Apical Periodontitis, a Predictor Variable for Preeclampsia: A Case-control Study

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Abstract

Introduction: Preeclampsia (PE) is characterized by hypertension and proteinuria after the 20th week of gestation. There is an association between systemic inflammation and adverse pregnancy outcomes such as PE. Therefore, for the first time, the present study aimed to investigate the possible association between maternal apical periodontitis (AP) and PE. **Methods:** In this case-control study, 50 mothers who were diagnosed with PE during pregnancy were included in the experimental group. The control group consisted of 50 matched mothers with a normal course of pregnancy. The endodontic and periodontal status of all participants was reviewed using the digital panoramic radiographs that were available before pregnancy. The number of remaining teeth and the presence of AP in all teeth and endodontically treated teeth were recorded using the periapical index. Binary logistic regression was used to determine the possible association between AP and PE ($\alpha = 0.05$). **Results:** AP in at least 1 tooth was found in 27 of the mothers who developed PE (54%) and in 16 of the control patients (32%) (odds ratio [OR] = 2.4, $P < .05$). Adjusted for the maternal periodontitis, number of teeth, and endodontic treatment, maternal AP was significantly associated with the occurrence of PE ($P < .05$; OR = 2.23; 95% confidence interval, 95% = 1.92–6.88). **Conclusions:** AP was significantly more prevalent in the experimental group. For the first time, this study has provided evidence that maternal AP may be a strong independent predictor of PE. Considering the high occurrence of PE, particularly in developing countries, it could be suggested that the risk of PE may be reduced through comprehensive dental examinations for detecting and treating any source of inflammation, including AP, before pregnancy. *(J Endod 2017; ■:1–4)*

Key Words

Apical periodontitis, association, endodontics, preeclampsia, root canal treatment, systematic diseases

Apical periodontitis (AP) is the inflammation and destruction of periradicular tissues after an endodontic infection (1). Systemic elevation of proinflammatory cytokines such as interleukin (IL) 1 beta, IL-6, and tumor necrosis factor alpha has been shown to be a result of AP (2). This elevated level of inflammatory cytokines may exert a systemic effect on the host, which could explain the possible association between AP and various systemic issues such as diabetes and cardiovascular and renal diseases (3).

Periodontal diseases have been shown to burden pregnant patients with systemic inflammatory stressors at the maternal-fetal interface. This burden may result in adverse pregnancy outcomes (4). Also, AP and periodontal disease share similar inflammatory responses (5). Therefore, there might be an association between AP and adverse pregnancy outcomes. However, this association has never been investigated.

One of the most common adverse outcomes of pregnancy is preeclampsia (PE) (6). PE is characterized by hypertension and proteinuria after the 20th week of gestation (7) and is among the leading causes of maternal mortality (6). Approximately 15%–20% of all preterm births are attributed to PE (7). Therefore, identifying possible predictor factors before and during prenatal care is important in the prevention and control of PE.

AP may contribute to a systemic immune response that is not confined to a localized lesion (2). Considering the fact that there is an association between systemic inflammation and adverse pregnancy outcomes such as PE (8), for the first time, this study aimed to investigate the association between the presence of maternal AP before pregnancy and the risk of developing PE.

Significance

This study for the first time has provided evidence that maternal apical periodontitis may be a strong independent predictor of PE.

Materials and Methods

Study Design

A pair-matched case-control study was performed from January 2014 to January 2016 in the maternity department. An explanation regarding the study was provided to all the participants, and informed consent was obtained. The protocol of the present study was approved by the Committee on Research Involving Human Subjects at Case Western Reserve University, Cleveland, OH.

Patient Selection

The present study gathered information regarding all childbirths that took place in the maternity center during the study period. These childbirths were limited to mothers who attended the maternal program in the hospital before pregnancy. Per hospital

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policy, these mothers had a full medical and dental history assessment including a periodontal assessment and panoramic radiographs before pregnancy. During the initial review, mothers were excluded from the study if they:

1. Were less than 18 years of age
2. Had a gestation period of greater than 26 weeks at the time of enrollment
3. Had multiple pregnancies
4. Had a history of diabetes, hypertension, heart murmur; or heart valve disease
5. Had any medical condition requiring antibiotic prophylaxis for dental treatment
6. Had suffered a spontaneous abortion
7. Had undergone *in vitro* fertilization

After the initial review of charts, 50 mothers who developed PE during their pregnancy were included in the experimental group for further investigation.

