Dental Care Throughout Pregnancy: What a Dentist Must Know

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Abstract

Pregnancy is a unique period in a woman's lifetime. Good oral health during pregnancy is important to the overall health of both the expectant mother and her baby. Oral health assessment should be part of comprehensive prenatal care for all women and every general medical practitioner and obstetrician should consider referral of a newly pregnant woman to a dentist as routine. Unfortunately, there may be times when pregnant women, obstetricians and—on occasion—dentists are sceptical of dental care during pregnancy owing to prejudices about the safety of dental treatment, resulting in delay of the dental treatment. The aim of this paper is to review the literature for evidence-based answers with regard to the frequent dilemmas of dentists concerning dental treatment of pregnant women. The search was performed using the PubMed database and systematic reviews and original articles (clinical and experimental studies) as well as guidelines produced by scientific organisations. From this review it can be concluded that most dental work is safe during pregnancy. Dentists and health agencies should provide and distribute information to women about the importance of maintaining oral health during pregnancy.

Key Words: Pregnancy, Dental Treatment, Dental Care

Introduction

Very often dentists have to face a pregnant woman's anxiety—along with her family's anxiety—over the matter of the safety of dental treatment during pregnancy [1]. This is due to a series of wrong assumptions that have been made and perpetuated by the lack of proper information, as well as by some dental professionals who consider dental treatments to be possibly dangerous for the fetus [2,3]. However, it is beyond doubt that dental treatment during pregnancy is not only safe, but also necessary. Ideally, during prenatal testing, the pregnant woman should be referred to a dentist. Unfortunately, up to now, there have been no such official guidelines in any country. Maintaining the expectant mother's oral health is important both for her own health and for that of the fetus. A typical example, which has been the subject of much research, is the relationship between periodontal disease and the increased risk of pre-term birth and low birthweight [4-8]. The relationship between early childhood caries (ECC) and the transmission of bacteria from the maternal oral flora to the baby has increased efforts to promote oral health during pregnancy and the perinatal period [9]. Although there has been improvement in the dental care of pregnant women during the past decades, inequalities and erroneous perceptions concerning the importance of dental care during pregnancy still exist, affecting mainly the socio-economically deprived in the population [10,11].

Many organisations, including the American Dental Association (ADA), the American Academy of Pediatrics (AAP), and the American Academy of Pediatric Dentistry (AAPD), have developed protocols and norms in order to improve the oral health of pregnant women and babies. They stress that pregnancy is not a disease, thus pregnant women should not be treated differently than the general population.

Health care professionals (physicians and dentists) should collaborate to develop comprehensive prenatal testing protocols, including complete treatment plans, which aim to prevent any problems and restore the pregnant woman's oral health. These protocols should also aim to inform the pregnant woman appropriately so that she will be able to look after the newborn baby's oral health [2].

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Purpose and Methodology

In order to help the dentist make the right decisions, we searched for documented answers on issues he or she very often has to face regarding the treatment of pregnant women. Our sources included PubMed, from which we collected the relevant bibliography using the following search criteria: dental, treatment, therapy, pregnancy (MeSH terms). We also used PubMed to search for reviews, clinical and experimental studies reported within the last five years, as well as the most important older publications that were highly cited. Additionally, we searched for guidelines from major accredited agencies, such as the ADA, the World Health Organization (WHO), the Food and Drug Administration (FDA), and international dental associations. Our search focused on the dental treatment of healthy pregnant women. But what are the difficulties a dentist may face when treating a pregnant woman?

Dental Radiography for Pregnant Women

According to the American College of Radiology, no single diagnostic x-ray involves a radiation dose significant enough to pose a threat to the health and normal development of the fetus [12]. More recent evidence suggests that ionising radiation at a dose of less than 5 rad does not increase the risk of malformation, growth retardation or miscarriage [13]. For this reason, dental radiographs are considered safe to be given at any time that it is deemed necessary during pregnancy, provided that the dentist follows all the proper radiologic practices, i.e., using a radiation protective apron with a thyroid collar, using high-speed films, following the proper procedures in order to take the radiograph, and following the ALARA (As Low As Reasonably Achievable) principle [9,14].

