

BACKGROUND OF THE PROPOSED RESEARCH

The periodontium consists of the investing and supporting tissues of the tooth: gingiva, periodontal ligament, cementum and alveolar bone.

Periodontal diseases comprise of a variety of conditions affecting the health of the periodontium. They are a group of infectious diseases caused by predominantly gram negative, anaerobic and microaerophilic bacteria that colonize the subgingival area.¹ Periodontitis can be considered a continuous pathogenic and inflammatory challenge at a systemic level, due to the large epithelium surface that could be ulcerated in the periodontal pockets. This fact allows bacteria and their products to reach other parts of the organism, creating lesions at different levels.²

There is emerging interest and increasing amount of evidence that support the inter-relationship between periodontitis and systemic conditions. The concept that periodontal disease might influence systemic health is not new. Miller originally published his “focal infection theory” in 1891, suggesting that “microorganisms or their waste products obtain entrance to parts of the body adjacent to or remote from the mouth.”³ Miller and subsequent proponents of the focal infection theory blamed oral foci of infection for a number of regional and systemic diseases.⁴ Periodontitis can have a great influence on individual systemic health and systemic diseases may influence periodontal health as well.⁵ Epidemiological and microbiological-immunological studies have lent credence to the concept that periodontal disease may be a separate risk factor for cardiovascular disease, cerebrovascular disease and respiratory disease, as well as preterm delivery of low-birth-weight infants.^{6,7} However, recent progress in identification

and characterization of periodontal pathogens, as well as elucidation of potential systemic mechanisms of action of bacterial products and inflammatory cytokines, have opened the way for a more realistic assessment of the systemic importance of periodontal disease.⁸

Low Birth Weight (LBW) infants represent a major medical, social and economic problem accounting for a large proportion of maternal and especially neonatal mortality and morbidity.² The various risk factors for low birth weight infants are low maternal age, gestational age, race, genetic background, low socio-economic status, maternal stress, hypertension, first delivery, history of LBW, abortion, habits like tobacco, coffee, drug abuse, education and gender of fetus. Generalized infections, including episodic illness such as viral respiratory infections, diarrhea and malaria, and more localized infections of the genital and urinary systems can also affect the gestational period.⁹ Oral infection presented by the gram negative anaerobic bacterial challenge can serve as a chronic reservoir for hematogenous translocation of bacteria or bacterial products such as lipopolysaccharides to the fetoplacental unit. The cytokines such as TNF- α , IL-1 β , IL-6 and PGE₂ and matrix metalloproteinases, which are produced by the infected periodontium and appear in the systemic circulation, can target the placenta.

Offenbacher et al developed a series of clinical studies to test the hypothesis that periodontal infections, serving as reservoirs for gram-negative bacteria, might pose a potential threat to the fetoplacental unit. They showed the relation between the periodontal disease and preterm infants who are born before 37 weeks of gestation and low birth weight infants whose birth weight is less than 2500 grams.⁷ The first investigation was a case-control study of 93 mothers of PLBW infants, which used clinical attachment level as a measure of periodontal health. Multivariate logistic

regression models, controlling for other risk factors and covariates (tobacco and drug use, alcohol consumption, level of prenatal care, parity, genitourinary infections and nutrition), demonstrated a statistically significant correlation between periodontal disease and PLBW delivery. After adjusting for all other risk factors, the authors determined that mothers with periodontal infection had more than 7 times the risk of delivering a PLBW infant. Extrapolation from these data suggested that 18.2% of the PLBW deliveries occurring each year might be attributable to periodontal disease. He concluded that periodontitis represents a previously unrecognized and clinically important risk factor for preterm low birth weight, which occurs as a sequelae to premature rupture of membranes or preterm labor at less than 36 completed weeks of gestation. But in 30-50% of cases the cause of low birth weight infants is unknown.¹⁰

Jeffcoat et al found a positive association between maternal periodontal disease and preterm birth in a comparable US cohort study involving 1313 pregnant subjects. Their results showed that mothers with severe periodontal disease were 4-7 times more likely to deliver a preterm infant relative to mothers with periodontal health.¹¹ In an experiment by Collin JG et al demonstrated that experimental periodontitis initiated in pregnant hamsters by subcutaneous injections with *Porphyromonas gingivalis* led to decreased fetal weight.¹²

In the light of the above facts, the present observational study has made an attempt to detect an association between periodontal diseases and low birth weight among mothers delivering between the period of September 2007 and December 2009 at KLE Hospital, Belgaum.

