Online publication ahead of print, AJMHS Vol 63, 2023

Guidelines for the Management of Pregnant Patients in Dentistry

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Abstract

During pregnancy body reactions to stress are reduced and the most of operator's therapeutic approaches on pregnant women may be dangerous. The purpose of this paper is to analyze the literature in order to outline guidelines for the management of pregnant patients in dentistry. In the first trimester nausea, vomiting and hypotension tendency are caused by endocrine alterations. In the third trimester, while the uterus goes enlarging itself, oxygen increased demand lowers diaphragmatic actions and can causes tachypnea and dyspnea. Hormonal increases induce oral mucosa modifications. Gingival reaction to local factors is modified and make it easier appearances of edema, of erythema and of blooding, reaching of specific periodontal diseases. Drugs administration and X-ray examinations can cause fetus malformations due to their teratogenic, mutagenic or toxic effects. Therefore, X-ray examinations should be restricted to emergencies. Expectant mothers need to be educated in proper dental behavior. They should do two-monthly checks in order to avoid from dental pathologies and from any kind of dangerous treatment.

Keyword: Dentistry; Pregnancy; Dental Treatment

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INTRODUCTION

During pregnancy, the woman undergoes a series of systemic changes that reduce the ability to react to psychophysical stress and the possibilities of dental interventions decrease. Pregnancy is a unique period in a woman's life that can adversely affect oral health (1).

The endocrine changes that occur during the first trimester of pregnancy are responsible for nausea, vomiting and a tendency towards hypotension. In the second trimester the patient enjoys a relative period of well-being which progressively decreases as the pregnancy continues (2). In the third trimester, the increased demand for oxygen, in conjunction with the encumbrance of the enlarged uterus, reduces the diaphragmatic excursion and can cause tachypnea and dyspnea. This symptomatology is accentuated by both iron deficiency anemia and hemodilution, due to the progressive increase in blood volume (40-50%) not balanced by the increase in hematocrit (20%). The consequence of these changes is a necessary adaptation of the cardiovascular system which consists of an increase in cardiac output, mild tachycardia and possible appearance of functional heart murmurs. In the third trimester, in the pregnant woman in the supine position, the enlarged uterus can compress the inferior vena cava, preventing venous return to the heart and causing transient arterial hypotension with lipothymia (3).

The pathological complications of pregnancy consist of spontaneous abortion (15% in the first three months), hyperemesis gravidarum, gestational diabetes and the gestosis of third trimester (oedema, high blood pressure and proteinuria).

Maintaining good oral health during pregnancy can be critical to the overall health of both pregnant women and their infants (4,5,6,7), any dental therapy must be correctly planned, and performed only if strictly necessary. For better management of the case, a multidisciplinary approach with close collaboration between the dentist and gynecologist would be appropriate (8).

During each phase of pregnancy, it is possible to carry out treatments and avoid others, all of which is summarized in table 1.

Table 1. Treatment plan in Pregnancy.

Time of pregnancy	Treatment
THROUGHT THE PREGNANCY decreased resistance to stress; risk of systemic diseases (gestational diabetes, arterial hypertension); increase in periodontal disease.	accurate medical history to identify the period of pregnancy; motivate to home and professional oral care; carry out 2/3 oral checks; recommend topical fluoroprophylaxis; postpone complex elective treatments (prosthesis, surgery); reduce stress (short appointment, pain control); limit the use of the vasoconstrictor (contraindications to the use of the vasoconstrictor in case of threat of miscarriage or preterm birth); avoid and/or reduce the number of x-rays; use safe drugs.
FIRST TRIMESTER nausea and vomiting hinder interventions; potentially increased risk of miscarriage from dental work; risk of drug and rx-induced teratogenicity.	Avoid drugs and rx (if it is possible); Perform emergency and/or simple therapies (necessary for pain control, to avoid worsening or complications of the disease) postpone elective treatments.
SECOND TRIMESTER best period for limited interventions; uterine bulk and functional demands are reduced.	Perform simple and routine treatments (conservative, endodontics, simple extraction).
THIRD TRIMESTER Increased fetal bulk, increased functional demand and anemia cause respiratory and cardiovascular problems (tachycardia, tachypnea, dyspnea, decreased venous return); risk of fetal distress and premature birth.	Perform simple therapies.

