

MATERNAL ORAL HEALTH AND PREGNANCY OUTCOMES

Literature Review

Maternal Oral Health and Pregnancy Outcomes

Report prepared for the

saskatchewan
preventioninstitute
our goal is **healthy** children

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Executive Summary

This review of the literature, conducted by the Saskatchewan Prevention Institute, examines the relationship between maternal oral health (i.e., periodontal disease) and pregnancy outcomes for both the mother and her fetus/infant. The purpose of this report is to provide a foundation for knowledge translation activities by the Prevention Institute which are aimed at making the information accessible to both oral health professionals and other health care professionals who care for pregnant and postpartum women as well as to women of child bearing age. The report highlights key prevention measures that can be undertaken by the Prevention Institute and its community partners, as well as areas for advocacy at the provincial and regional levels.

In the past decade, multiple reports have highlighted the potential link between periodontal disease and adverse pregnancy outcomes. Potential risks linked to maternal periodontal disease in the prenatal period include preeclampsia, gestational diabetes mellitus, perinatal mortality and miscarriage. The most identified health risk of maternal periodontal disease during labour is the delivery of a pre-term low birth weight infant (PLBW). Other potential outcomes related to maternal periodontal disease include health risks for the child, adolescent and adult offspring (e.g., cardiovascular disease and diabetes).

According to multiple researchers, periodontal infection is highly prevalent among women of childbearing age, particularly low-income women and women of racial and ethnic minority groups. Other socio-demographic and maternal characteristics related to periodontal disease include: advancing age, smoking, diabetes and other systemic diseases, genetics, nutritional status, level of oral hygiene, and socioeconomic status. The literature reveals that the majority of pregnant women do not access dental care. Potential barriers to accessing dental care identified in the literature include: pregnant women not recognizing they have an oral disease; the belief that poor oral health is common during pregnancy; the belief that dental treatment can harm the fetus; a lack of information regarding the importance of oral care; a lack of practice standards; and inadequate dental insurance.

Because of the potential link between maternal periodontal disease and poor pregnancy outcomes, oral health promotion (including efforts to prevent poor oral health) is particularly important among women contemplating pregnancy and those who are already pregnant. Oral health promotion should include educating reproductive-aged women, health care providers and dental professionals regarding the importance of oral health during pregnancy and their ability to prevent/manage periodontal disease. Listed below are the Key Prevention Measures that have been highlighted in the report. These have been divided into those measures that could be implemented by the Saskatchewan Prevention Institute and other community organizations, and those that require advocacy to Government.

Key Prevention Measures for Community Organizations:

- Educate pregnant and preconception women about the risks of periodontal disease during pregnancy.
- Increase awareness among dental and health professionals of the risks associated with periodontal disease during pregnancy.
- Increase awareness among women and dental professionals on the safety of oral treatment during pregnancy.
- Encourage all pregnant or preconception women to consult with an oral health professional.
- Encourage and support future research endeavours regarding oral health during pregnancy and pregnancy outcomes.
- Encourage interdisciplinary collaboration and communication between dental and health professionals.
- Provide evidence-based information and facilitate conferences, workshops and continuing education sessions.
- Encourage provincial Ministry of Health, health regions and professional organizations to issue messages specific to perinatal oral health.
- Include in perinatal care oral health anticipatory guidance and referral for pregnant women.
- Encourage dental professionals to provide pregnant women with assessment, anticipatory guidance, and treatment when indicated.
- Conduct a provincial needs assessment.

Key Prevention Measures at the Provincial Government level:

- Reduce geographic and other barriers to accessing care.
- Implement incentives to encourage young graduates to set up practices in areas with inadequate supply of dentists.
- Issue advisory to dental professionals about the importance and safety of treating pregnant women.
- Support community water fluoridation and expand preventive dental public health programs among sections of the population exhibiting greatest dental health disparities.
- Introduce a surveillance system to evaluate the relationship between pre-term and low birth weight birth and poor maternal oral health status.

To assist in determining which of the highlighted prevention measures would be most appropriate at this time for Saskatchewan, the Prevention Institute will be conducting a scan of existing resources and programs, along with a Needs Assessment, throughout the province.

To obtain a copy of the full report, or to request further information please contact:

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1. Introduction

Research has shown that oral health contributes to overall health. Maintaining good oral health can lead to improved health and well-being of women during pregnancy and overall health later in life; it also has the potential to improve the health of the fetus/infant. Although largely preventable, periodontal disease among women of childbearing age is highly prevalent. Maternal periodontal disease has been linked with harmful implications for both the mother and her fetus/infant; including preeclampsia, gestational diabetes mellitus, perinatal mortality, and pre-term low birth weight (PLBW). It is important to improve a woman's oral health prior to conception or early in her pregnancy in order to reduce the risk of adverse pregnancy outcomes. Education and intervention may have success at this time, as pregnancy is a time when women may be more motivated to make healthy lifestyle changes.

1.1 Defining Periodontal Disease

Periodontal disease consists of both *gingivitis* and *periodontitis*. Ferguson, Hansen, Novak and Novak (2007) define gingivitis as "an inflammatory condition of the soft tissue surrounding the tooth or the gingival" (p. 455). These authors define periodontitis as "the destruction of supporting structures such as the periodontal ligament, alveolar bone, cementum, or soft tissue" (p. 455). Although periodontal disease is both preventable and treatable, it remains one of the most common chronic diseases of infectious origin affecting children, adolescents, adults and the elderly (Ferguson et al., 2007; Lux, 2007). According to Lux and Lavigne (2004), 10-15% of the world's population is affected by advanced periodontal disease.

1.2 Maternal Periodontal Disease

1.2.1 Pregnancy as a Risk Factor for Periodontal Disease

It has been well established that changes in the gingiva occur during pregnancy (Gajendra & Kumar, 2004). Specifically, pregnancy is associated with increased levels of both progesterone and estrogen, which contribute to gingival inflammation (Carl, Roux, & Matacale, 2000). One of the most prevalent forms of gingival inflammation associated with pregnancy is pregnancy gingivitis, most notably seen in anterior teeth with no tissue attachment loss (Gajendra & Kumar, 2004). Because pregnancy is a risk factor for gingival inflammation, oral health is particularly important for women who are planning a pregnancy or who are pregnant.

1.2.2 Prevalence of Periodontal Disease among Women of Childbearing Age

According to Boggess and Edelstein (2006), up to 15% of women of childbearing age are affected by periodontal disease. Higher estimates have been reported by Dasanayake, Gennaro, Hendricks-Munoz and Chhun (2008) with between 37% and 46% of reproductive-aged women being affected by periodontal disease. It has been reported that up to 40% of pregnant women experience some form of periodontal infection (i.e., gingivitis or periodontitis; Boggess, 2008). As highlighted above, gingivitis is the most commonly occurring oral manifestation related to pregnancy and studies have shown that

anywhere from 25% to 100% of pregnant women experience gingivitis (Gajendra & Kumar, 2004; Lux & Lavigne, 2004; Russell & Mayberry, 2008). In a case-control study conducted in Thailand, the researchers found that pregnant women were 2.9 times and 2.2 times more likely to have caries and gingivitis respectively (Rakchanok, Amporn, Yoshida, Harun-Or-Rashid, & Sakamoto, 2010).

