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Original Article

The relationship between maternal periodontal and dental health status and preterm birth: A case-control study

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Abstract

Introduction: The idea that oral infections spread to other systems has long been of interest to clinicians. On the other hand, there are researches suggesting the possibility of periodontitis and dental caries being a risk factor for low birth weight (LBW) and preterm birth (PTB). The purpose of this study is to investigate the relationship between periodontal and dental health status with PTB.

Methods: In this case-control study, 82 pregnant women were evaluated. The case group included mothers with preterm infants (gestational age of less than 37 weeks), while the control group involved mothers who had term labors (gestational age of 37-42 weeks). Oral examinations were carried out up to 48 hours after delivery. Periodontal and dental health indicators, including decayed, missed, filled teeth (DMFT), periodontal pocket depth, clinical attachment loss (CAL), bleeding on probing (BOP) and gingival index (GI) were recorded. The data were analyzed using SPSS 17 software through Kolmogorov–Smirnov, Mann-Whitney U and Fisher exact tests.

Results: DMFT was 7.34 ± 4.45 and 5.68 ± 4.29 for mothers with preterm infants and mothers in control group, respectively ($P=0.023$). CAL ($P=0.001$) and BOP ($P=0.012$) were significantly higher in mothers with preterm infants, but there was no significant difference in Pocket depth ($P=0.57$) and GI ($P=0.51$) between the studied groups.

Conclusion: There is a relationship between some maternal periodontal and dental health indicators and PTBs signifying that elimination of any oral sources of inflammation may reduce the risk of premature birth.

Introduction

Infants with low birth weight (LBW) and preterm birth (PTB) are considered as the major problems of general health in many countries.[1] PTB is one of the etiologic factors for infant mortality,[2] and those infants who survived PTB caused mortality, compared to infants with term birth, exhibit a higher incidence of neurological and respiratory problems, subnormal growth, visual and congenital anomalies, and behavioral and emotional disturbances during the preschool and elementary school periods.[3] There are several risk factors which can cause PTB and LBW, including age, ethnicity, smoking, alcohol use, medications, a history of abortion, and different infections.[4] In particular, there is evidence indicating a relationship between PTB and urogenital infections.[4,5]

Periodontal diseases are a group of infectious diseases initiating gingivitis, periodontitis, and the progressive destruction of the alveolar bone; which are considered as an important source of systemic infection. Periodontal diseases have a multifactorial nature and are mainly caused by anaerobic or gram-negative microaerophilic bacteria. It has been hypothesized recently that periodontal diseases are risk factors for PTB.[6]

Gingival disease is an infectious process and is a chronic source for lipopolysaccharides (LPS), which can reach the fetal membranes through the bloodstream. It has been shown that LPS induce the secretion of interleukin-β1 (IL-β1) and prostaglandin E2 (PGE2) from the chorioamniotic and trophoblastic cells resulting PTB.[7] The interaction between prostaglandins and cytokines is a major physiologic mediatory pathway in pregnancy and normal delivery. The infection induces an inflammatory immune response in the host, resulting in the activation of cytokines (especially IL-1 and tumor necrosis factor-alpha [TNF-α]), which cross the placental barrier and lead to uterine contractions and the rupture of the amniotic sac, resulting in PTB and LBW.[7,8]

Gesase et al[9] reported a weak but positive correlation

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between improvement of periodontal parameters of mothers and the infant weight, concluding that treatment of periodontitis decreases the incidence of pregnancy problems, enhancing the chance of a full-term delivery. Besides, there are other studies conforming this positive correlation between infant weight and periodontal parameters.[9,10] On the other hand, some studies were unable to show a significant correlation between periodontal status and PTB e.g. in a study by Fogacci et al,[11] pregnant women in case and control groups underwent periodontal evaluations. Based on the results, no significant relationship was detected between periodontal conditions and PTB risk. In addition, studies on periodontal treatment during pregnancy did not reveal a significant decrease in the PTB risk. Based on a meta-analysis by Schwendicke et al,[12] periodontal treatments did not reduce the risk of PTB.

However, there are a limited number of studies evaluating the effect of odontogenic infection on PTB but due to the similarities between odontogenic infections and inflammatory conditions of the gingiva, in terms of the microbial etiologic agents (gram-negative bacteria), they considered to exert similar effects.[13,14] Despite the availability of several studies on the effect of periodontal status on premature birth[15], none of these studies has evaluated the dental conditions and the history of odontogenic infections and inflammation during pregnancy, which might be attributed to the conflicting results of such studies.

Leal et al[16] reported that mothers with chronic apical periodontitis had a 3.5-fold higher chance of giving birth to infants with LBW and PTB compared to mothers without such a problem. In addition, mothers who had ≥6 dental visits before delivery exhibited an 80% reduction in giving birth to infants with PTB and LBW. It was estimated that a one score increase in the periapical index was significantly associated with a decrease in pregnancy weeks in raw analysis, to a mean decrease of 211 g in weight at birth.