SCOPE OF THE STUDY

To date, many studies have demonstrated the effects of maternal periodontal status on preterm low birth weight, but fewer studies are available exclusively on LBW. According to most of these studies, this association which appears to be present in some, but not all mothers.¹

In view of this, the present study was undertaken to evaluate whether poor periodontal health in pregnant women is associated with LBW in a homogenous sample of mothers who delivered at the free labour ward , KLE Hospital, Belgaum between the period of September 2007 and December 2009.

AIM OF THE STUDY

The *aim* of the study was to determine the association between periodontal diseases and the prevalence of low birth weight infants.

OBJECTIVES OF THE STUDY

1. To *find the prevalence of periodontal disease* among mothers delivering during the study period.
2. To *determine the prevalence of low birth weight* infants among the singleton gestation mothers in tertiary care hospitals.
3. To *examine the association* between periodontal disease and LBW infants among mothers.
4. To *find the association* between periodontal and maternal risk factors and LBW infants among mothers.

MATERIALS AND METHODS

Study Design

The observational study was conducted between September 2007 and December 2009 wherein 770 subjects were selected from the free labour ward of KLE Hospital, Belgaum, Karnataka. After obtaining the ethical approval to carry the study and consent of the subjects, the subjects were screened for the periodontal condition and the data was also recorded from the Hospital birth register.

Inclusion Criteria

- Age group of 18 – 35 years
- Mothers with a singleton gestation

Exclusion Criteria

- Systemic conditions like diabetes, cardiovascular disorders, hypertension
- Genitourinary tract infections
- Multiple pregnancies
- Pre eclampsia or eclampsia and gestational diabetes

Data Collection

- Data collected from Hospital case records - Age, Hb%, obstetric history, gestational age and sex and birth weight of the newborn

- Structured questionnaire survey - Education, adverse oral habits and h/o dental treatment
- Antenatal care – information recorded from antenatal records provided from the mother

Periodontal examinations were performed using the World Health Organisation criteria. The periodontal status of the mother was recorded using Community periodontal index. A specially designed lightweight CPI probe with 0.5 mm ball tip was used, with a black band between 3.5 and 5.5 mm and rings at 8.5 and 11.5 mm from the ball tip. (This probe was the earlier known “CPITN-C” probe).

The oral cavity was divided into 6 sextants. One index tooth was selected from each sextant according to the WHO criteria. Examination was done on 6 index teeth and the highest score was recorded for the patient.

The scoring was as follows:

- 0 – healthy
- 1 – bleeding on probing present
- 2 – presence of calculus
- 3 – presence of periodontal pockets 4-5mm deep
- 4 – presence of periodontal pockets \geq 6mm deep
- X – excluded sextant (if less than 2 teeth present)

RESULTS

Periodontal Status and Age

Among 770 mothers only 13.7% had healthy periodontium, 86.3% had variation in the distribution of CPI scores depicting periodontal disease progression among mothers. The periodontal disease did not show positive relation with age of mothers ($\chi^2=8.313$, DF =12 and p = 0.760).

Periodontal Status and Literacy

The literacy of the mothers was divided in four groups. Among these groups, 5.1% of the illiterate mothers had healthy periodontium. Among the literate groups, there was a varied difference in the prevalence of mothers showing healthy periodontium. The highest prevalence (18.9%) of healthy periodontium was seen in mothers in the highest educated group in the study (degree holders). The CPI score 4 was found in 15.2% mothers in the illiterate group and in 12.3 % in degree holders. Literacy of mothers showed statistical significant association with periodontal disease ($\chi^2=36.778$, DF= 16 and p = 0.002)

Periodontal Status and Adverse Oral Habits

Twenty eight percent mothers with no adverse oral habits had healthy periodontium as compared to 9.4% with habits. There were higher CPI scores in mothers

with habits as compared to mothers without habits. A CPI score 4 was observed in 10.3% mothers with habits and in 3.4% mothers without habits. The adverse oral habits showed significance with periodontal disease ($\chi^2=144.6$, DF = 4, p = 0.00).

