimizes adverse outcomes. (Table-3) Fortunately, there is a small number but a wide variety of drugs that are teratogens (ie, drugs that can cause either structural or functional birth defects). (Table-4) Several categories of drugs are known to be teratogenic, including alcohol, tobacco, cocaine, thalidomide, methyl mercury, anticonvulsant medications, warfarin compounds, angiotensin-converting enzyme (ACE) inhibitors, retinoids, and certain antimicrobial agents.

Table 3: Common Drugs used in Dental Therapies with its Limitations and Remarks.

Drugs	Use in Pregnancy	Use in Lactation	Remarks
Antibiotics			
Amoxicillin Metronidazole Erythromycin Penicillin Cephalosporins	yes	yes	Fetal ototoxicity with gentamycin. Discoloration of teeth with tetracycline. Maternal toxicity/fetal death with chloramphenicol
Gentamycin Clindamycin	yes	yes	
Tetracycline Chloramphenicol	no	no	
Analgesics			
Acetaminophen Morphine Meperidine	yes	yes	Postpartum hemorrhage associated with aspirin. Respiratory depression with morphine.
Oxycodone Hydrocodone Propoxyphene Pentazocine	With caution	With caution	
Aspirin Ibuprofen Naproxen	Not in 3rd trimester	no	
Antifungals			
Clotrimazole Nystatin	yes	yes	Fetal toxicity with ketoconazole.
Fluconazole Ketoconazole	With caution	With caution	
Local Anesthetics			
Lidocaine Prilocaine Etidocaine	yes	yes	Fetal bradycardia with Mepivacaine & Bupivacaine
Mepivacaine Bupivacaine	With caution	yes	
Corticosteroids			
Prednisolone	yes	yes	
Sedative/Hypnotic			
Nitrous oxide	Not in 1st trimester ++	yes	Spontaneous abortions with Nitrous oxide.
Barbiturate Benzodiazepines	no	no	Cleft lip/palate with Benzodiazepines
++ Because of neonatal respiratory depression.			

Most antibiotics do cross the placenta and thus have the potential to affect the fetus. The cyclooxygenase (COX)-2 inhibitors (celecoxib and rofecoxib) is classified as category C medication

Table 4: Known Teratogens and their Fetal Effects.

Teratogens	Effects on Fetus
Ethyl alcohol	Fetal alcohol syndrome
Tobacco	Low birth rate, cleft lip and palate
Cocaine	cognitive delay, Placental abruption
Thalidomide	Micromelia
Methyl mercury	Microcephaly, Brain damage
Anticonvulsants (all)	Orofacial clefts, cardiac Malformations,
Carbamazepine	Spina bifida
Valproic acid	Neural tube defects
Lamotrigine	Neural tube defects
Phenobarbital	Urinary malformations
Topiramate	Abnormalities in all subjects
Warfarin (eg, Coumadin)	Warfarin embryopathy (midface and long bone deficiency) spontaneous abortion.
Angiotensin-converting enzyme inhibitors	Oliguria, renal dysgenesis, lung and limb abnormalities
Retinoids	Spontaneous abortion Multiple malformations

macrolides, such as erythromycin, azithromycin, and clarithromycin, do not cross the placenta to any significant extent. They do not cause fetal anomalies. The tetracyclines are to be avoided in the pregnant patient and in children up to 12 years of age because of permanent dental staining. Use of metronidazole justified for significant oral and maxillofacial infections in the pregnant patient because of its less effects.

Obstetricians have discouraged pregnant women from taking analgesic doses of aspirin; mainly because of the wide spread availability of acetaminophen, which causes less gastric irritation, but also because of the concerns listed earlier. Use of nonsteroidal anti-inflammatory drugs, ibuprofen, naproxen, and ketoprofen drugs in early pregnancy has been associated with an increased risk of cardiac septal defects. By inhibiting prostaglandin synthesis, they also may cause dystocia and delayed parturition. A new class of anti-inflammatory analgesics,

based on animal studies. Like other NSAIDs, COX-2 inhibitors should be avoided in late pregnancy because they may cause premature closure of the ductus arteriosus; they are also classified as category C medications. In general, nonsteroidal anti-inflammatory drugs should be avoided, especially during late pregnancy.

