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Original Research Paper

Periodontology

A CROSS-SECTIONAL STUDY TO ASSESS THE RELATIONSHIP BETWEEN MATERNAL PERIODONTAL DISEASE AND PRETERM LOW BIRTH WEIGHT AMONG BENGALURU URBAN POPULATION.

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ABSTRACT

Background : Periodontitis has been identified as a risk factor for preterm delivery and low birth weight infants. Lipopolysaccharides derived from periodontal pathogens may enter the systemic circulation which are strong inducers of Interleukin-1 and prostaglandin-E2, causes uterine contractions and results in preterm parturition. This study was conducted as there is inconsistent data regarding this association. **Objective:** To evaluate the relationship between maternal periodontal disease and preterm low birth weight infants. **Methodology:** 40 patients were evaluated in which test group consisted of 20 patients having preterm delivery and low birth weight infants and control group consisted of 20 patients having full term delivery with normal birth weight infants. Simplified oral hygiene index, bleeding index, probing pocket depth and clinical attachment levels were measured within 72 hours of delivery. **Results:** The mean OHI scores was 2.8 in test group and 2.1 in control group , mean BI scores was 56.60% in test group and 44.2% in control group, mean CAL score was 1.6mm in test group and 0.6 mm in control group, mean PPD scores were 3.4mm in test group and 2.02mm in control group . There was statistically significant greater mean Clinical Attachment Loss, OHI-Scores, bleeding scores in the test group compared to control group (p value < 0.05) except for PPD (p =0.13). **Conclusion:** Therefore it can be concluded that there is a significant relationship between maternal periodontal disease and preterm birth and low birth weight.

KEYWORDS : Full term , Preterm , Periodontitis, Risk factors, Prostaglandin-E2, Interleukin-1

INTRODUCTION

Preterm birth is a major medical, social, and economic problem that accounts for a large proportion (26.3%) of neonatal mortality and morbidity. Patients with labour before 37 completed weeks of pregnancy is considered as preterm and infants weighing <2500 grams are considered as low birth weight. Preterm babies who survive the neonatal period are at increased risk for, respiratory disorders, infection and neurodevelopmental disabilities.[1] The primary cause of LBW deliveries is preterm labor or premature rupture of membranes (PROM). Factors such as smoking, alcohol, or drug use during pregnancy, inadequate prenatal care, race, low socioeconomic status, hypertension, old (>30 years) or young maternal age, diabetes; and genitourinary tract infections and certain idiopathic factors can increase the risk of preterm LBW delivery. However, these risk factors are not present in approximately one-fourth of preterm LBW cases, which results in a continued search for other causes.[2]

Onset of new and worsening of existing gingival inflammation during pregnancy are normal and well documented, peaking in the second or third trimester. Galloway (1931) suggested that "infection of the periodontium by gram negative bacteria may provide sufficient infectious microbial challenge to have potentially harmful effects on the developing foetus".[3] Furthermore Offenbacher et al. (1996) were the first to report a link between poor maternal health and composite adverse pregnancy outcome of preterm low birth weight in humans.[4] The major physiological and hormonal changes occur during pregnancy are increased permeability of gingival capillaries, altered immune system activity and shifts in composition of the sub-gingival microbiome, including proliferation of bacteria associated with periodontitis, such as Porphyromonasgingivalis etc. Moreover, Lipopolysacc harides derived from periodontal pathogens may enter the systemic circulation which are strong inducers of IL1 and prostaglandin-E2, causes uterine contractions and results in preterm parturition. Besides this Periodontitis also trigger the release of inflammatory mediators that can reach the placenta, disrupting foetal development and also bacteria from infected gums can enter the bloodstream, colonizing the placenta and causing inflammation. Hence maternal immune responses to oral pathogens, vascular effects leading to reduced blood flow to the placenta, and systemic inflammation further contribute to adverse pregnancy outcomes.[5]

Several researches have demonstrated that periodontitis could be an independent risk factor for this condition yet randomised controlled trials (RCTs) evaluating the impact of periodontal therapy during pregnancy on adverse pregnancy outcomes have produced inconsistent results. So, in this present study evaluation of relationship between maternal periodontal disease and preterm low birth weight was done.

MATERIALS AND METHODS

The present study was conducted in accordance with the ethical principles outlined in Helsinki Declaration of 1975, as revised in 2013 for medical research involving human materials or data. The Institutional Review Board granted ethical approval.