Prescription of Medication

When prescribing medication during pregnancy, the main concern is the risk of teratogenesis, because drugs cross the placenta by simple diffusion. Drugs are administered during pregnancy only when they are essential for the pregnant woman's well-being, and the drug of choice should always be the one that is the least toxic. In practice, dentists mainly prescribe antibiotics to control infections and painkillers to relieve the pain. Any drug that is prescribed during pregnancy should have the fewest possible side effects and it should aim to improve the health of the mother or the fetus [15].

The FDA has classified drugs into four categories, according to how dangerous they are for the mother and the fetus when prescribed during pregnancy [16]. This classification provides a useful guide with regard to what drugs should or should not be prescribed for a pregnant woman.

- Category A includes drugs that have been tested in humans and there is evidence to support that they are 100% safe to use (e.g., folic acid).
- Category B includes drugs that are relatively safe to use. Generally these drugs are considered safe to use during pregnancy (e.g., paracetamol and amoxicillin) [17].
- Category C includes the majority of drugs, such as aspirin, which should be used with caution and certainly according to the treating doctor's orders.
- Category D includes drugs such as tetracycline, which should be avoided during pregnancy [16] (*Tables 1* and *2*).

As far as antibiotics are concerned, amoxicillin and penicillin V are the safest and the most common ones to prescribe [18,19]. Tetracyclines are contra-indicated during pregnancy because they accumulate in fetal dental tissue during the calcification stage, causing discoloration of the teeth [19].

The safest choice among painkillers is paracetamol, as it is not teratogenic. The absorption of the usual recommended dose in the body does not seem to change during pregnancy [18,19].

Local Anaesthesia Containing Vasoconstrictor

Usually dentists prefer to administer local anaesthesia with mepivacaine 3% without a vasoconstrictor. However, according to the FDA classification, mepivacaine, as well as articaine, are included in Category C, which means that they are drugs that should be used with caution while always weighing the risks and benefits involved [16].

According to the FDA classification, lidocaine, prilocaine, and etidocaine are included in Category B, so the administered dose to pregnant women (as well as to the general population) should be well below the maximum recommended dose.

The above-mentioned local anaesthetics (lidocaine, prilocaine, and etidocaine) may be combined with vasoconstrictors and can be administered during pregnancy. Their dosage is adjusted as follows: maximum dose of lidocaine 500 mg, prilocaine 600 mg, etidocaine 400 mg.

Any concerns regarding the vasoconstrictor effect on the uterine muscle have proved to be speculative, as there is no clear evidence to support this view [20,21]. Moreover, according to research, lidocaine appears to cause no increase in the rates of malformations in infants [13] (*Tables 2* and *3*).

Antibiotic Prophylaxis Prior to any Dental Procedure That Involves Bleeding

Pregnancy by itself is not an indication for administering prophylactic antibiotics. Transient bacteraemia may occur as a result of certain dental procedures, such as tooth extractions, supragingival or subgingival scaling, as well as gingivectomy. However, there are no reports to suggest that this transient bacteraemia is harmful to the fetus [13]. Thus, the guideline that applies to pregnant women is no different than the guideline that applies to the general population according to American Heart Association guidelines. Prophylactic antibiotics are administered only if there is a risk of developing infective endocarditis (IE) [13].