2. Oral Health and Systemic Health¹

Oral disease or periodontal disease has been linked with a number of systemic health care problems (Ferguson et al., 2007). For example, it is well established that periodontal disease is associated with **diabetes**, with this relationship appearing to be of a *bi-directional* nature. Some studies have found that periodontal disease increases the risk for diabetes. According to Boggess (2008), individuals experiencing periodontal disease are at a two- to three-fold increased risk of diabetes. Taylor et al. (1996, as cited in Ferguson et al., 2007) conducted a two-year longitudinal study of patients with Type 2 Diabetes and found that those with periodontitis were six times more likely to experience deteriorating glycemic control, as compared to patients without periodontitis.

Other studies have reported that diabetes increases the risk of developing periodontal disease. According to Ferguson and colleagues (2007), those individuals with Type 2 Diabetes have a three-fold increased risk of developing periodontal disease compared to those individuals without diabetes.

Periodontal disease has also been linked to an increased risk of **cardiovascular disease**. According to Boggess (2008), individuals experiencing periodontal disease are at approximately 1.5-1.9 increased odds for developing cardiovascular disease. Other researchers, including Dasanayake et al. (2008) and Ferguson et al. (2007), have also supported a link between periodontal disease and cardiovascular disease.

Another systemic health problem associated with periodontal disease identified in the literature is **respiratory disease**. Scannapieco and colleagues (1998, as cited in Ferguson et al., 2007) examined the relationship between oral conditions and the risk of pulmonary disease. After controlling for age, race, sex, and smoking status, the authors found that those individuals with poor oral hygiene were at a 4.5 increased risk of experiencing chronic respiratory disease compared to those with good oral hygiene. An association has also been reported between periodontal disease and community- and hospital-acquired respiratory infections (e.g., pneumonia; Boggess, 2008).

¹ The impact of poor oral health in childhood on systemic health is covered in greater detail in the report, *Prevention of Early Childhood Caries* (2011) by the Prevention Institute.

Additional health risks associated with periodontal disease identified in the literature include **stroke** (Dasanayake et al., 2008; Ferguson et al., 2007), **atherosclerosis** (Boggess & Edelstein, 2006), **rheumatoid arthritis** (Boggess & Edelstein, 2006), and **neurologic disease** (e.g., Alzheimer disease; Ferguson et al., 2007).

2.1 Physiological Changes in the Oral Cavity During Pregnancy

Pregnancy Granuloma/Pregnancy Epulis/Pregnancy Tumour: A non-cancerous, soft, localized, red in color, painless lesion due to an increase in the number of cells (hyperplasia). These lesions develop on the gums due to a hormonal related, exaggerated response to plaque, reported in up to 9.6% of pregnancies (Laine, 2002; Torgerson, Marnach, Bruce, & Rogers, 2006; Silk, Douglass, Douglass, & Silk, 2008).

Pregnancy Gingivitis: Pregnant women are at an increased risk for gingivitis due to an exaggerated response to dental plaque. There might be exacerbation of existing gingivitis during pregnancy. Also, the rise in levels of progesterone and estrogen contribute to gingivitis causing increased blood flow in the gums anywhere from 30-50%, which bleeds easily, when subjected to trauma. It is often noticed in the upper/lower front teeth, during the second month of pregnancy and peaks during the third trimester (Pirie, Cooke, Linden, & Irwin, 2007).

Periodontitis: Untreated gingivitis can lead to periodontitis, as bacteria continues to thrive, resulting in the loss of supporting tooth structure, mobility, loss of attachment, pain and infection. Increased levels of bacteria in the oral cavity might travel systemically, increasing the chances for pregnancy related complications, such as miscarriage. Bacteria may also travel to vital organs, such as the heart, increasing the risk for heart disease or stroke (Pirie, Cooke, Linden, & Irwin, 2007). The prevalence of periodontal disease among women of child bearing age is between 37 to 46 percent and up to 30 percent during pregnancy (NYSDH, 2006). Gestational diabetes is reported in nearly 4% of pregnant women. Women with gestational diabetes are nine times more likely to have periodontal disease (Dabelea, Snell-Bergeon, Hartsfield, Bischoff, Hamman & McDuffie, 2005; Xiong, Buekens, Vastardis & Pridjian, 2006).

Ptyalism/Sialorrhoea Gravidarum: Ptyalism is a condition that results in excessive salivation in pregnant women suffering from nausea. The symptom of nausea limits their desire to swallow this saliva, as swallowing excessive saliva thin in consistency in itself precipitates nausea. Ptyalism during pregnancy is a secondary cause, resulting in pooling of saliva in the mouth with normal levels of saliva production, rather than the actual increase in saliva secretion. Ptyalism sometimes leaves a bad taste in the mouth, causes skin maceration, nocturnal awakening, decline in food intake and limitation of social interaction due to distended cheek pouches (Van Dinter, 1991; Erick, 1998; Gordon, 2002).

Tooth Mobility: Loosening of teeth, especially the upper front teeth, has been noticed even in pregnant women with good oral hygiene. Such a development is due to the mineral shift in the underlying bone supporting the tooth (Hunter & Hunter, 1997).

Tooth Surface Loss/Enamel Erosion: Pregnant women are prone to nausea and morning sickness. Also, a rise in progesterone hormone levels decreases the tonicity of the esophagus and lower gastrointestinal tract motility causing increased sensitivity for gag reflex and risk for frequent gastric acid reflux. This is further aided by the superior displaced position of the stomach by the uterus. Vomiting of the gastric contents decreases the pH content of the oral cavity, resulting in tooth sensitivity due to loss of tooth surface from acid-induced erosion caused by repeated vomiting (Hunter & Hunter, 1997; Giglio, Lanni, Laskin & Giglio, 2009).

3. Consequences of Periodontal Disease on Mother and Offspring

It has been understood for some time that the oral cavity can be both the focus of infection, as well as the source of infection in other areas of the body, including systemic infection (Miller, 1891). Periodontitis and gum disease can initiate the spread of bacteria and host mediators to the developing fetus through the blood to induce pregnancy related complications (Collins, Smith, Arnold, & Offenbacher, 1994; Collins, Smith, Windley, & Offenbacher, 1994).

In the past decade, multiple reports have highlighted the potential link between periodontal disease and adverse pregnancy outcomes; the majority of these studies have had a primary focus on preterm delivery. Less research exists regarding the relationship between maternal oral health and other adverse pregnancy outcomes, such as preeclampsia and gestational diabetes mellitus. It is important to note that although researchers have suggested that periodontal disease affects pregnancy outcomes (including preterm delivery), the causal nature of this relationship is not well-established. Only with well-designed randomized control trials (RCTs) can definitive conclusions be made regarding the causal nature of the periodontal disease-pregnancy outcome relationship.