Finally, even with the various studies on the subject, it should be pointed out that there are still questions about the relationship between dental and gingival status and PTB.

Therefore, this study aimed to evaluate the relationship between the dental and periodontal health parameters of pregnant women and PTB in an attempt to resolve some of the existing ambiguities.

Methods

In the present case–control study, which was carried out in 2019, 82 pregnant women, consisting of 41 women in the case and 41 in the control group were evaluated. To determine the sample size, PS Power and Sample Size software was used, considering $\alpha = 0.05$, power of 80% and 10% error and the mean and standard deviation of pocket depth in case and control groups were 2.18 ± 0.3 and 2.13 ± 0.2 respectively.[17] The statistical population of the study was all pregnant mothers referred to Al-Zahra hospital in Tabriz/Iran.

The participants were selected using the free random sampling technique. The participants were included in the study after the study procedures were explained to them, and informed consent was obtained.

The inclusion criteria were an age range of 25 to 33 years, presence of at least 20 teeth in the oral cavity, giving birth to an infant during the previous 48-hour period, and signing an informed consent form.

The exclusion criteria consisted of a history of any known hemorrhagic disorder, or a history of pregnancy complications with the possibility of hemorrhage and coagulation disorders, such as premature separation of the placenta (abruptio placentae) and preeclampsia, systemic infectious diseases, a previous history of abortion, stillbirth, premature birth and use of tobacco and alcohol.

The recording of information may vary depending on the investigator's awareness of participant's group which is known as observer bias. Therefore, the examiner of the oral health was blinded about the length of pregnancy and for avoiding selection bias the participants were included solely based on pregnancy length and not based on the oral health status.

The case group consisted of mothers given birth to an infant with gestational age of < 37 weeks, while the gestational age of infants in the control group was 37 to 42 weeks. Oro-dental examinations were carried out after the delivery (a maximum of 48 hours after delivery) when the mother was able to tolerate periodontal and dental examinations. The information was recorded in data forms including the age, history of systemic infection, use of medications, gestational age, signs and symptoms of urogenital infection, vaginal hemorrhage, amniotic sac rupture.

All the participants in both groups underwent thorough periodontal and dental examinations by the means of a Williams probe and dental mirror under a strong light. The examinations were carried out by single clinician blinded about the demographic and medical history of participants. The following periodontal health parameters were evaluated: pocket depth (mm), clinical attachment loss (CAL), bleeding on probing (BOP) based on definition presented by Mühlemann,[18] gingival index (GI) based on the definition presented by Silness and Loe,[19] and the width of the keratinized gingiva (mm) and decayed, missed, filled teeth (DMFT).

Following the clinical examinations, the participants diagnosed as needing treatment were referred to Faculty of Dentistry. The data obtained from clinical evaluations were analyzed using software SPSS 17, with descriptive statistical methods. The normality of data was assessed using Kolmogorov–Smirnov test and due to Non-Normal Distribution of data, Mann-Whitney U and Fisher exact tests were used to compare the periodontal and dental health parameters and chi-square test was used to compare

the educational level between two groups.

Results

Forty-one mothers with full-term babies and 41 mothers with healthy but preterm babies were evaluated in the present study within 48 hours of delivery. The mean age of the participants in case and control groups were 27.6 ± 1.4 and 28.4 ± 2.2 respectively ($P = 0.79$). As it is obvious from Table 1 the education level of the studied mothers was categorized in four groups. However it is expected that the educational level can show a confounding effect on the oral health of the mothers, but in the present study no statistical difference was found between the educational level of the participants from the case and control groups. Mean pregnancy length in preterm infants was 31.6 ± 3.2 weeks. The DMFT rate in mothers with preterm infants (7.34 ± 4.45) was significantly higher than DMFT of mothers with full-term infants (5.68 ± 4.29) ($P = 0.023$). The prevalence of dental abscess in mothers with preterm infants (19.51%), was significantly higher than mothers with term infants (4.88%) ($P = 0.026$). CAL was significantly ($P = 0.001$) higher in case group (3.7 ± 0.69 mm) than the control group (2.94 ± 0.8mm).

BOP was also significantly ($P = 0.012$) higher in case group (63.65%) comparing with 39% in control group. But there was no significant difference ($P = 0.57$) in mean periodontal pocket depth between two groups. The difference in GI was also non-significant in two groups ($P = 0.51$). (Table 2)

Discussion

This study was conducted to investigate the potential association between dental caries and periodontal status and adverse pregnancy outcomes such as PTB.

Table 1. Educational level of mothers in case and control group

Educational level	Case	Control	*P* value[a]
	No. (%)	No. (%)	
illiterate	4 (9.8)	3 (7.32)	0.07
elementary School	12 (29.3)	10 (24.39)	0.21
Junior high school	12 (29.3)	9 (21.95)	0.15
High school diploma	13 (31.7)	19 (46.34)	0.41

[a] *P* value is based on chi-square test.