Optimal Trimester of Pregnancy for Dental Treatment

Any dental treatment of an urgent nature can be provided at any time during pregnancy [22]. Traditionally, dental treatment of any kind has been

Table 1. *Drugs used in dentistry (with FDA pregnancy risk category [2])*

Drug	Consult with the patient's obstetrician	Considerations for use
Paracetamol	B	Use with no risk
Amoxicillin	B	Use with no risk
Clindamycin	B	Use with no risk
Metronidazole	B	Use with no risk **(After 1st trimester for 24 to 72 hrs only)**
Chlorhexidine rinse	B	Use with no risk
Non-steroidal anti-inflammatory drugs (NSAIDs)	C (most of them)	Consult with the patient's obstetrician Use only if it is needed

Table 2. *Class definition according to the FDA classifications for drugs in terms of their safety during pregnancy [2]*

A	Adequate, well-controlled studies in pregnant women failed to demonstrate risk to fetus
B	No evidence of risk in humans; animal studies show risk but human findings do not; or animal findings are negative and no adequate human studies have been performed
C	Human studies are lacking and animal studies are either lacking or test positive for fetal risk; however, potential benefits may justify the risk
D	Positive evidence of risk; investigational or post-marketing data show risk to foetus; however, potential benefits may outweigh risks (as with some anti-convulsive medications)

Table 3. *Local anaesthetics used in dentistry (with FDA pregnancy risk category [2])*

Local anaesthetic	FDA Category	Considerations for use
Lidocaine (2%)	B	Use with no risk
Mepivacaine (3%)	C	Consult with the patient's obstetrician Use only if it is needed
Prilocaine	B	Use with no risk
Bupivacaine	C	Consult with the patient's obstetrician Use only if it is needed.
Etidocaine	B	Use with no risk
Procaine	C	Consult with the patient's obstetrician Use only if it is needed
Articaine	C	Consult with the patient's obstetrician Use only if it is needed

avoided during the first trimester of pregnancy, so as not to harm the fetus during the stage of organogenesis. However, there is not enough evidence to forbid dental treatment even during the first trimester of pregnancy.

The ideal period for a complete dental treatment of a pregnant woman is the beginning of the second trimester (14-20 weeks of pregnancy) [23]. At this stage, there is no risk of teratogenesis, nausea and vomiting have subsided, and the uterus is not yet large enough to cause discomfort.

It is essential to treat all dental problems during the second trimester, not only because the woman should have a healthy mouth, but also because during labour she might need to be intubated, in which case teeth with a bad prognosis (e.g., tooth mobility due to periodontal disease) may be damaged or lost [2].

Positioning of Pregnant Women in the Dental Chair

During the third trimester of pregnancy, when the woman is supine, the uterus may press on the inferior vena cava and impede venous return to the heart, which may lead to hypotensive syndrome (occurring at a rate of 15-20%) and loss of consciousness [13].

In order to prevent this from happening during dental treatment, when seated in the dentist's chair the pregnant woman's head should always be higher than her feet, and, if necessary, a small pillow (or a folded blanket) should be placed under her right hip ("left uterine displacement") so that the uterus is moved away from the inferior vena cava [9,22].

When Should a Dentist Consult the Patient's Obstetrician?

Provided that the pregnant woman is healthy, a dentist does not normally need the obstetrician's consent in order to perform common dental procedures. However, if for some reason the dentist thinks that the dental treatment should be postponed or if there are any co-morbid conditions for which the patient receives medication (e.g., hypertension, diabetes, heparin intake) that may affect dental treatment, the dentist should inform and consult the obstetrician. Similarly, the obstetrician should be informed if the dentist thinks it necessary that the pregnant woman should be treated in a hospital setting, especially if the dental treatment should be performed under general anaesthesia [1].

Amalgam Fillings in Pregnant Women

Dental amalgam is a metal alloy, 50% of which consists of organic mercury, and is widely used in the restoration of posterior teeth. Dental amalgam fillings release mercury vapour (a form of inorganic mercury) in the mouth, especially during chewing. As a result, mercury crosses the placenta through blood circulation. This fact has concerned the scientific community as to whether or not amalgam fillings should be used in vulnerable populations, such as pregnant women. Using a rubber dam and high-speed evacuation (suction) during amalgam placement or removal may significantly reduce the inhalation of mercury elements (mercury vapour) [9].