This portion of the document is divided into three sections. The first section will explore the possible consequences of maternal periodontal disease on both the mother and her fetus during pregnancy. The second section will examine the possible risks of periodontal disease for the mother and her fetus/infant during labour and in the postpartum. The third section will discuss the implications of maternal periodontal disease for the child, adolescent and adult offspring.

3.1 Health Risks during Pregnancy

Several studies have found an association between maternal periodontal disease and **preeclampsia** (Boggess, 2008; Boggess & Edelstein, 2006; Contreras et al., 2006; Ferguson et al., 2007; Goepfert, et al., 2004). Approximately 3% to 5% of all pregnancies are complicated by preeclampsia. Preeclampsia is a condition that typically starts after the 20th week of pregnancy and is related to increased blood pressure and protein in the mother's urine (as a result of kidney problems). Preeclampsia affects the placenta, and can affect the mother's kidney, liver, and brain. Although the etiology of this disorder is unknown, preeclampsia has been reported as a major cause of perinatal mortality and morbidity (Conde-Angudelo, Villar & Lindheimer, 2008;

Contreras et al., 2006). Conde-Angudelo and colleagues (2008) conducted a systematic review and meta-analysis of observational studies examining the relationship between maternal infection and preeclampsia and found that maternal periodontal disease (detected within 48 hours before or after delivery or 3-28 months' postpartum) was associated with an increased risk of preeclampsia. Because few studies have examined the link between oral health and preeclampsia, and those that have, have only found an association, with no indication of causality, more research is needed to better understand this association, including the causal nature of the relationship.

The relationship between periodontal disease and Type 1 or 2 Diabetes has been well established (Xiong, Buekens, Vastardis & Pridjian, 2006). However, only one study to date has examined the relationship between periodontal disease and **gestational diabetes mellitus** (GDM). Xiong et al. (2006) found that 44.8% of pregnant women with GDM had periodontitis, while 13.2% of non-diabetic pregnant women had periodontitis. Although the causal nature of the GDM-periodontal disease relationship is unknown at present, Xiong and colleagues (2006) describe why it is unlikely that GDM causes periodontitis (i.e., GDM is temporary and occurs later in pregnancy):

Compared to Type 1 and 2 Diabetes, GDM represents an early stage of glucose dysregulation and a temporary impaired glucose tolerance that occur in later pregnancy. The elevated glucose levels in the majority of women diagnosed with GDM will usually return to normal after birth. Therefore, the hyperglycemia of GDM may be too mild and of too short a duration to have a significant effect on gingival tissues and to cause periodontitis. (p. 1088)

Xiong and colleagues also suggest that a common genetic cause for both periodontal disease and GDM might explain the link between the two disorders. Because only one study to date has examined the link between periodontal disease and GDM, no definitive conclusions can be made at this time. More research is needed to better understand this possible association, including its causal nature.

Another health risk associated with maternal periodontal disease during pregnancy is **perinatal mortality**. Shub, Wong, Jennings, Swain and Newnham (2009) examined the association between clinical periodontal disease, maternal oral health symptoms and perinatal mortality. Shub and colleagues defined perinatal mortality as "the death of babies weighing at least 400 g or greater than 20 weeks' gestation where birthweight is not known" (p. 131). The authors found that women who experienced perinatal loss were two times more likely to have periodontal disease than women who had not experienced perinatal loss. Women who experienced perinatal loss as a result of extreme prematurity were four times more likely to have periodontal disease, as compared to women who delivered full-term, live born infants. Other researchers, including Boggess (2008) and Goepfert et al. (2004), have also reported an association between maternal periodontal disease and perinatal mortality.

Although the evidence is not conclusive, the literature has identified two additional, potential health risks of maternal periodontal disease for the infant during pregnancy, including **miscarriage** (Ferguson et al., 2007; Moore et al., 2004) and **fetal growth deficiencies/restrictions** (Goepfert et al., 2004).

3.2 Health Risks during Labour and in the Postpartum Period

According to Mitchell-Lewis and colleagues (2001), “Pre-term low birth weight (PLBW) is considered the foremost problem in obstetrical medicine and remains the leading cause of morbidity and mortality among neonates” (p. 34). Preterm birth is defined by the World Health Organization (WHO) as birth prior to 37 weeks of gestation, while low birth weight is defined by the WHO as babies born under 2500 grams (Lux, 2007). Emerging evidence has identified a link between maternal periodontal disease and PLBW (Bogges, 2008; Bogges & Edelstein, 2006; Dasanayake et al., 2008; Ferguson et al., 2007; Goepfert et al., 2004; Lux, 2007; and Lux & Lavigne, 2004).

Proposed mechanisms: Three proposed mechanisms have been identified in the literature to explain how maternal periodontal disease may influence PLBW (Lux & Lavigne, 2004; p. 156):

1. *Action of the proinflammatory mediators:* Periodontal diseases are associated with chronic gram negative anaerobic infections or those resulting in local and systemic elevations of proinflammatory prostaglandins, including prostaglandin E₂ (PGE₂) and cytokines (IL-1, IL-6, and TNF-α). Proinflammatory prostaglandins are unsaturated fatty acids in the body that cause inflammation. It is suggested that the artificially high levels of the prostaglandins foster premature labour.

Periodontal Infection → Proinflammatory Prostaglandins → Premature Labour

2. *The action of the periodontal reservoir of LPS:* The periodontal infection provides a source of microbial products such as lipopolysaccharides (LPS), which trigger the release of proinflammatory prostaglandins, such as prostaglandin E₂ (PGE₂) and cytokines (TNF-α, IL-6, interleukin-1β (IL-1 β)). Again, it is suggested that the artificially high levels of the prostaglandins foster premature labour.

Periodontal Infection → LPS → Proinflammatory Prostaglandins → Premature Labour

3. *Direct micro-organism assault on the fetoplacental unit:* The oral micro-organisms are directly implicated in the PLBW: this mechanism involves translocation of periodontal pathogens to the fetoplacental unit, through the blood, stimulating the release of prostaglandins and as a result, fostering premature labour.

Evidence linking maternal periodontal disease to PLBW: Four distinct lines of evidence have related periodontal disease to PLBW: microbiological studies; case-controlled studies; prospective studies; and intervention studies. In an effort to better understand the mechanisms behind the periodontal disease-PLBW association, several **microbiological studies** have examined amniotic fluid, maternal and fetal cord serum, and gingival crevicular fluid (GCF). Specifically, Damare et al. (1997) and Offenbacher et al. (1998; as cited in Lux & Lavigne, 2004) examined GCF and amniotic fluid and the role of PGE₂ and IL-1 β , which trigger inflammation. Damare and colleagues found that mothers of PLBW infants had higher levels of PGE₂ and IL-1 β in their GCF and amniotic fluid compared to mothers of normal birth weight babies. Similarly, Offenbacher et al. found that the GCF of mothers of PLBW infants had significantly higher levels of PGE₂ compared with mothers of infants with normal birth weight (as cited in Lux & Lavigne, 2004). Two other studies examined antibody responses to periodontal pathogens in the maternal and fetal serum. Specifically, Offenbacher et al. (1999; as cited in Lux & Lavigne, 2004) and Madianos et al. (2001; as cited in Lux & Lavigne, 2004) examined the presence of immunoglobulin M (IgM) antibody against various periodontal pathogens. Both researchers found that the IgM was higher in the PLBW serum samples, as compared to the normal birth weight samples. Lux and Lavigne (2004) make the following conclusion from these microbiological studies:

Each study suggests that periodontal infection is a source of microbial products that affect the pregnancy outcome. The studies also suggest that maternal periodontal infections, resulting in blood-borne micro-organisms that can translocate to the fetus, provide a systemic challenge to the fetus and induce an immunologic response. They show it is the inflammatory and host responses, not the clinical signs of periodontitis that are associated with preterm births. (p. 158)

Several **case-controlled studies** have been conducted to examine the possible association between periodontal disease and PLBW. Case-controlled studies compare two groups of people: those with the disease or condition of interest (cases) and a very similar group of people who do not have the disease or condition under study (controls). Case-controlled studies are retrospective, meaning data is collected and analyzed after the outcomes have occurred (retrospective studies look back in time). Offenbacher et al. (1996; as cited in Lux & Lavigne, 2004) sought to determine whether the prevalence of maternal periodontal infection is associated with PLBW. These authors examined 124 mothers. Cases were defined as low birth weight infants (i.e., infants less than 2500 grams and one or more of the following: gestational age < 37 weeks, preterm labour or premature rupture of membranes). Controls were defined as normal birth weight infants. Maternal periodontal status was determined three days following the birth of these infants. Offenbacher and colleagues found that mothers with periodontal disease were more than seven times more likely to deliver a PLBW infant. In contrast, Davenport, Williams, Sterne, Murad, Sivapathasundram and Curtis (2001) reported a case-control study of 236 mothers and found no evidence for an association between periodontal disease and PLBW.

Several **prospective studies** have been conducted to explore the possible link between maternal periodontal disease and PLBW. Compared to case-controlled studies, prospective studies involve following those people who meet the study criteria over a period of time in order to collect data on events or outcomes subsequent to enrolment (prospective studies look forward in time). Jeffcoat et al. (2001) reported on a prospective study of approximately 1,300 pregnant women, where they correlated the occurrence of periodontitis at 21 to 24 weeks' gestation with the presence and severity of consequent preterm births. Jeffcoat and colleagues found that preterm birth among participants with periodontitis was 4.45 to 7.07 times higher compared to periodontally healthy patients.

The majority of the findings outlined above show an association between maternal periodontal disease and the delivery of a PLBW infant; however, they do not reveal whether periodontal therapy among mothers with periodontal disease will reduce the likelihood of delivering a PLBW infant. Only intervention studies can address this question. Three **intervention studies** have used periodontal treatment for pregnant women with existing periodontal problems. In a non-randomized study by Mitchell-Lewis et al. (2001), they examined the effect of a periodontal intervention on pregnancy outcomes among a cohort of young, minority, pregnant women. The intervention involved oral hygiene instructions and full mouth debridement (including scaling, polishing, fluoridated paste, and dental sealants). Mitchell-Lewis and colleagues found that 18.9% of women who did not participate in the intervention gave birth to PLBW babies, as compared to 13.5% of those who did receive periodontal therapy. Although this difference did not reach statistical significance, Mitchell-Lewis and colleagues suggest the need for further examination of the association between maternal oral health and PLBW.

Lopez, Smith and Gutierrez (2001) conducted an RCT intervention study to assess whether periodontal treatment among a group of low socio-economic status (SES) women with periodontal disease would reduce the occurrence of PLBW. Periodontal treatment for the intervention group consisted of plaque control instructions, supra and subgingival scaling, root planning and chlorhexidine rinse once a day. Lopez et al. found periodontal disease to be an independent risk factor for PLBW. Women with periodontal disease were four times more likely to have a PLBW infant than women who did not experience periodontal disease. In addition, the authors found that the incidence of PLBW in the intervention group was significantly lower (1.84%) in comparison to the control group (10.11%).

Jeffcoat et al. (2003) conducted an RCT intervention study to determine whether periodontal therapy would reduce the likelihood of spontaneous preterm birth. Participants were randomly assigned to one of three treatment groups: 1) tooth cleaning and polish plus placebo capsule three times a day; 2) scaling and root planing plus placebo capsule three times a day; and 3) scaling and root planing plus metronidazole 250 mg three times a day for one week. Jeffcoat and colleagues found that the rate of preterm birth was 4.9% for the first group (tooth cleaning and polish plus placebo), 0.8% for the second group (scaling and root planing plus placebo), and 3.3% for the third group (scaling and root planing plus metronidazole). The rate of preterm

birth was 6.3% for the control or untreated group. However, these point estimates of prevalence are not exact and not applicable to women without periodontal diseases. Therefore, the results cannot be generalized to all pregnant women.

Based on results from case-controlled, prospective, and intervention studies, the Canadian Dental Hygienists Association's (CDHA) 2004 position paper concludes that "there is a possible link or correlation between periodontal disease and PLBW and preterm birth and that women with periodontal disease may have a 4 to 7.9 odds ratio (OR) of having a preterm birth than women with good oral health" (p. 3; Lux, 2007). Furthermore, the CDHA's 2004 position paper indicates that "there is preliminary evidence that periodontal treatment during pregnancy may reduce the incidence of adverse pregnancy outcomes" (p. 2; Lux, 2007).

3.3 Health Risks for the Child, Adolescent and Adult Offspring

Little evidence-based research has linked maternal periodontal disease to health risks for the offspring later in life; however, Dasanayake and colleagues (2008) have suggested that exposure to chronic inflammation in utero may lead to the later onset of cardiovascular disease and diabetes as adults. It is important to note that these health risks (i.e., cardiovascular disease, diabetes) are also associated with preterm birth. In addition, Boggess and Edelstein (2006) have suggested that maternal periodontal disease is linked to the infant's risk of developing early and severe dental caries.²

3.4 Reasons for Conflicting Data

Although researchers have made a compelling argument for the association between maternal periodontal disease and adverse pregnancy outcomes (e.g., PLBW, preeclampsia, perinatal morbidity/mortality), other studies have not found an association. Moore et al. (2004) sought to examine the possible relationship between maternal periodontal disease and preterm birth and low birth weight; the authors found no association between either preterm birth or low birth weight and maternal periodontal disease. Buduneli, Baylas, Buduneli, Turkoglu, Kose and Dahlen (2005) also did not find an association between maternal periodontal infection and the delivery of a PLBW infant. Several explanations have been offered in the literature for why conflicting data exists. First, there is no agreed upon or universal clinical definition of periodontal disease. Second, variations exist among research studies in the clinical criteria used to define periodontal disease. Third, several studies do not control for potential confounding variables and the studies that do control for confounding variables vary substantially in terms of the confounders controlled for (Boggess, 2008). Ferguson et al. (2007) assert that it is difficult to determine the causal relationship of two variables (e.g., periodontal disease and pregnancy outcomes) as the relationship could be based on confounding effects of other variables known to affect pregnancy (e.g., low SES, smoking). Finally, conflicting data may be partially attributed to differences in the

² The link between maternal periodontal disease and infant/child oral health is discussed in further detail in the report, *Preventing Early Childhood Caries* (2011), by the Prevention Institute.

populations studied. For example, differential access to health care insurance, dental care and prenatal care may blur the relationship between maternal periodontal disease and adverse pregnancy outcomes (Boggess, 2008).