The purpose of this guideline is to provide practical recommendations for clinicians to improve the quality of care based on scientific evidence.

Oral Health changes during pregnancy

Organogenesis occurs in the first three months of pregnancy and for this reason the fetus is more susceptible to serious malformations in this period (teratogenesis); in the subsequent phase of growth and maturation, the risk is instead linked to development and growth anomalies (fetotoxicity). The high levels of circulating estrogen cause some changes in the oral mucosa such as acanthosis, increased desquamation and vascularization. The gingival response to local factors such as bacterial plaque, tartar and protruding reconstructions or prostheses is altered facilitating the appearance of edema, erythema, bleeding, up to the appearance of specific forms of periodontal disease, which regress at the end of pregnancy and which predispose to an increased susceptibility (9,10,11,12,13) (Figure 1).

Figure 1. Inflammation of the gums during pregnancy (Biasotto, Lo Muzio, Mignogna. Ed. Edra 2022)

It is not uncommon for the pregnant woman to develop an epulis (epulis gravidarum), hyperplasia of the connective tissue of the periodontal tissue (Fig. 2 – Fig. 3).

Figure 2. Mandibular Epulis Gravidarum (Favia. Ed. Schena 2006)

Figure 3. Maxilla median Epulis Gravidarum (Reichart, Philipsen. Ed. Masson 1999)

For these reasons it is advisable to recommend strengthening both professional and home oral care procedures with the use of specific local asepsis protocols, with 0.12% Chlorhexidine-based solutions and 3% 10 V hydrogen peroxide, diluted 50% with drinking water (14,15).

There is no certain scientific proof that the pregnancy status can in any way facilitate the onset of carious pathology whose etiopathogenesis can be traced back to normal factors such as host susceptibility, diet, bacteria and time, however, some physiological factors such as ptyalism gravidarum, nausea, hyperemesis gravidarum, gastroesophageal

reflux, can increase the woman's carioreceptivity (1,4).

Dental treatments, both surgical and non-surgical, may increase the risk of first trimester miscarriage or premature birth later in pregnancy through several mechanisms such as stress resulting from anxiety and pain which may increase prostaglandin levels and of oxytocin moreover, vasoconstrictors associated with loco-regional anesthesia can increase uterine contractions and reduce placental blood perfusion with a dose-dependent pharmacological effect (2).

Use of drugs in pregnancy

In normal routine dental procedures with usual drug dosages, the risk of adverse effects is reduced in uncomplicated pregnancies. It is rather consistent in high-risk pregnancies with a positive history of threatened abortion, premature birth, cervical cerclage, anxiety or panic attacks or high-risk systemic conditions such as diabetes and heart disease (16).

The administration of drugs and the execution of radiographic examinations can cause malformations due to the teratogenic effect. In the third trimester, the pregnant woman has a reduced resistance to stress, due to the increase in the functional demands of Oxygen and A.T.P. (anemia, arterial hypotension, tachypnoea and dyspnea, tachycardia) with consequent increased fatigability and risk of lipothymia and vasovagal syncope or increased uterine contractions and preterm birth.