Although the amalgam fillings contain mercury, which is toxic, the amount of mercury released in the mouth is minimal (estimated to be 10 μg/d whereas, according to the WHO, the total-mercury tolerable intake is 2 μg/kg/d) [24,25].

Even though the Public Health Agency of Canada recommends that no dental amalgam placement or removal take place during pregnancy [24], the ADA, the FDA and the WHO consider dental amalgams safe to use in dental restorations, because research has shown that there is no relation between amalgam fillings and complications during pregnancy [26-29].

Filling materials that can be used instead of amalgam include glass-ionomer cement, composite resins, as well as gold or porcelain. However, amalgam fillings last longer than glass-ionomer fillings and composite resins; they also cost less than gold or porcelain fillings. Moreover, there are no extensive studies to prove the safety of the aforementioned alternative materials during pregnancy, compared to amalgam fillings. Furthermore, based on studies in animals, bisphenol-A, a component found in composite resin fillings, has been proven to cause endocrine disruptions [30].

Consequently, when a filling is required during pregnancy, the patient needs to be informed of the different options, and, together with the dentist, they should decide on the best material to use.

Periodontal Therapy and Pregnancy

Periodontal treatment is very important during pregnancy. The hormones that are released in the pregnant woman's body make her more susceptible to plaque and in turn gum bleeding (*Figure 1*) [31,32]. Many pregnant women mistakenly think that gum bleeding is normal during pregnancy and

they do not seek dental care [13]. The dentist has to inform the pregnant woman and give her instructions on how to improve her oral health. Furthermore, if necessary, more frequent visits to the dentist should be scheduled.

Figure 1. *Gingivitis during pregnancy*

Because infections (such as urinary tract infection) in pregnant women are associated with pre-term birth and low birthweight, the hypothesis has been formulated that periodontitis is possibly linked to pre-term birth. This hypothesis was supported by experiments that showed fetal growth restriction in pregnant women who were affected by periodontitis [33-36]. The hypothesis is that periodontal pathogens, mainly those belonging to the group of Gram-negative anaerobic rods, affect fetal growth either through their toxins or through the release of inflammatory mediators. This hypothesis has been explored in numerous scientific publications [5-8,33,37]. Because pre-term infants have significant health problems that require costly medical treatment, if periodontal treatment could prevent pre-term labour, the benefit would be great both for the health of the infants and for the reduction of medical costs. Thus, large-scale studies have been carried out, such as PIPS (Periodontal Infections and Prematurity Study) and OPT (Obstetrics and Periodontal Therapy), as well as other, small-scale studies, which focus on the benefits of periodontal treatment and the prevention of pre-term and low birthweight infants [38,39]. So far, the results of these studies have been conflicting, as, according to some researchers, it has been estimated that periodontal treatment in pregnant women has not reduced the risk of pre-term low birthweight infants [38,40-47] whereas others report positive results regarding the prevention of such occurrences [48-52].

A recent meta-analysis has suggested that pregnant women who received successful periodontal treatment based on strict criteria had a significantly lower risk of undergoing pre-term labour. The same meta-analysis suggested that the hormonal state of pregnant women makes the periodontal therapy more challenging and that there should be more studies that focus not only on the periodontal treatment procedure, but also on its success as well as the time that the treatment takes place [53,54].

It is worth noting that among the large number of pregnant women who took part in the studies and received periodontal treatment, none experienced any problems due to the treatment [41,46].

A periodontal lesion characteristic during pregnancy is the pregnancy epulis (*Figure 2*). The lesion is estimated to affect 0.2-5% of pregnant women and is more common in the maxillary gingiva [55]. It is a form of pyogenic granuloma that is hormone related. Lesions may regress spontaneously after birth. If not, they should be surgically removed. If they are bleeding excessively and cause trouble in mastication they may be removed with safety during pregnancy [55].