4. Socio-Demographic and Maternal Characteristics

According to existing research, periodontal infection is highly prevalent among women of childbearing age, particularly **low-income women** and women of **racial and ethnic minority groups** (Boggess, 2008; Boggess & Edelstein, 2006; Mills & Moses, 2002; Russell & Mayberry, 2008). Xiong and colleagues (2006) conducted a systematic review of the existing evidence on the association between periodontal disease and adverse pregnancy outcomes. Interestingly, the authors found a difference between those studies conducted in the United States or in developing countries, and those conducted in European countries and Canada. Specifically, samples in studies conducted in the United States and developing countries had a propensity to include African American women and economically disadvantaged women; furthermore, these studies consistently reported an association between periodontal disease and adverse pregnancy outcomes. In contrast, findings were less consistent regarding the association between periodontal disease and adverse pregnancy outcomes in countries offering universal health care (i.e., European countries and Canada). Xiong et al. (2006) conclude that “pregnancy outcomes may be different according to the socio-economic status and access to dental care” (p. 141).

Other risk factors associated with periodontal disease have been identified in the literature, including *advancing age, smoking and diabetes* (Boggess & Edelstein, 2006). Carl et al. (2000) identified several factors that may modify how periodontal infection affects an individual, including *genetics, tobacco use, pharmacologic therapy, systemic disease, nutritional status and level of oral hygiene*. Furthermore, these authors suggest that the risk of periodontal disease can be reduced by identifying and eliminating or reducing those factors that can be altered (e.g., smoking, nutritional status).

Machuca, Khoshfeiz, Lacalle, Machuca and Bullon (1999) examined the periodontal status of 130 pregnant women and its relationship to demographic (age, professional level, education, and urban or rural residence) and clinical variables (gestation period, previous pregnancy, health status, previous live births, previous periodontal maintenance). Gingivitis resulting from the build up of plaque was the most prevalent periodontal condition in the sample and was negatively associated with *professional level, education level, and previous periodontal maintenance*. In addition, patients who lived in *rural areas* were significantly more likely to experience gingivitis due to the accumulation of plaque.

Most research in the area of maternal oral health has examined the implications of periodontal disease during pregnancy; little research has examined the socio-demographic and maternal characteristics of periodontal disease during pregnancy. As such, further investigation is needed to assess the social determinants of periodontal disease and the impact on pregnancy outcomes.

5. Barriers to Dental Care

5.1 Barriers to *Accessing* Dental Care

The literature reveals that the majority of pregnant women do not access dental care (Gajendra & Kumar, 2004). For example, studies using the Centers for Disease Control and Prevention's Pregnancy Risk Assessment Monitoring System report that only 23-43% of pregnant women receive dental care during pregnancy (Bogges, 2008). According to Dasanayake et al. (2008), those pregnant women who do access dental care are more likely to be Caucasian, married, have dental insurance, and have completed more than high school.

Researchers such as Dasanayake et al. (2008) and Silk, Douglass, Douglass and Silk (2008) have offered several explanations for why more pregnant women do not access dental care, including:

- pregnant women not recognizing they have an oral disease
- the belief that poor oral health is normal during pregnancy
- the belief that treatment can harm the fetus
- a lack of information regarding the importance of seeking dental care
- a lack of practice standards
- inadequate dental insurance
- misinformation about the safety to the mother and fetus

Other factors include, lack of participation of dentists in public dental insurance plans, inadequate employer based dental insurance coverage, inequitable distribution of dental health care providers, and transportation issues to reach the nearest dental office (CDA, 2010).

5.1.1 Addressing Barriers to *Accessing* Dental Care during Pregnancy

Although many women may not access dental care during pregnancy, it is necessary that all women be provided the opportunity to have their oral health assessed during pregnancy and educated about the link between periodontal disease and pregnancy outcomes. Dasanayake et al. (2008) state:

Regardless of the reasons for the underuse of oral healthcare services, pregnancy actually provides an opportunity to counsel, educate, detect, and treat oral health problems, especially because pregnancy is often the only time that some low-income women have medical and dental insurance...It is essential that nurses use the opportunity of pregnancy to assess women for periodontal disease, a condition that can have a negative impact on pregnancy outcome. (p. 46)

Anticipatory Guidance: Pregnancy is considered to be a ‘teachable moment’, when women are receptive to changes that would benefit themselves and their children. The perinatal period is a time to build capacity, motivate, educate and treat expectant mothers. The teachings impact the mother, including how she cares for her child(ren) in the future (De La Cruz, Rozier, & Slade, 2004; NYSDH, 2006; Silk, Douglass, Douglass, & Silk, 2008; Boggers, 2008). Prenatal visits provide an opportunity to discuss with pregnant women the importance of good oral health during pregnancy. This discussion should include oral health education, proper oral hygiene practices and diet counseling. Women should be educated about how improved maternal oral health will improve the woman’s quality of life, reduce the potential for impact on pregnancy outcomes and decrease the potential for the transmission of pathogenic bacteria from mother to the child (AAPD, 2009). Maintaining good oral health is equally important during preconception for women who are planning a pregnancy, as well as for all women of child bearing age. Data from the United States suggest that as many as 49% of all pregnancies are unplanned (Finer, & Henshaw, 2006; Henshaw, 1998). As a result, many women conceive with less than optimum oral health status. Improvement in preconception oral health by health promotion, primary prevention and disease stabilization has been shown to improve overall pregnancy outcomes (Moos, & Cefalo, 1987; Takahashi, Libet, Ramstrom, Jocson, & Marie, 2007).

Dental Home³: Women should be encouraged to find a “Dental Home” for themselves and their children. This is a model of care that is responsible for the oral health of both pregnant women and their children. The mother’s oral health is important for her own health, the health of her pregnancy, and to prevent the occurrence of caries in her children⁴. Regular follow-ups with the mothers are arranged to establish a dental home for their children, by age one or sooner, to initiate primary preventive dental interventions and provide continuous care (Milgrom, Ludwig, Shirtcliff, Smolen, Sutherland, Gates, & Weinstein, 2008).

Education and Professional Development for Health Professionals: Health professionals who work with pregnant women need to be educated about the importance of, and their role in, providing anticipatory guidance and referring to a dental professional.

³ Refer to definitions section for a detailed explanation.

⁴ Refer to the report *Prevention of Early Childhood Caries* 2011, by the Prevention Institute, for more information on this.