Periodontal Status and H/o dental treatment

In our study, 20.6% of mothers who had received dental treatment had healthy periodontium as against 10.3% mothers in the other group. The mothers who received the dental treatment had lower CPI scores. There was a significant association between periodontal disease and history of dental treatment ($\chi^2 = 46.065$, DF = 4, p = 0.000).

Periodontal Status and Obstetric History

It was observed that, 5.8% mothers with history of abortion had healthy periodontium as opposed to 15.3% with no history of abortion. 14.6% mothers with history of abortion and 7.4% mothers with no history of abortion exhibited CPI score of 4. Thus, periodontal disease and obstetric history showed a significant positive relation ($\chi^2 = 19.666$, DF = 4, p = 0.001).

Periodontal Status and Antenatal Care

The high literacy rate of mothers in the study resulted in awareness of antenatal care. Hence the number of mothers who did not take antenatal care was very small. Thus,

we did not find a significant association between periodontal disease and antenatal care ($\chi^2 = 3.505$, DF = 2, p = 0.173).

Periodontal Status and Hemoglobin Levels

The mothers were divided in 3 groups based on the hemoglobin % (≤ 10 gm%, 10-11 gm % and ≥ 11 gm %). 14.2%, 13.7% and 13.2% mothers showed healthy periodontium in the three groups respectively. However only 7.4% mothers with hemoglobin levels ≤ 11 gm% showed probing pocket depth ≥ 6 mm as compared to 13.2% and 15.9% in the other two groups. The periodontal status and hemoglobin levels of the mothers showed a significant association ($\chi^2 = 34.009$, DF = 8, p = 0.000).

Periodontal Status and Gestational Period

Gestational period of the mothers was categorized as preterm delivery and term delivery. 9.8% mothers with preterm delivery showed healthy periodontium as compared to 15 % mothers with term delivery. There was a marginal decrease in CPI scores in term delivery group as opposed to preterm group. This exhibited a modest significance between periodontal disease and the gestational period of the mothers ($\chi^2 = 9.436$, DF = 4, p = 0.051).

Birth Weight and Age

The mothers were divided into four groups according to their age. There was an uneven distribution of mothers in the different age groups. A majority of the mothers (512 out of 770 mothers) belonged to the age group of 21-24 years. There was no association observed between age of mothers and LBW ($\chi^2 = 5.353$, DF = 3 and p = 0.148).

Birth weight and Literacy

The literacy status among the mothers in the two groups was same. In the present study, only 10.3% of the mothers were illiterate. There was no significant difference in prevalence rate of LBW in different literacy categories ($\chi^2 = 4.238$, DF = 4, p = 0.347).

Birth Weight and Adverse oral habits

There was no significant association between adverse oral habits of the mothers with LBW ($\chi^2 = 0.885$, DF = 1, p = 0.347).

Birth Weight and H/o dental treatment

The previous dental treatment for treatment showed no significant association with low birth weight ($\chi^2 = 0.066$, DF = 1, p = 0.798).

Birth Weight and Obstetric history

The obstetric antecedents of the mothers showed that 28.5% mothers with history of abortion delivered LBW infants as against 25% mothers without a history of abortion. The results revealed no significant association of obstetric history and LBW ($\chi^2 = 0.727$, DF = 1, p= 0.394).

Birth Weight and Ante natal care

Among the total samples, antenatal care was taken by 763 mothers (99%). Only 7 mothers (1%) did not seek ANC. ANC was not found to be associated with low birth weight ($\chi^2 = 0.066$, DF= 1, p = 0.800).

Birth Weight and Hemoglobin levels

The mothers were divided in three groups based on their hemoglobin concentration. The percentage of mothers delivering low birth weight infants were evenly distributed in all the three groups ($\leq 10\text{g\%} = 25.1\%$, $10-11\text{g\%} = 26.3\%$, $\geq 11\text{g\%} = 25.3\%$). Thus no association was observed between birth weight and hemoglobin levels ($\chi^2 = 0.099$, DF = 2, p = 0.952).