In patients of reproductive age, the anamnesis should investigate the possibility of pregnancy; in doubtful cases it is appropriate to temporarily postpone elective therapies that may represent a potential risk for the embryo. In pregnancy, the gestation period and the presence of any systemic complications must be identified. The consultation of the gynecology specialist is recommended before starting complex elective treatment plans, mandatory in the presence of systemic complications. In pregnant patients, who have not been monitored in the last month, it is advisable to measure blood pressure to evaluate the presence of arterial hypertension or hypotension (1). The risks associated with exposure to radiation and the administration of drugs capable of overcoming the placental barrier must be minimized and only if strictly necessary. The use of anesthetics with vasoconstrictors must be absolutely avoided and molecules with low or limited fetotoxicity must be preferred, such as Articaine or Ropivacaine (4,16,17,18,19); the presence of a threatened abortion or premature birth are an absolute contraindication to the use of vasoconstrictors such as adrenaline or felypressin (2).

Pregnant women must be motivated to maintain correct oral hygiene and to undergo 2-3 dental check-ups during pregnancy, to prevent the onset of periodontal disease and destructive caries (9,20). Extensive or complex therapies should be postponed until the end of pregnancy considering the altered periodontal response and decreased resistance to stress. In the first trimester, dental

therapy should be limited to simple and necessary interventions to control pain and prevent complications or aggravation of the oral-dental pathology. Simple therapies can be programmed in the second trimester.

Even in the third trimester it is advisable to carry out only simple therapeutic interventions; maintain the patient in a comfortable position and allow frequent changes of position in relation to individual requests and prevent potential lipothymia due to compression of the inferior vena cava by the uterus in the supine position (3).

The appearance of undesirable effects is secondary to the drug's ability to cross the placental barrier. This possibility is linked to various factors that are not always completely predictable, such as for example the molecular weight (less than 500 Dalton), the liposolubility, the degree of ionization of the molecule, the binding with plasma proteins, the thickness of the placental barrier.

Few clinical drug trials have included pregnant women; therefore, successful long-term clinical use without known adverse effects is the best available evidence supporting the safety of a given drug (4). It is useful to propose as a guideline a classification of drugs based on the level of risk of adverse effects in pregnancy:

1. Safe drugs: the absence of intrinsic and extrinsic danger has been demonstrated;
2. Border-Line drugs: to be used with caution, certain and definitive studies are not available therefore they should be used only when necessary and under strict medical supervision;
3. Contraindicated drugs: teratogenic effects have been demonstrated, greater in the first trimester, and fetotoxic effects, after the twelfth week with growth retardation, growth reduction and functional damage.

The data of the safe and unsafe drugs are presented in table 2 and the data of side effects of the contraindicated drugs are presented in table 3.

The antibiotics considered safe in pregnancy are the aminopenicillins (amoxicillin, bacampicillin and ampicillin, in association or not with clavulanic acid), which can be replaced in the presence of allergies by macrolides, such as erythromycin and clarithromycin (16).

Contraindicated antibiotics are tetracycline due to their Chelate effect which are the cause of skeletal malformations and dental pigmentations. Are also contraindicated chloramphenicol which is able to generate a powerful myelosuppression, and metronidazole due to its predisposition to the genesis of thymine dimers which can generate DNA mutations (21).

The drug of first choice is paracetamol which has analgesic-antipyretic properties, does not interfere with bleeding time and is not teratogenic.

Acetylsalicylic acid and therefore all NSAIDs are generally contraindicated in the gestational period, as they have an antiplatelet aggregation effect (risk of hemorrhage) but they reduce uterine contractions (prostaglandin effect) (22).

Table 2. Drugs tolerance in Pregnancy

Drugs	**Safe**	**Use with caution**	**Unsafe**
Local anesthetics	Lidocaine, Articaine, Etidocaine	Mepivacaine*, bupivacaine*	Prilocaine
Vasoconstrictors	Adrenaline		All other vasoconstrictors (Vasopressin, Octapressin)
Analgesics	Paracetamol	acetylsalicylic acid** NSAIDs	Corticosteroids, Pyrazolones (noramidopirina, phenylbutazone
Opioids**		Codeine, Propoxyphene Pentazocine	Morphine, Buprenorphine
Antibiotics	Penicillins (ampicillin, amoxicillin), Erythromycin	Cephalosporins, Aminoglycosides, Lincosamides, Other macrolides	Tetracyclines, Clindamycin, Metronidazole, Imidazoles (Ketoconazole), Co-trimoxazole,
Anxiolytics		Nitrous oxide, Amobarbital, Temazepam***, lorazepam***, Oxazepam***.	Barbiturates, long-acting benzodiazepines (diazepam), Non-benzodiazepine anxiolytics (meprobamate)
Other drugs			Antifibrinolytics (amino caproic acid, acid tranexamic), Vitamin A analogues (etretinate)