5.2 Barriers to Providing Dental Care

The literature reveals that dental health care providers also contribute to the barriers to providing care. Some researchers have suggested that dentists are often hesitant to offer care (particularly non-urgent care) to pregnant women because of the concern regarding the possible risks (e.g., possible teratogenic {ability to disrupt fetal growth and development}) consequences in first trimester and discomfort of the dental chair in third trimester (Boggess & Edelstein, 2006; Dasanayake et al., 2008; Silk et al., 2008). Despite these concerns, there is no evidence to suggest that periodontal treatment during pregnancy is harmful to the pregnant woman or her developing fetus (Boggess, 2008). For example, Michalowicz et al. (2006) examined the effect of nonsurgical periodontal treatment on preterm birth and concluded that periodontal care is safe and effective during pregnancy and that dental care during pregnancy has been an issue governed more by caution than data.

A survey conducted in Oregon, by Huebner, Milgrom, Conrad and Lee (2009) found that 71% of dentists reported inadequate compensation by the insurance companies for the time spent counselling pregnant women as the reason for not accepting pregnant women. In a study of obstetricians and gynaecologists, nearly 77% of clients were denied treatment by their dentists because of their pregnancy (Morgan, Crall, Goldbert, & Schulkin, 2009). Stanford, Shellhaas and Hade (2008) concluded in their study that obstetricians were more comfortable and likely to recommend dental treatment than dentists. Lee, Milgrom, Huebner and Conrad (2010) concluded that incorrect knowledge among dentists about routine and emergency dental procedures might create barriers in providing care for pregnant patients.

Dental health care provider attitudes, cultural incompetency and the restrictive policies in the dental practice might prevent pregnant women from accessing care (CDA, 2010). For example, among Latino immigrants, who have high prevalence rates of caries, drinking bottled water is a cultural norm as they fear illness from drinking tap water. Lack of cross-cultural training might result in a dental care provider failing to encourage Latino people to drink tap water that is fluoridated (Hobson, Knochel, Byington, Young, Hoff, & Buchi, 2007; Barker, & Horton, 2008).

Fear of law suits or medico-legal issues related to taking an x-ray might also contribute to reluctance on the part of dentists to treat pregnant women (Rushton, Horner, & Worthington, 2006). There are also concerns among dentists in treating pregnant women of low socio-economic status, because they are expected to have poor oral health status and untreated dental diseases, which might take a longer duration for the treatment to be completed. Also, they often qualify for only short term dental insurance, which might end following pregnancy (Ramos-Gomez, 2008).

5.2.1 Addressing Barriers to Providing Dental Care during Pregnancy

Education and Professional Development for Dental Professionals: It is important for dental professionals to understand and improve their dental knowledge in treating pregnant women as well as the fetus, by learning about the normal changes that occur in the oral cavity, complications of untreated oral conditions on the pregnancy and the impact of dental interventions affecting the oral health status of pregnant women (CDA, 2010).

6. Myths & Facts Held Among Pregnant Women

Many pregnant women with oral problems do not seek care due to a perceived notion that dental treatment during pregnancy could affect the developing fetus (Ressler-Maerlender, Krishna, & Robison, 2005).

Myth: A pregnant woman loses a tooth for every child she has.

Fact: Losing a tooth for every child is an old wives' tale and does not carry any scientific evidence to support the claim. If a tooth is lost during pregnancy, it is due to the poor oral health status of the pregnant woman or due to the physiological changes that occur in the oral cavity during pregnancy that predispose one to the loss of teeth. In a survey conducted in United States, one in every five pregnant women from low income families believed that a woman loses a tooth for every pregnancy (Al Habashneh, Guthmiller, Levy, Johnson, Squier, Dawson, & Fang, 2005).

Myth: A woman loses calcium from her teeth during pregnancy and develops cavities as a result.

Fact: The primary source of calcium for the fetus is the diet of the pregnant woman. The presence of cavities is due to a lack of proper oral hygiene maintenance, poor oral health status, consumption of sticky cariogenic (cavity causing) food or frequent snacking. Tooth calcium is stable during pregnancy and is not influenced by the body's increase in demand for more calcium (Scheutz, Baelium, Matee, & Mwangosi, 2002).

Myth: Dental work during pregnancy should be avoided.

Fact: Many pregnant women are unaware of the adverse effects of poor oral health on their unborn child, themselves or on their pregnancy and do not seek professional dental care (Gaffield, Gilbert, & Makvitz, 2001; NYSDH, 2006). Pregnancy should be considered no different than any other phase of a woman's life with respect to seeking dental care/treatment. Diagnosis and preventive and non-invasive dental treatments, including required dental x-rays and the use of local anaesthesia during pregnancy are not only recommended, but also safe for the mother and her developing fetus. The benefits of dental treatment outweigh any risks, compared to the risks for not providing care (CDA, 2010). A more detailed description of what dental care is recommended during pregnancy is provided below.

Myth: Toothaches during pregnancy should be dealt with in the second trimester only.

Fact: The second trimester and early third trimester is considered ideal for addressing dental needs, but it is not the only period during which dental needs can be addressed. Following necessary precautions, emergency treatment such as for a toothache or infection should be undertaken immediately. However, non-emergency and elective treatment can and should be postponed until the second trimester or after pregnancy (American Pregnancy Association, 2007; Little, Falace, Miller, & Rhodus, 2008; CDA, 2010).

Myth: Dental X-rays are harmful for the fetus.

Fact: Dental radiography is safe during pregnancy. Modern diagnostic procedures follow the principle of 'ALARA' (As Low As Reasonably Achievable), by which only radiographs that aid in diagnosis are taken. Protective equipment, such as a lead apron, thyroid collar and the use of high speed x-ray films, direction of the x-ray beam (away from uterus), collimation, filtration and intensifying screens limit the amount of radiation reaching the patient. The uterine radiation dose for full mouth radiography is nearly 75 times less than the uterine radiation exposure occurring naturally in the environment. The benefits clearly outweigh any potential risks (Matteson et al., 1991; Freeman & Brand, 1994; Carlton, Adler, & Burns, 2000).

7. Interventions and Precautions during Pregnancy

7.1 Interventions during Gestation/Period of Pregnancy

- **First Trimester (1st to 3rd month):** A dental examination to assess dental health status and oral prophylaxis (scaling, root planing, polishing, and other preventive procedures) is recommended during this period to eliminate etiological factors that contribute to gingivitis or periodontitis. Fluoride treatment (in the form of varnish) might be required for patients with nausea or gastric reflux, to protect the eroded enamel. As fetal organogenesis (vital organ development) occurs during this period, any elective (simple tooth extractions, restorations, endodontic therapy) and cosmetic dental treatment (crown & bridge, veneers, bleaching) should be delayed until the second trimester, early third trimester or nearing the end of a woman's pregnancy.
- **Second Trimester (4th to 6th month):** Dental interventions (e.g., cavity fillings, diagnostic x-rays, crown preparation, root canal treatments, tooth extractions) are considered to be safe and generally women are able to sit comfortably in the dental chair during this phase. Nausea is generally low or might have ceased by the start of this phase, which reduces any nausea related discomfort during the treatment.
- **Third Trimester (7th to 9th month):** The early phase of this trimester is considered safe and relatively comfortable for any dental treatment. The appointments should be short, as reclining for too long in the dental chair may cause back pain. The use of narcotic analgesics (codeine or oxycodone) is contraindicated during this phase, as they may cause neonatal respiratory depression.