Birth Weight and Periodontal Status

Among 770 mothers, 105 mothers showed healthy periodontium while the remaining mothers showed varied clinical signs of periodontal disease.

In mothers delivering LBW infants, a CPI score of 1 and 2 was seen in 20% and 25.3% of mothers, respectively and a CPI score of 3 and 4 in 31.6% and 31.3%, respectively. This indicated that the percentage of mothers delivering LBW infants increased with increasing CPI scores.

The study showed statistical significance between periodontal disease and low birth weight ($\chi^2=10.503$, DF=4, p= 0.033).

Birth Weight and Sex of the infant

Sex of the infant did not show any significance with the low birth weight infants in our study ($\chi^2 = 0.001$, DF = 1, p = 0.974).

Birth weight and Gestational status

In our study, 17.3% mothers in the term delivery group gave birth to LBW infants as opposed to 48.5% in preterm delivery group. The results exhibited a significant association between birth weight and gestational status of the mothers ($\chi^2 = 76.743$, DF = 1, p = 0.000).

Logistic Regression – Univariate Analysis

The risk of LBW is associated with gestational age. The prevalence of low birth weight is significantly more in preterm compared to normal delivery with the unadjusted odds ratio of 1.36 (95% CI - 1.28 – 1.49). The risk of LBW reduces with healthy periodontal status compared to severity of periodontal disease (unadjusted odds ratio 0.56; 95% CI - 0.33 – 0.96).

Logistic Regression – Multivariate Analysis

With multivariate logistic analysis, the same findings are confirmed with adjusted odds ratio of 1.38 for gestational age and 0.57 for periodontal status.

So, periodontal status and gestational age emerged as risk factors for LBW.

DISCUSSION

According to descriptive analysis of our study, the prevalence of LBW was 25.58% and that of periodontal disease was 86.3%.

Literacy, adverse oral habits, previous dental treatment exhibited a significant association with periodontal disease. Our results are supported by the findings of previous studies.^{13,14,15,16}

Periodontitis shared marginal significance ($p = 0.051$) with PTB. The average gestational age of the mothers in our study was 38.09 ± 2.58 weeks. However prevalence of PTB increased with severity of periodontal disease and decreased with term deliveries.

Previous history of abortion showed positive association ($p = 0.001$) with periodontal disease which increased with the severity of periodontitis thus emphasizing that the presence of chronic inflammation can increase the risk of abortion.¹⁷

In our study, periodontal disease and hemoglobin concentration showed a significant association between them ($p = 0.000$). The average hemoglobin % in mothers in our study was 10.37 ± 1.26 g%. Periodontitis, like other chronic conditions, may tend towards anemia, as the number of erythrocytes and levels of hemoglobin are lower in affected patients. Thus, long standing chronic conditions like periodontitis could also induce anemia thereby increasing the incidence of LBW.^{18,19,20}

A significant association between periodontal disease ($p = 0.033$), gestational age ($p = 0.000$) and LBW was found.^{1,11,21,22,23} In contrast most studies conducted in

European countries or Canada which offer universal health care, have shown significantly lower percentage of PTB/ LBW and no association between periodontitis and adverse pregnancy outcomes.²⁴ Thus, indicating the importance of universal health care in the general population in developing countries.

No relationship was found between periodontal (adverse oral habits, professional dental treatment) as well as maternal (literacy, history of abortion, hemoglobin, sex of the child) risk factors and LBW.

The present study showed modest association between periodontitis and gestational age, and significant association between periodontitis, gestational age and LBW.

CONCLUSION

In our study periodontal disease and gestational age demonstrated as risk factors of LBW. Periodontal infections are preventable and treatable therefore periodontitis can be viewed as modifiable risk factor for LBW.

In this regard, the key messages of the study are

1. Awareness of the gynecologist towards periodontal disease as a risk factor for LBW should be created.
2. Regular dental check up should become mandatory for pregnant women as a part of antenatal care.
3. Interdisciplinary care between the obstetrician and periodontist should be a routine procedure, as it would enhance the quality of medical and dental care being provided to our patients in the community.

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