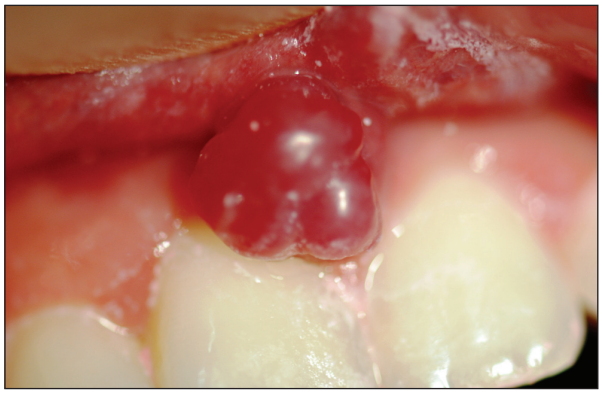

Figure 2. *Pregnancy epulis, characteristic during pregnancy.*

The Role of the Dentist Regarding the Oral Health of a Pregnant Woman

During pregnancy, the dentist's role is to prevent oral health problems, to inform, and to provide dental care to the pregnant woman throughout the pregnancy period at any time it is thought necessary. The reason for this is that pregnancy is not a disease and, consequently, there is no reason to postpone dental appointments and procedures.

In conclusion, a pregnant woman should receive adequate information from her obstetrician so as to visit the dentist early in her pregnancy. She should also look after her oral health and, conse-

quently, the oral health of her newborn baby. The dental treatment that will deal with any oral health problems should preferably be completed during the second trimester of pregnancy, so that the woman goes into labour with a fully restored mouth.

Conclusion

Good oral health during pregnancy is important because the condition of a pregnant woman's mouth can affect her health and that of the fetus. It is vital that health professionals collaborate to ensure pregnant women receive proper oral assessment and intervention as well as oral health education. Some oral health professionals hesitate to treat pregnant women but there is sufficient evidence to recommend that after consulting the general medical practitioner and/or obstetrician and assessing the potential risks of undergoing dental treatment during pregnancy, routine dental visits can be safely performed, including the use of radiographs, plaque removal, treatment of periodontitis, local anaesthesia, and the provision of composite and amalgam fillings. Prescribing of systemic drugs of any kind ideally should be performed after consultation with the general medical practitioner or obstetrician. Pregnancy is a life-changing event and a particularly important time to access oral health care because the consequences of poor oral health may have a lifelong impact. Women's health care providers ought to help them to understand the importance of protecting their oral health during pregnancy and assist them to do so.

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Contributions of each author

- MA planned the paper, wrote several sections, and checked and revised all drafts and the final version.
- EG wrote the section on periodontal health in pregnancy.
- NA wrote the section on dental radiography.
- All authors were involved in the literature search.

Statement of conflict of interest

In the opinion of the authors, there is no conflict of interests.

References

1. American Dental Association (ADA). Council on Access, Prevention and Interprofessional Relations. *Women's Oral Health Issues*. Chicago, IL: ADA; 2006. Available from: http://www.ada.org/sections/professionalResources/pdfs/healthcare_womens.pdf

2. Amini H, Casimassimo PS. Prenatal dental care: a review. *General Dentistry*. 2010; **58**: 176-180.

3. Detman LA, Cottrell BH, Denis-Luque MF. Exploring dental care misconceptions and barriers in pregnancy. *Birth*. 2010; **37**: 318-324.

4. Agueda A, Echeverria A, Manau C. Association between periodontitis in pregnancy and preterm or low birth weight: Review of the literature. *Medicina Oral, Patología, Oral y Cirugía Bucal*. 2008; **13**: 609-615.

5. Tucker R. Periodontitis and pregnancy. *Journal of the Royal Society for the Promotion of Health*. 2006; **126**: 24-27.

6. Dortbudak O, Eberhardt R, Ulm M, Persson GR. Periodontitis, a marker of risk in pregnancy for preterm birth. *Journal of Clinical Periodontology*. 2005; **32**: 45-52.

