Relationship among Periodontal Disease, Apical Periodontitis and Offspring Health

Relación entre Doença Periodontal, Periodontite Apical e Saúde da Prole

Relación entre Enfermedad Periodontal, Periodontitis Apical y Salud de la Descendencia

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Abstract

The relationship between maternal health and the fetal environment has been widely discussed in recent decades. Several studies have shown that insults that occur during the perinatal period modify fetal development, leading to harmful long-term results that culminate in pathologies after complete

Descriptors: Fetal Development; Low Birth Weight; Periapical Periodontitis; Periodontal Diseases.

Resumo

A relação entre a saúde materna e o ambiente fetal tem sido amplamente discutida nas últimas décadas. Vários estudos têm mostrado que os insultos que ocorrem durante o período perinatal modificam o desenvolvimento fetal, levando a resultados prejudiciais a longo prazo que culminam em patologias na vida adulta. As doenças periodontais (PD) compreendem uma ampla gama de condições inflamatórias que afetam as estruturas de suporte dos dentes (gingiva, osso e periodontal ligament). A periodontite periapical (PA) é uma inflamação no ápice da raiz do pé, geralmente causada por infecção por bactérias do sistema de canal radicular. O presente estudo tem como objetivo mostrar os efeitos das infecções orais maternas na saúde da prole. O estudo fornece informações de que tanto a DP materna quanto a PA têm efeitos negativos a curto e longo prazo na saúde da prole. Assim, uma saúde bucal adequada pode prevenir resultados adversos da gravidez e mudanças permanentes na prole adulta. Ou seja, a higiene oral durante a gravidez deve ser incentivada.

Descritores: Desenvolvimento Fetal; Baixo Peso ao Nacer; Periodontite Periapical; Doenças Periodontais.

Introduction

The relationship between maternal health and the fetal environment has been widely discussed in recent decades. Several studies have shown that insults that occur during the perinatal period modify fetal development, leading to harmful long-term results that culminate in pathologies after complete...
Pregnancy is a period when a woman goes through a series of physiological changes that affect the body, as well as the cavity of mouth\(^1\). During pregnancy, women become more susceptible to oral health conditions, such as tooth decay, gingivitis and PD\(^2\) due to changes in the diet (introduction of more carbohydrates and / or higher food frequency), hyperacidity of the oral environment due to vomiting, hormonal changes, which associated with inattention in maintaining oral hygiene, favor the installation of oral diseases\(^4\). In decorrence, pregnant women are considered a patient of temporary dental risk. However, there is a certain resistance on the part of pregnant women to dental treatment, as they believe that the intervention will bring risks to the baby's development and life\(^5\).

From the 13th week of pregnancy, it is the best and safest period for dental treatment. Even so, fear and unpreparedness are the main reasons that lead dentists to refuse to provide dental care to pregnant women. The postponement of dental care to the late puerperium, instead of solving the problem as soon as it is diagnosed, can cause greater damage due to the development of oral diseases\(^6\).

**PERIODONTAL DISEASE AND APICAL PERIODONTITIS**

The PD is a common oral disease among pregnant women\(^2,23\). Gingivitis is an inflammation in the supporting tissue of teeth\(^11,24,25\) and affects more than half pregnant women\(^26\). The increase in plasmatic progesterone concentration increases the permeability of gingival blood vessels, making the area more sensitive to local irritants, such as dental plaque\(^27\). In addition, estrogen decreases gingival keratinization and increases glycogen in periodontal tissues, compromising the effectiveness of the epithelial barrier\(^28\). Gingivitis is usually reversible\(^27\). However, when untreated, it progresses to periodontitis, in which the inflammation extends to the supporting tissues\(^11,25\), resulting in tooth loss\(^25\). Periodontitis affects a smaller proportion in pregnant women, approximately 30%\(^26\).

PD is an infection caused by anaerobic Gram-negative bacteria. As the disease progresses, these complexes are modified. Initially, colonization of the periodontal sulcus in the early stages of dental plaque formation, the complexes are “blue”, “green”, “yellow” and “purple”. As the PD progresses, due to the maturation of the biofilm, the complex is modified with the appearance of the “orange” cluster (Campylobacter rectus, F.nucleatum, Peptostreptococcus micros, Prevotella intermedia and Prevotella nigrescens) and of more aggressive bacteria of the “red” (Porphyromonas gingivalis, Tannerella forsythia and Treponema-denticola)\(^25,30\).

In addition to PD, dental caries is another prevalent oral disease in pregnant women\(^31\). This pathology is characterized by the demineralization of dental structures, such as enamel, dentin and cementum\(^32\) caused by organic acids produced by bacteria present on the surface of teeth in the form of dental
pathology of RA in pregnant female baboons with ligature (P. gingivalis) induced periodontitis. The progression of this disease caused by infection in rats promotes hypermethylation in subcutaneous, intra-placental infection with P. gingivalis, in different periods of pregnancy, promoted (in the serum and placenta) an increase in the concentrations of inflammatory cytokines, such as Interleukin-6 (IL-6) and the tumor necrosis factor alpha (TNF-α) and therefore LBW in rats. In addition, it proved that the period of greatest risk for diffusion of the process was before or in the middle of pregnancy. 