Table 2. Variables investigated in the study in case and control groups

Variable	Case	Control	*P* value
DMFT (mean ± SD)	7.34 ± 4.45	5.68 ± 4.29	0.023[a]
Dental abscess (%)	19.51%	4.88%	0.026[b]
Clinical attachment loss (mean ± SD)	3.7 ± 0.69 mm	2.94 ± 0.8 mm	0.001[a]
Bleeding on probing (%)	63.65%	39%	0.012[b]
Periodontal pocket depth (mean ± SD)	3.28 ± 0.31 mm	2.84 ± 0.44	0.57[a]
Gingival index (mean ± SD)	1.02 ± 1.14	0.67 ± 0.82	0.51[a]

[a] *P* value based on Mann-Whitney U test.
[b] *P* value based on exact fisher test.

The results of the current study showed that CAL and BOP indexes were higher in the case group. This finding is in accordance with the results of study performed by Afiat and Sanaei[20] who reported that mean BOP was higher in mothers with PTBs. The results of the current study did not show any difference in the pocket depth between two groups, although the Afiat and Sanaei reported that mean pocket depth of mothers with PTBs were significantly higher than control group.[20] This difference in results may be due to different socioeconomic status of the participants.

Kawar et al[21] after excluding confounding factors such as cigarette smoking, preeclampsia, and any systemic infection or inflammation other than periodontitis, reported a significant relationship between PTB and moderate and severe periodontitis. Haerian-Anaraki et al[22] reported that mothers giving birth to babies with LBW exhibited significantly low gingival health status and deeper pockets.

The present study indicates a significant relationship between periodontal parameters and PTB, which is highly consistent with the results reported in many previous studies. On the other hand, there are some other studies[23] reporting any significant relationship between the periodontal parameters and PTB.

A systematic review, Teshome and Yitayeh[24] compilated seven studies showing the relationship between periodontal disease and the increased risk of PTB, alongside an individual study disaffirming such a relationship. Another meta-analysis review paper by López et al[25] is conducted of six clinical trials, two of which show the positive effect of periodontal treatment on decreasing the risk of PTB while the left four studies were not agreed with these results. It should be emphasized that the studies lacked the information in the dental status in their design. All the studies above have only evaluated the periodontal conditions; however, a comprehensive view is that the oral health comprises all the dental and gingival conditions, which are almost similar in terms of the microbial and inflammatory process. Therefore, the evaluation of each of these conditions without considering the other conditions may complicate interpretation of results. Moreover, studies have been carried out in different communities with different cultures, where the rate of tobacco, drug, and alcohol use is various between them. Hence, all of the mentioned factors should be taken into account when generalizing the results.[26]

The age is a confounding factor because there is an increase in the odds of preterm labors with aging of mothers. In addition, mothers' educational level is an effective and confounding factor because it affects mothers' awareness about risk factors of premature labor. In the present study, the two groups were matched in terms of age and educational level to eliminate the confounding effect.

Study Highlights

What is current knowledge?

- Periodontal diseases and odontogenic infections are constant source of inflammatory cytokines, but their effect on birth is unclear.

What is new here?

- Clinical attachment loss, bleeding on probing, and DMFT were significantly higher in mothers with preterm infants compared to mothers with full-term babies.

It is necessary to control and consider the systemic factors, use of tobacco, preeclampsia and infection/inflammation other than periodontitis, a history of abortion, the number of pregnancies, mother's age, and socioeconomic status not only during conducting of a study as intervening factors but also in comparison of the results of different studies. In addition, the periodontal factors that are evaluated in different studies should be matched.

Most studies about evaluating the relationship about oral health and gynecological complications studied periodontal indexes and none of them studied the history of dental infection and inflammation during pregnancy. In this study the dental caries were also studied and it was shown that dental caries can affect the result of pregnancy. Therefore, this might be an explanation for conflicting results of previous studies. Most important limitation of this study was the lack of information on the income level of the families which can have an effect on PTB. Careful oral and dental evaluation of pregnant women seems to be of high importance not only for women's own health but also for the well-being of infants.

Conclusion

The results of the present study showed that the CAL, BOP, and DMFT were significantly higher in mothers with preterm infants compared to mothers with full-term babies. This finding shows the importance of preconception dental visits and dental consultations.

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Authors' contribution

ZA: Concept and design, clinical studies, manuscript review. EH: Literature search, data analysis, manuscript editing. KK: Statistical analysis, manuscript preparation. EJ: Clinical studies, data acquisition

Ethical Approval

The participants were included after the study procedures were explained to them, and informed consent was obtained. The ethics code of IR.TBZMED.REC.1397.244 was assigned to this study by regional ethics committee.

Conflict of Interest

The Authors declare that there is no competing interest.

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