7. Mannem S, Chava VK. The relationship between maternal periodontitis and preterm low birth weight: A case-control study. *Contemporary Clinical Dentistry*. 2011; **2**: 88-93.

8. Siqueira FM, Cota LO, Costa JE, Haddad JP, Lana AM, Costa FO. Intrauterine growth restriction, low birth weight, and preterm birth: adverse pregnancy outcomes and their association with maternal periodontitis. *Journal of Periodontology*. 2007**; 78**: 2266-2276.

9. Stein EJ, Weintraub JA, Brown C, Conry J, Foley M, Hilton I, *et al*. Oral health during pregnancy and early childhood: evidence-based guidelines for health professionals. *Journal of the California Dental Association*. 2010; **38**: 391-403, 405-440.

10. Hullah E, Turok Y, Nauta M, Yoong W. Self-reported oral hygiene habits, dental attendance and attitudes to dentistry during pregnancy in a sample of immigrant women in North London. *Archives of Gynecology and Obstetrics*. 2008; **277**: 405-409.

11. Silk H, Douglass AB, Douglass JM, Silk L. Oral health during pregnancy. *American Family Physician.* 2008; **77**: 1139-1144.

12. American Congress of Obstetricians and Gynecologists (ACOG). Committee Opinion. Number 299. Guidelines for diagnostic imaging during pregnancy. *Obstetrics and Gynecology*. 2004; **104**: 647-651.

13. New York State Department of Health (NYSDH). *Oral Health Care During Pregnancy and Early Childhood.*

Practice Guidelines. New York, NY: NYSDH; 2006. Available from: http://www.health.state.ny.us/publications/0824.pdf

14. American Dental Association (ADA). The use of dental radiographs (update and recommendations). *Journal of American Dental Association*. 2006; **137**: 1304-1312.

15. American Academy of Pediatric Dentistry (AAPD). *Guideline on Oral Health Care for the Pregnant Adolescent.* Council on Clinical Affairs Committee on the Adolescent. Chicago: AAPD; 2007. Available from: http://www.aapd.org/media/Policies_Guidelines/G_Pregnancy.pdf

16. US Food and Drug Administration. Labeling and prescription drug advertising: Content and format for labeling for human prescription drugs. *Federal Register*. 1979; **44**: 434-467.

17. Moore PA. Selecting drugs for the pregnant dental patient. *Journal of the American Dental Association*. 1998; **129**: 1281-1286.

18. Haas DA, Pynn BR, Sands TD. Drug use for the pregnant or lactating patient. *General Dentistry*. 2000; **48**: 54-60.

19. Cengiz SB. The pregnant patient: considerations for dental management and drug use. *Quintessence International*. 2007 ; **38**: 133-142.

20. Haas DA. An update on local anesthetics in dentistry. *Journal of the Canada Dental Association*. 2002; **68**: 546-551.

21. Yagiela JA. Local anesthetics. In: Dionne RA, Phero JC, Becker DE, editors. *Management of Pain and Anxiety Control in the Dental Office*. Philadelphia, PA: WB Saunders; 2002. p. 78-96.

22. Cunningham FG, Gilstrap LC, Gant NF, Hauth JC, Leveno KJ, Wenstrom KD, *et al*. *Williams Obstetrics*. New York, NY: McGraw-Hill; 2001. p. 107-129.

23. Wasylko L, Matsui D, Dykxhoorn SM, Rieder MJ, Weinberg S. A review of common dental treatments during pregnancy: implications for patients and dental personnel. *Journal of the Canadian Dental Association*. 1998; **64**: 434-439.

24. Health Canada (HC). *The Safety of Dental Amalgam*. Ottawa, ON: HC; 2002 Available from: http://www.hc-sc.gc.ca/dhp-mps/md-im/applic-demande/pubs/dent_amalgam-eng.php

25. *World Health Organization (WHO). Exposure to Mercury: A Major Public Health Concern.* Geneva: WHO; 2007 Available from: www.who.int/phe/news/Mercury-flyer.pdf

26. Bates MN, Fawcett J, Garrett N, Cutress T, Kjellstrom T. Health effects of dental amalgam exposure: a retrospective cohort study. *International Journal of Epidemiology.* 2004; **33**: 894-902.