Ao et al. demonstrated that the infection of the dental pulp by P. gingivalis in pregnant female mice caused changes in the placental tissues, verified by the degeneration of the amnion with partial detachment of the surface of the chorionic plate and trophoblast necrosis. In this same study, there was an increase in the number of polymorphonuclear leukocytes and macrophages in placental tissues, associated with the increase in the localized expression of cyclooxygenase-2 (COX-2) and proinflammatory cytokines, as TNF-α. COX-2 is an enzyme responsible for the synthesis of prostaglandins (PGs) which are stimulators of myometrium contractility.

Physiologically, intra-amniotic levels of PG and pro-inflammatory cytokines, such as TNF-α and IL-1β, increase progressively during pregnancy until high levels of these substances induce labor29,53. Pro-inflammatory cytokines stimulate synthesis of PG by uterine tissues54. Knowing this, changes that occur during this process, such as infections, can shorten labor29.

Offenbacher et al. demonstrated a significant increase in intra-amniotic levels of prostaglandin E2 (PGE2) and TNF-α in pregnant rats with periodontitis compared to pregnant rats without this disease. Other studies have found an increase in the concentrations of PGE2, IL-6 and IL-1β in the gingival crevicular fluid of women who had a PTB. Collins et al. indicated a statistically significant association between increased of PGE2 and TNF-α levels and fetal growth retardation.

Yeo et al., to investigate the consequences of infection by C. rectus, performed an experimental model using the subcutaneous, intra-chamber challenge with live C. rectus in pregnant female mice. These authors verified that the infected animals had fetuses with IUGR. Similar results were found after subcutaneous infection with P. gingivalis. Bobetsis et al. demonstrated that C. rectus infection in rats promotes hypermethylation in the gene promoter of insulin-like growth factor 2,
causing attenuation of this gene involved in fetal growth and development, contributing to IUGR.

In 1996, Offenbacher et al. conducted a pioneering study to assess the influence of poor oral hygiene on PTB and the occurrence of LBW. The results of this study showed that pregnant women with PD were 7.5 times more at risk of having PTB with LBW than pregnant women with good periodontal health. Subsequently, several other studies have indicated an association between maternal PD and pregnancy complications. Previous studies from our laboratory have shown that offspring of rats with PD had LBW compared to offspring of control rats.

Interventionist study by López et al. demonstrated that pregnant women who underwent gingivitis treatment before the 28th week of pregnancy had a lower incidence of low-birth-weight preterm births (LBWPB) than pregnant women who remained exposed to gingivitis throughout the gestational period. López, Smith and Gutierrez also found that periodontal treatment among pregnant women with periodontitis reduced the incidence of LBWPT.

Another demonstrated evidence that *C. rectus* is capable of modifying or placental labyrinth (site that promotes exchange of nutrients between fetus and mother) in hamsters can reduce fetal weight by up to 25%.

Because of this, the fetus undergoes adaptations prioritizing the expenditure of energy for tissues, such as the brain and heart. These adaptations decrease the development of other tissues, such as skeletal muscle, this is known as the thrifty phenotype hypothesis, leading these individuals to diseases as diabetes.

Although there are several studies that relate PD to adverse pregnancy outcomes, little research correlates the effects of AP maternal on the health of offspring. Leal et al., including 33 mothers of LBWPB (case group) and 30 mothers of newborns at term (control group), it was observed that chronic apical periodontitis was present in 54.5% of mothers in the case group and 20% in the control group. Additionally, mothers who had at least one dental periapical infections had significantly shorter duration of pregnancy and delivery to children with lower mean body weight than mothers who had no dental periapical infections.

Mattera et al. observed that maternal PD in rats, induced by ligation, promotes LBW, insulin resistance, increased plasma cytokine concentrations, reduced content (translocation index to the plasma membrane) and RNA expression GLUT4 in the gastrocnemius muscle of adult offspring. In addition, maternal periodontal disease was able to activate inflammatory pathways in adult offspring, this activation was proven by increased expression of TNF-α, NF-κBp65, NF-κBp50, ERK1 / 2 and IKKα/β. However, there was no change in the DNA methylation of the GLUT4 gene and in the expression of JNK in adult offspring.

A pioneering study in rats showed that maternal PA is capable of promoting changes in adult offspring, they are: 1) insulin resistance; 2) impaired the initial steps of insulin signalling (AKT and IRS1); 3) activate inflammatory pathways (IKKα / β phosphorylation) in muscle tissue. However, there was no change in JNK phosphorylation, this fact is explained by this protein is important to counteract the changes found previously.

**FINAL CONSIDERATION**

Adequate health can prevent adverse pregnancy outcomes and permanent changes in adult offspring. The oral hygiene during the pregnancy should be encouraged.

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CONFLICTS OF INTERESTS
The authors declare no conflicts of interests.

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