Note: Emergency dental treatment such as tooth extraction or root canal therapy could be provided anytime during the pregnancy in order to relieve pain and to limit the spread of oral infection. Similarly, oral prophylaxis and diagnostic x-rays can be undertaken during all three trimesters to eliminate plaque/calculus and for diagnosis of any oral problems/diseases respectively (AAP, 2004).

(Levy, 2004; APA, 2007; Little, Falace, Miller, & Rhodus, 2008; CDA, 2010)

7.2 Precautions during Pregnancy

- Ensure that women let their dentist know they are pregnant, or might be pregnant, prior to any treatment.
- Second trimester is considered to be the safest for dental treatment.
- Elective dental procedures need to be postponed until second trimester, early third trimester or after delivery.
- Legs should not be crossed while seated in the dental chair to allow for proper blood circulation.
- Ensure a woman does not immediately get up from the dental chair after treatment, due to the low blood pressure created by the postural position, which might result in loss of consciousness/fainting.
- Advise a woman to eat a healthy diet that meets the daily requirements of both the mother and the fetus, especially one that is rich in calcium, vitamin B₁₂ & C, which maintains healthy gums and teeth.
- Provide shorter appointments and have the woman change position often on the dental chair.
- Use rubber dam and high speed suction tube during placement or removal of amalgam restoration.
- Avoid a woman lying on her back on the dental chair for too long during the last trimester, as the enlarged uterus may obstruct or cut off inferior vena cava (blood vessel that returns blood towards the heart from extremities), resulting in poor heart perfusion (pumping action).
- If subjected to hypotension (low blood pressure) due to the supine position while on the dental chair, have the woman roll over on to the left side and place a pillow or towel to bring about an elevation of 15 degrees to reverse the blocked blood flow to the heart.
- Dental chair should be as upright as possible.

(Whittle, Whittle, & Sarll, 1998; Thornburg, Jacobson, Girauld & Morton, 2000; American Pregnancy Association, 2007)

8. Management of Existing Dental Conditions during Pregnancy

Gingivitis & Periodontitis: Root planning and supra (above the level of gums) and sub (below the level of gums) gingival scaling should be done to remove the plaque and calculus from the surface of the tooth. The woman should perform regular oral hygiene practices, including: brush twice a day, use dental floss regularly, change tooth brush every 3 months, use anti-bacterial mouth wash, and chew gum with xylitol. Advanced stages of gingivitis, which often progress to periodontitis, require invasive procedures (periodontal flap surgery) to eliminate the etiological factors causing gums diseases (Steinberg, 2000). As indicated above, this emergency intervention can be done at any time during the pregnancy.

Medication⁵: Local anaesthesia, lidocaine or prilocaine (FDA drug category B) can be used with epinephrine. Analgesic (pain killer/reliever), e.g., acetaminophen (FDA drug category B), is commonly used and is the safest drug used for the control of pain during pregnancy. Antibiotics such as penicillin, cephalosporin and erythromycin (FDA drug category B) are used to treat infection. Nonsteroidal anti-inflammatory drugs (NSAID) are contraindicated during the first and third trimester because they are associated with the early closure of ductus arteriosus, decrease in the levels of amniotic fluid and inhibition of labour. Antibiotics such as tetracycline and erythromycin must be avoided during pregnancy. Belladonna alkaloids are effective in treating ptyalism and use of atropine is contraindicated during pregnancy (Mandel, & Tamari, 1995; FDA, n.d.; OTIS, n.d.).

Pregnancy Granuloma/Pregnancy Epulis: This usually subsides after childbirth and no treatment is required, unless the lesion interferes with speaking, eating or swallowing. Non-surgical management of small lesions involves local debridement, chlorhexidine mouthrinses and reduction in the amount of plaque around the epulis. If the lesion is unsightly (if visible due to its size, during speech, near the upper or lower front teeth), painful, bleeds easily, interferes with speech or eating, or is being traumatized by opposing jaw teeth, surgical excision might be required (Manson, & Eley, 1995; Barak Oettinger-Barak, Oettinger, Machtei, Peled, & Ohel, 2003).

Tooth Surface Loss: Tooth erosion due to nausea or acid reflux could lead to pain and therefore avoidance of brushing, which increases the risk for caries. Mouth should be rinsed with water mixed with baking soda (one teaspoon) after vomiting. If possible drink milk or water, but do not brush immediately after vomiting (i.e., wait at least one hour), as the enamel is already demineralized due to exposure to acid and tooth brushing would simply aggravate the problem (NYSDH, 2006).

⁵ For a detailed list of pregnancy drug categories, refer to the Appendix.

9. Conclusion

Emerging evidence exists to suggest that poor oral health during pregnancy can negatively impact pregnancy outcomes for both the mother and her fetus/infant. Potential risks of maternal periodontal disease for the mother include preeclampsia and gestational diabetes mellitus. Possible health risks for the fetus/infant include preterm low birth weight, perinatal mortality and health risks later in life (i.e., in childhood, adolescents and adulthood). Maternal periodontal disease (i.e., gingivitis and periodontitis) is preventable, yet remains highly prevalent among reproductive-aged and pregnant women. Because of the potential link between maternal periodontal disease and poor pregnancy outcomes, oral health promotion (including efforts to prevent poor oral health) is particularly important among women contemplating pregnancy and those who are already pregnant. Oral health promotion should include educating both reproductive-aged women and health care providers regarding the importance of oral health and their ability to prevent/manage periodontal disease.

9.1 Key Prevention Measures for Community Organizations

Based on the existing evidence, the following are key prevention measures that can be undertaken by the Saskatchewan Prevention Institute and its community partners:

- Educate pregnant women and those contemplating pregnancy about the potential health risks of periodontal disease during pregnancy (i.e., poor pregnancy outcomes) and the benefits of treatment.
- Increase awareness among dental and other healthcare professionals regarding the potential link between maternal periodontal disease and adverse pregnancy outcomes.
- Increase awareness among both women of reproductive age and dental health professionals regarding the safety of oral treatment during pregnancy.
- Encourage all women who are pregnant or planning a pregnancy to consult with an oral health professional for examination and evaluation.
- Encourage and support future research endeavours (including intervention studies) examining the potential link between periodontal disease during pregnancy and poor pregnancy outcomes.
- Encourage interdisciplinary collaboration and communication between healthcare professionals (e.g., physicians and dentists), in order to share information concerning the safety of dental treatment during pregnancy and provide clear referral recommendations.
- Provide evidence-based information resources (e.g. contribute to newsletters, web-based information); and facilitate conferences, workshops and continuing education sessions; for both dental (to update their current knowledge and practice) and non-dental professionals (to introduce the concept of perinatal oral health and the role played by them in promoting maternal oral health).
- Encourage provincial Ministry of Health, health regions and local/national professional organizations to issue messages specific to perinatal oral health in the interest of the general public to create public awareness using paper or electronic mass media (government website, internet, radio, television).