27. Brownawell AM, Berent S, Brent RL, Bruckner JV, Doull J, Gershwin EM, *et al*. The potential adverse health effects of dental amalgam. *Toxicological Reviews*. 2005; **24**: 1-10.

28. Hujoel PP, Lydon-Rochelle M, Bollen AM, Woods JS, Geurtsen W, del Aguila MA. Mercury exposure from dental filling placement during pregnancy and low birth weight risk. *American Journal of Epidemiology*. 2005; **161**: 734-740.

29. American Dental Association (ADA). *Literature Review: Dental Amalgam Fillings and Health Effects.* Council on Scientific Affairs. Chicago, IL: ADA; 2010. Available from: http://www.ada.org/sections/professionalResources/pdfs/ amalgam_literature_review_1009.pdf

30. Olea N, Pulgar R, Perez P, Olea-Serrano F, Rivas A, Novillo-Fertrell A, *et al*. Estrogenicity of resin-based composites and sealants used in dentistry. *Environmental Health Perspectives*. 1996; **104**: 298-305.

31. Silness J, Löe H. Periodontal disease in pregnancy. 3. Response to local treatment. *Acta Odontologica Scandinavica*. 1966; **24**: 747-759.

32. Keirse MJ, Plutzer K. Women's attitudes to and perceptions of oral health and dental care during pregnancy. *Journal of Perinatal Medicine*. 2010; **38**: 3-8.

33. Madianos PN, Lieff S, Murtha AP, Boggess KA, Auten RL Jr, Beck JD, *et al*. Maternal periodontitis and prematurity. Part II: Maternal infection and fetal exposure. *Annals of Periodontology.* 2001; **6**: 175-182.

34. Hasegawa-Nakamura K, Tateishi F, Nakamura T, Nakajima Y, Kawamata K, Douchi T, *et al*. The possible mechanism of preterm birth associated with periodontopathic *Porphyromonas gingivalis*. *Journal of Periodontal Research*. 2011; **46**: 497-504.

35. Inaba H, Kuboniwa M, Bainbridge B, Yilmaz O, Katz J, Shiverick KT, *et al*. *Porphyromonas gingivalis* invades human trophoblasts and inhibits proliferation by inducing G1 arrest and apoptosis. *Cell Microbiology*. 2009; **11**: 1517-1532.

36. Offenbacher S, Katz V, Fertik G, Collins J, Boyd D, Maynor G, *et al*. Periodontal infection as a possible risk factor for preterm low birth weight. *Journal of Periodontology*. 1996; **67**: 1103-1113.

37. Offenbacher S, Lieff S, Boggess KA, Murtha AP, Madianos PN, Champagne CM, *et al*. Maternal periodontitis and prematurity. Part I: Obstetric outcome of prematurity and growth restriction. *Annals of Periodontology*. 2001; **6**: 164-174.

38. Boggess KA. Treatment of localized periodontal disease in pregnancy does not reduce the occurrence of preterm birth: results from the Periodontal Infections and Prematurity Study (PIPS). *American Journal of Obstetrics and Gynecology*. 2010; **202**: 101-102.

39. Ebersole JL, Novak MJ, Michalowicz BS, Hodges JS, Steffen MJ, Ferguson JE, *et al*. Systemic immune responses in pregnancy and periodontitis: relationship to pregnancy outcomes in the Obstetrics and Periodontal Therapy (OPT) study. *Journal of Periodontology*. 2009; **80**: 953-960.

40. Niederman R. Periodontal treatment did not prevent complications of pregnancy. *Evidence-Based Dentistry*. 2010; **11**: 18-19.