* Not recommended according to FDA, no adverse effects reported in dentistry
** Not recommended in the first six months, contraindicated in the third trimeste
*** Avoid administration; if necessary, use short-acting benzodiazepines (hypnoinducers)

Table 3. Side effects of contraindicated drugs

Contraindicated drugs	Side effects	Contraindicated drugs	Side effects
Acetylsalicylic acid	Platelet function disorders (haemorrhage), uterine inertia	**Opioids**	Sedation, respiratory depression, hypoxia. chronic addiction e withdrawal syndrome (for extended use)
Tetracyclines	Dental dyschromia, enamel hypoplasia, bone growth inhibition and skeletal changes	**Etretinate**	Teratogenesis
Erythromycin	Hepatotoxicity, cholestasis, hyperbilirubinemia	**Co-trimoxazole**	Folate deficiency (anemia)
Benzodiazepines	Sedation, respiratory depression, hypoxia	**Antifibrinolytics**	Thrombosis
Metronidazole	Teratogenesis	**Corticosteroids**	teratogenesis, cleft lip and palate

Anesthetics for dental therapies, since the molecules used in normal dental practice are unable to cross the placental barrier due to their high molecular weight (2,16,17,18,19). The appearance of side effects related to their use is linked to absolute or relative overdose, in a similar way to other patients. Care should be taken when evaluating patients with gestational anemia; in these cases, the use of Mepivacaine and Prilocaine can cause methemoglobinemia, with a reduction in the ability of the erythrocytes to transport oxygen and consequent fetal hypoxia. The use of vasoconstrictors associated with local anesthetics is not contraindicated in an absolute way, even if normally they should be limited to cases of real need, due to the presence of some dose-dependent side effects, which can cause abortion or premature birth. The oxytocin-like effect on the uterine muscles can cause actual uterine contractions; stimulation of α and β adrenergic receptors can stimulate intense uteroplacental vasoconstriction. When local anesthetics with vasoconstrictors are used in pregnant women, it is recommended to use the lowest concentration of the vasoconstrictor (16). In addition, the use of an aspiration technique to avoid inadvertent intravascular injection is required (22). The recommended dose, in the absence of pregnancy pathologies, should not exceed 2-3 cartridges with the concentration of the vasoconstrictor not exceeding 1:100,000. The absolute contraindications to the use of vasoconstrictors are the threatened miscarriage in the first trimester or the possibility of premature birth in the following periods.

X-ray exposure during pregnancy

Exposure to X-rays must also follow precise indications. As is now evident, radiations are powerful mutagens and teratogens with a dose-dependent effect, capable of causing the onset of oncological pathologies in adults and malformations of the fetus (23). The damages of ionizing radiation on humans can be classified into three main categories: deterministic somatic, stochastic somatic and stochastic genetic. Today in radioprotection the energy that radiation deposits in the matter with which it interacts is measured and the unit of measurement is given by the absorbed dose which is calculated in gray (Gy). This unit of measurement is too large for the doses normally absorbed by humans, and therefore the milligray (mGy) is more commonly used (24).

Since radiations behave differently, the unit of measurement of the equivalent dose of radiation has been introduced, which expresses the different ability to release energy, called sievert (Sv); in dentistry the millisivert (mSv) measure is more used. For the general population, 5 mSv/year is considered as the maximum risk-free acceptable dose of absorbed radiation; while for an operator exposed for professional reasons, a negligible risk is admitted for doses lower than 50 mSv/year.