- Advise perinatal care providers to provide anticipatory guidance and consider referring pregnant women for routine dental consultation as part of their practice.
- Impress upon dental professionals to accept pregnant women for dental treatment by providing a review of best practice literature.
- Encourage dental care professionals to assess the oral health of pregnant women, provide anticipatory guidance, and treatment when indicated.
- Conduct a provincial needs assessment to determine the perceived needs and priority for the Key Prevention Measures highlighted here, and to learn the preferred methods of delivery in each region and throughout the province.

9.2 Key Prevention Measures at the Provincial Government Level

- Reduce non-spatial barriers to accessing care by providing public dental health insurance for pregnant women during the perinatal period to cover preventive dental treatment, disease stabilization and health promotion.
- Reduce spatial/geographic barriers to access care, by recruiting dental professionals to areas with dental health professional shortages (northern communities, rural areas, and low-income neighbourhoods within major cities) within the province.
- Implement incentive programs (student loan reimbursement) that would retain young graduates from the province and encourage them to set up practices in areas with an inadequate supply of dentists.
- Issue advisory to dental professionals about the importance and safety of treating pregnant women, based on best practice evidence.
- Support community water fluoridation and expand preventive dental public health programs among sections of the population exhibiting greatest dental health disparities.
- Introduce a surveillance system to record all pre-term and low birth weight deliveries within the province and evaluate the relationship to poor maternal oral health status.

10. Definitions

Amalgam Restoration: Commonly used, low costing, high strength, long lasting posterior filling material formed by the mixing of metal alloy particles, mostly copper, tin, silver with mercury.

Atherosclerosis: Condition in which medium and large sized arteries (that carry pure blood) narrow down due to depositions such as fat, calcium or cholesterol, along the inner surface of the artery wall, resulting in blockade of the blood flow.

Dental Calculus: Mineralized plaque formed from the calcium and minerals present in the saliva. Dental calculus firmly adheres to the tooth surface and cannot be removed by brushing or flossing alone. It can lead to the progression of gum diseases that can affect the strength of tooth attachment to bone leading to tooth mobility and ultimately tooth loss if not removed from the tooth surface.

Dental Caries: Irreversible, chronic, progressive, multifactorial and microbiological disease that results in increased demineralization and destruction of the calcified structures of the tooth. Also known as 'cavity' or 'decay'.

Dental Floss: Special type of thread used to remove plaque and food debris from places between the teeth, otherwise not reached by a regular tooth brush.

Dental Home: This is a dental clinic that a child visits for the first time after the first birthday or sooner. It is responsible for the early implementation of preventive dental health practices and continuous care, where a child feels comfortable and has reinforcement for a positive attitude towards dental personnel and oral health.

Dental Plaque: Soft and sticky substance that is formed on the tooth surface from food debris, which is colonized by acid producing bacteria. It can lead to caries and gum disease if not removed either by brushing or flossing.

Fetus: Unborn baby from the period after 8 weeks following conception until birth.

Gingival Crevicular Fluid: A fluid occurring in minute amounts in the gingival crevice (space between tooth enamel and unattached gingival), believed by some authorities to be an inflammatory exudate and by others to cleanse material from the crevice, containing sticky plasma proteins which improve adhesions of the epithelial attachment, has antimicrobial properties, and exerts protective activity against foreign organisms/particles (From Jablonski, Illustrated Dictionary of Dentistry, 1982).

Gingival Flap Surgery: Invasive procedure, which involves separation of gums from the surface of tooth and bone, performed when conventional procedures (scaling & root planning) failed to remove the etiological factors. It is indicated when gingivitis has progressed to moderate or advanced stages of periodontitis.

Gingivitis: Inflammation of the gums, with symptoms ranging from redness, swelling, pain, bad odour and bleeding from the gums depending on the stage of the disease. It is often due to poor oral hygiene resulting in the accumulation of plaque. If untreated, gingivitis can progress to periodontitis.

Hypertension: Increase in blood pressure.

Hypotension: Decrease in blood pressure.

IL-1 β : Produced by macrophages, monocytes, fibroblasts and dendritic cells. They form an important part of the inflammatory response of the body against infection.

Low Birth Weight: Babies born under 2.5 kg (5.5 pounds), usually when they are born too soon or if they are too small for their gestational age.

Morbidity: Measure of illness/disease/injury in a population.

Mortality: Measure of death due to illness/injury in a population.

Perinatal Period: Period around the time of birth, which includes both the prenatal phase, beginning from the 20-28th week of gestation and postnatal phase ending 7-28 days after birth.

Periodontitis: Inflammatory disease that affects the supporting structures of the teeth, including bone. This represents an advanced stage of gum swelling/disease, resulting in mobility and loss of teeth, if untreated.

PGE2: The most common and most biologically active of the mammalian prostaglandins. It exhibits most biological activities characteristic of prostaglandins and has been used extensively as an oxytocic agent. The compound also displays a protective effect on the intestinal mucosa. It has important effects in labour (softens cervix and causes uterine contraction).

Postural Hypotension: Abnormal physiological sudden decrease in blood pressure, causing fainting or loss of consciousness, when a person stands up on one's feet from a relative static position.

Pre Term Delivery: Babies born before the usual period of gestation/pregnancy period (37 weeks).

Prostaglandins: A group of compounds derived from unsaturated 20-carbon fatty acids, primarily arachidonic acid, via the cyclooxygenase pathway. They are extremely potent mediators of a diverse group of physiological processes, including labour (softens cervix and causes uterine contraction).

Rheumatoid Arthritis: A chronic, systemic, auto-immune condition, resulting in inflammation of joints and surrounding tissues due to a body's immune system mistakenly attacking the body's own tissues, leading to gradual destruction of joint surfaces.

Root Planing: Non-invasive method of removing plaque, calculus and diseased cementum from the surface of the root. It is performed by hand instruments known as curettes.

Scaling: Non-invasive method of removing plaque, calculus and stains from the surface of tooth. It is performed by either hand or engine driven instruments known as scalers.

Stroke: A condition that develops due to the impaired blood supply to any part of the brain, resulting in loss of brain function.

Supine Position: Position of the body, resting on the back with face up.

Teratogen: Any substance, agent, or process that interferes with normal prenatal development, causing the formation of one or more developmental abnormalities of the fetus.

Appendix

U.S. Food and Drug Administration Pregnancy Drug Categories

Category A	Adequate, well-controlled studies in pregnant women have not shown any risk for fetal abnormalities.
Category B	Animal studies have shown no evidence of harmful effects on the fetus, but these results are not confirmed with the human studies. or Animal studies have shown positive results, whereas, well-controlled studies in pregnant women have failed to show any adverse effects.
Category C	Animal studies have shown adverse effects and there are no well-controlled human studies. or No human or animal well-controlled studies have been conducted.
Category D	Studies in pregnant women have demonstrated a risk to the developing fetus, but the benefits of the drug outweigh the potential risk.
Category X	Studies have strongly demonstrated positive evidence of fetal abnormalities and are strictly contraindicated in pregnant women.

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