Pregnant patient management guidelines:

Based on the earlier review of gravid and fetal physiology, the adjustments documented here in the treatment of the pregnant patient should be implemented by dentists. Initial assessment includes a comprehensive review of the patient's medical and surgical history. All elective surgical procedures should be postponed until postpartum. Minor/outpatient oral and maxillofacial surgical procedures should follow some basic guidelines.

The supine position should be avoided for a variety of reasons: to avoid the development of the "supine hypotensive syndrome" in which a supine

position causes a decrease in cardiac output, resulting in hypotension, syncope, and decreased uteroplacental perfusion. In addition, the supine position may cause a decrease in arterial oxygen tension (PaO₂) and increase the incidence of dyspepsia from gastroesophageal reflux secondary to an incompetent lower esophageal sphincter. Finally, the supine position poses an increased risk of developing DVT, by compression of the inferior vena cava, leading to venous stasis and clot formation. The ideal position of the gravid patient in the dental chair is the left lateral decubitus position with the right buttock and hip elevated by 15°.

Radiographs, Pregnancy, And the Fetus: A radiation dose of 10 Gy (5 Gy in the first trimester, when organogenesis is initiated) causes congenital fetal abnormalities¹. It has been estimated that the dose to the fetus is approximately 1/50,000 of that to the mother's head in any of the exposure ranging from full mouth x-ray to CT images of head and neck. The exposure of any radiographic films required for management of the pregnant patient in most situations should not place the fetus at increased risk. Adequate shielding and protective equipment must be used at all times.

First trimester (conception to 14th week): The most critical and rapid cell division and active organogenesis occur between the second and the eighth week of post conception. Therefore, the greater risk of susceptibility to stress and teratogens occurs during this time and 50% to 75% of all spontaneous abortions occur during this period.³³

The recommendations are:

1. Educate the patient about maternal oral changes during pregnancy.
2. Emphasize strict oral hygiene instructions and thereby plaque control.
3. Limit dental treatment to periodontal prophylaxis and emergency treatments only.

4. Avoid routine radiographs. Use selectively and when needed.

Second trimester (14th to 28th week):

Organogenesis is completed and therefore the risk to the fetus is low. Some elective and emergent dentoalveolar procedures are more safely accomplished during the second trimester.

The recommendations are:

1. Oral hygiene instruction, and plaque control.
2. Scaling, polishing, and curettage may be performed if necessary.
3. Control of active oral diseases, if any.
4. Elective dental care is safe.
5. Avoid routine radiographs. Use selectively and when needed.

Third trimester (29th week until childbirth):

Although there is no risk to the fetus during this trimester, the pregnant mother may experience an increasing level of discomfort. Short dental appointments should be scheduled with appropriate positioning while in the chair to prevent supine hypotension. It is safe to perform routine dental treatment in the early part of the third trimester, but from the middle of the third trimester routine dental treatment should be avoided.

The recommendations are:

1. Oral hygiene instruction, and plaque control.
2. Scaling, polishing, and curettage may be performed if necessary.
3. Avoid elective dental care during the second half of the third trimester.
4. Avoid routine radiographs. Use selectively and when needed.

In conclusion it is important to remember that treatment is being rendered to two patients: mother and fetus. All treatment should be done only after consultation with the patient's gynecologist. It is best to avoid drugs and therapy that would put a fetus at risk in all women of child-bearing age or for whom a negative

pregnancy test has not been ensured. Oral and maxillofacial surgeons should avoid elective surgery in the pregnant patient, if possible. Routine dental health procedures should be accomplished before conception in planned pregnancies and during the middle trimester in unplanned pregnancies. Oral and maxillofacial surgeons may be called on to treat urgent or emergency cases involving trauma, infection, and pathology whose treatment cannot be postponed. Active treatment is directed toward optimizing maternal health while minimizing fetal risk.

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