The radiation risk varies according to the progress of the pregnancy: before implantation of the embryo (ninth day after fertilization) the effects of radiation are of the all-or-non type, in the period of morphogenesis (ninth day-end of second month of pregnancy) irradiation can more easily induce the appearance of malformations, in the fetal stage (from the third month to the end of pregnancy) the frequency and severity of malformations decrease while the risk of defective CNS development is high (25).

The natural background radiation has an annual effective dose intensity of 2.4 mSv and the threshold for deterministic damage on organogenesis has been calculated at around 0.1 Gy (25,26).

The average values of radiation absorbed by the ovaries or by the embryo in the early stages of development vary according to the different radiological examinations performed: 0.1 mGy for a skull X-ray, 0.0006 mGy for an orthopantomography, 0.02 mGy for a standard chest x-ray, 0.2 mGy for a CT scan of the skull, for a complete series of intraoral radiographs with the appropriate precautions the absorbed dose is 0.01 mSv (23). We can therefore conclude that the use of intraoral radiographs represents a relatively low risk factor in pregnancy (27). As for any patient, the standard of care is to take the minimum number of images required for a comprehensive examination, diagnosis, and treatment plan (1). Guidelines for using x-rays during pregnancy is summarized in table 4.

Table 4. Guidelines of intraoral x-rays in pregnancy

Precautions for the patient	**Precautions for the healthcare Personnel (HCP)**
Limit exams Do not take x-rays during the first trimester Minimize radiographic investigations over the course of the whole pregnancy. ***Limit the irradiated area*** Do not direct the primary beam towards the abdomen; Place protective shields on the chest and abdomen (lead apron); Use long cone braces, centerers and collimators. ***Limit the dose per exposure*** Use high kilovoltage appliances or constant beams; Use high sensitivity film.	***Position yourself in the safety zone during the emission of radiation*** Distance >150cm from the x-ray tube; Avoid being on the lead of the main beam. ***Surveillance*** Wear a film (film badge) to periodically check the absorbed dose; Have a radiation protection program (Qualified expert)

If possible, x-rays must be avoided in the first trimester, the period in which the main stages of organogenesis take place; subsequently they can be performed as needed, with the patient's consent, however in a reduced number and using all the appropriate precautions. As with all patients, a thyroid collar and abdominal apron should be used (1,16).

CONCLUSIONS

Pregnancy is a particular period for the whole organism and the oral cavity is affected by the hormonal changes that characterize pregnancy. For example, the level of progesterone and estradiol increases by about 20 times compared to the menstrual cycle, acting as a growth factor for opportunistic bacteria, facilitating the formation of carious lesions and gingival tissue disorders. The soft tissues will appear inflamed and edematous, painful and bleeding, with the formation of various types of periodontal defects. The particular physical and psychological conditions that arise during pregnancy can predict the appearance of problems such as hyperemesis gravidarum, acid reflux, qualitative and quantitative changes in saliva, with a tendency to eat little but often.

All these factors, although not included in the etiopathogenetic mechanisms of oral diseases, are predisposing factors that increase the risk of the onset of carious and periodontal diseases.

We can conclude that the maintenance of accurate home oral hygiene is the most important thing to limit the onset of oral diseases during pregnancy.

Future mothers must be carefully educated on the correct oral hygiene to be followed at home, motivating them to consider the oral cavity a delicate area which is affected by hormonal alterations during pregnancy and which must be even more controlled in order to avoid the onset and aggravation of pathologies that may require the administration of drugs and X-rays, which can potentially cause harm to the fetus.

For symptomatic dental, pulpal, and periodontal diseases, dental restorations, root canal therapies, periodontal cleaning, and scaling and root planning can be safely carried out during second trimester.

Acknowledgements: None declared.

Conflict of Interest Statement: The authors declare that they have no conflict of interest.

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