The following information was then extracted from included childbirth records:

1. Mothers' age at the time of pregnancy
2. Status of smoking
3. Body mass index (BMI)
4. Educational level
5. Periodontal status before pregnancy
6. Endodontic status before pregnancy

The experimental group consisted of mothers who were diagnosed with PE during the gestation period based on hospital records ($n = 50$). Also, 50 mothers with an uncomplicated course of pregnancy without PE who were matched regarding age and smoking status were included in the control group from the same hospital. PE was defined by the following criteria: a systolic blood pressure $\geq$140 mm Hg or a diastolic pressure $\geq$90 mm Hg and proteinuria >300 mg/24 h developed after the 20th week of gestation (7).

Endodontic Evaluation

The periapical and endodontic status in both groups was evaluated on the basis of examination of digital panoramic radiographs that were taken before pregnancies. Digital panoramic radiographs of all participants were independently analyzed on a computer screen by 2 endodontists who were blinded regarding the participants of the 2 groups.

Results of all teeth evaluations, excluding third molars, were recorded. They were categorized as endodontically treated teeth if the root canal system(s) had been filled with a radiopaque material. The periapical status (presence of AP) was assessed according to the study by López-López et al (9) using the periapical index (PAI) (10). The periapical status of each root was categorized as follows: 1, normal periapical structure; 2, small changes in bone structure; 3, changes in bone structure with some mineral loss; 4, periodontitis with a well-defined radiolucent area; and 5, severe periodontitis with exacerbating features. PAI $\geq$3 was considered to be a sign of periapical pathosis. The worst score out of all roots was taken to represent the PAI score for multirooted teeth. The following information was recorded for each subject based on modified criteria used by Marotta et al (11): the number of teeth present, the number of endodontically treated teeth, and the total number of teeth with AP. The kappa coefficient was used at the end of the evaluation to analyze agreement between the 2 evaluators regarding the presence/absence of AP ($\kappa = 0.86$). Cases in which the evaluators disagreed were resolved by joint discussion until consensus was achieved.

Periodontal Evaluation

An oral examination had been performed by a single dentist for all participants before pregnancy per hospital policy. The examination involved probing depth, gingival recession, and clinical attachment loss. Periodontitis was diagnosed according to criteria suggested by López et al (12). Periodontal status was recorded as a dichotomous variable (normal, periodontitis) as a potential independent variable.

Statistical Analysis

All analyses were performed in an SPSS environment (Version 24; SPSS, Inc, Chicago, IL). The independent *t* test and chi-square test were used to compare the characteristics of the 2 groups. Crude odds ratios (ORs) and respective 95% confidence intervals (CIs) and *P* values were calculated for the association between AP and PE. The effect of potential confounding factors such as BMI, educational level, periodontitis, and smoking habits was assessed using logistic regression. Binary logistic regression was used to determine the possible association between AP as an independent variable and PE as the outcome variable.

Results

The present study involved a sample of 100 pregnant patients with a complete medical and dental history at the maternity department. Fifty mothers who were diagnosed with PE based on hospital records were included in the experimental group. Fifty mothers without PE were included in the control group.

Table 1 depicts the distribution of baseline characteristics of subjects in both groups. The mean age of participants in the experimental and control groups was 26 ± 3.2 and 24 ± 2.8 years, respectively. According to Table 1, there was no significant difference between the 2 groups regarding the variables that could potentially affect the occurrence of PE except maternal periodontitis.

The distribution of the endodontic-related factors as independent variables is detailed in Table 2. The average number of remaining teeth per patient was 25.2 ± 2.1 and 26.87 ± 3.7 teeth in the experimental and control groups, respectively ($P > .05$). At least 1 endodontically treated tooth was found in 44% of the experimental subjects and 76% of the controls ($P < .05$, OR = 0.24).

AP in at least 1 tooth was found in 54% of mothers who developed PE during their pregnancy. This rate was 32% in the control group

TABLE 1. Distribution of Cases of Pre-eclampsia and Controls according to Biologic and Socioeconomic Characteristics, Dental Care Factors, and Chronic Conditions

Variables	Experimental group (preeclampsia) (*n* = 50)	Control group (*n* = 50)	*P* value
Age	26 ± 3.2	24 ± 2.8	.32
BMI			
<30	33 (66)	29 (58)	.12
>30	17 (34)	21 (42)	
Last educational degree			
High school and less	19 (38)	22 (44)	.76
More than high school	31 (62)	28 (56)	
Smoking habit			
Yes	14 (28)	12 (24)	.08
No	36 (72)	38 (76)	
Maternal periodontitis			
Normal	17 (34)	26 (52)	.046*
Periodontitis	33 (66)	24 (48)	

BMI, body mass index.

*$P < .05$.