41. Polyzos NP, Polyzos IP, Zavos A, Valachis A, Mauri D, Papanikolaou EG, *et al*. Obstetric outcomes after treatment of periodontal disease during pregnancy: systematic review and meta-analysis. *British Medical Journal.* 2010; **341**: 7017.

42. Deppe H, Hohlweg-Majert B, Holzle F, Schneider KT, Wagenpfeil S. Pilot study for periodontal treatment and pregnancy outcome: a clinical prospective study. *Quintessence International*. 2010; **41**: 101-110.

43. Lopez R. Periodontal treatment during pregnancy did not reduce the occurrence of poor pregnancy outcomes. *Evidence-Based Dentistry*. 2009; **10**: 105.

44. Macones GA, Parry S, Nelson DB, Strauss JF, Ludmir J, Cohen AW, *et al*. Treatment of localized periodontal disease in pregnancy does not reduce the occurrence of preterm birth: results from the Periodontal Infections and Prematurity Study (PIPS). *American Journal of Obstetrics and Gynecology*. 2010; **202**: 147.e1-8

45. McCrory PV. Periodontal treatment did not prevent complications of pregnancy. Evidence-based Dentistry 2010;11: 18-19. *Evidence-Based Dentistry*. 2010; **11**: 34

46. Newnham JP, Newnham IA, Ball CM, Wright M, Pennell CE, Swain J, *et al*. Treatment of periodontal disease during pregnancy: a randomized controlled trial. *Obstetrics and Gynecology*. 2009; **114**: 1239-1248.

47. Uppal A, Uppal S, Pinto A, Dutta M, Shrivatsa S, Dandolu V, *et al.* The effectiveness of periodontal disease treatment during pregnancy in reducing the risk of experiencing preterm birth and low birth weight: a meta-analysis.

Journal of the American Dental Association. 2010; **141**: 1423-1434.

48. Sant'Ana AC, de Campos MR, Passanezi SC, de Rezende ML, Greghi SL, Passanezi E. Periodontal treatment during pregnancy decreases the rate of adverse pregnancy outcome: a controlled clinical trial. *Journal of Applied Oral Science*. 2011; **19**: 130-136.

49. Albert DA, Begg MD, Andrews HF, Williams SZ, Ward A, Conicella ML, *et al*. An examination of periodontal treatment, dental care, and pregnancy outcomes in an insured population in the United States. *American Journal of Public Health*. 2011; **101**: 151-156.

50. Fogacci MF, Leao A, Vettore MV, Sheiham A, Radnai M, Pal A, *et al.* Periodontal treatment completed before the 35th week of pregnancy appeared to have a beneficial effect on birthweight and time of delivery [letter]. *Journal of Dental Research.* 2010; **89**: 101.

51. George A, Shamim S, Johnson M, Ajwani S, Bhole S, Blinkhorn A, *et al*. Periodontal treatment during pregnancy and birth outcomes: a meta-analysis of randomised trials. *International Journal of Evidence-Based Healthcare*. 2011; **9**: 122-147.

52. Polyzos NP, Polyzos IP, Mauri D, Tzioras S, Tsappi M, Cortinovis I, *et al*. Effect of periodontal disease treatment during pregnancy on preterm birth incidence: a metaanalysis of randomized trials. *American Journal of Obstetrics and Gynecology.* 2009; **200**: 225-232.

53. Jeffcoat M, Parry S, Sammel M, Clothier B, Catlin A, Macones G. Periodontal infection and preterm birth: successful periodontal therapy reduces the risk of preterm birth. *International Journal of Obstetrics and Gynaecology.* 2011; **118**: 250-256.

54. Xiong X, Buekens P, Goldenberg RL, Offenbacher S, Qian X. Optimal timing of periodontal disease treatment for prevention of adverse pregnancy outcomes: before or during pregnancy? *American Journal of Obstetrics and Gynecology.* 2011; **205**: 111.

55. Laskaris G. *Color Atlas of Oral Diseases*. Athens: Litsas; 1998. p. 502-504.