Study design

This study was conducted on 40 subjects meeting the inclusion and exclusion criteria, reporting to the Department of Obstetrics and Gynaecology, KIMS medical college and hospital, Bangalore. Verbal and written informed consent was obtained from those who agree to participate.20 women who had preterm delivery and low birth weight infants were included in test group whereas 20 women who had full term delivery with normal birth weight infants were included in the control group.

Inclusion criteria:[1]

- Patients who are systemically healthy.
- Age >18 years
- Full term delivery with normal birth weight and pre term (<37 weeks) delivery with low birth weight (<2500 grams) delivery patients were included.

Exclusion criteria:[1]

- The patients with a history of previous pre term deliveries
- Smoking
- Alcohol consumption

- Psychological stress
- Malnourished patients
- Patients who are on steroid therapy previously
- Patient who have undergone elective and/or induced pre term delivery

Periodontal examination and data collection

Case history and clinical parameters were recorded within 72 hours of delivery/ c-section. Oral hygiene and gingival status were evaluated by using S–OHI (Greene and vermillion 1964) and Bleeding index (Animo and Bay1975). The probing pocket depth (PPD), clinical attachment level (CAL), were measured with a calibrated periodontal probe.

Statistical analysis

Statistical Package for Social Sciences [SPSS] for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp.,was used to perform statistical analyses.

Descriptive statistics:

Descriptive analysis of all the explanatory and outcome parameters was done using mean and standard deviation for quantitative variables, frequency and proportions for categorical variables.

Inferential statistics:

Mann Whitney test was used to compare the mean age of the subjects between 2 groups . Independent Student t Test / Mann Whitney [based on the data distribution] was used to compare the mean values of different Indices and clinical parameters between 2 groups. The level of significance was set at $P < 0.05$.

RESULTS

There was significant difference in mean OHIs Scores, BI (%), PD & CAL (in mm) between Preterm (Group A) and Full Term (Group B) Pregnant Women. The mean scores of OHI, BI, CAL, PPD were 2.8,56.60,1.6,3.4 respectively in test group and 2.1,44.2,0.6,2.02 respectively in control group. (Table 1. Table 2, Fig 1, Fig 2). There was significantly greater mean Clinical Attachment Loss, OHI-Scores, bleeding scores in the test group compared to control group

Table 1

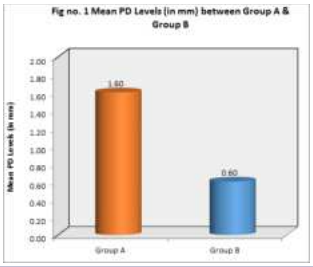
Comparison of mean OHIs Scores between Group A & Group B using Independent Student t Test								
Group	N	Mean	SD	Mean Diff	95% CI of the diff.		t	p-value
					Lower	Upper		
Group A	20	2.890	0.898	0.730	0.246	1.121	3.059	0.004*
Group B	20	2.160	0.575					

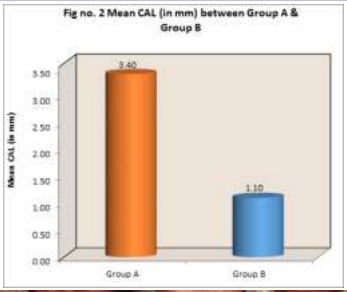
* - Statistically Significant , **Note:** Group A – Preterm Pregnant Women & Group B – Full term Pregnant Women

Table 2

Comparison of mean BI Scores (%) between Group A & Group B using Independent Student t Test								
Group	N	Mean	SD	Mean Diff	95% CI of the diff.		t	p-value
					Lower	Upper		
Group A	20	56.60	9.58	12.40	7.04	17.76	4.685	<0.001*
Group B	20	44.20	6.96					

* - Statistically Significant





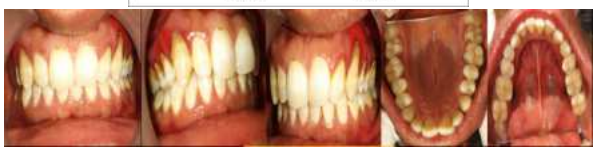


Fig no.3- Preterm

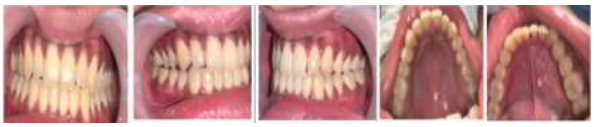


Fig no.4-Full term

DISCUSSION

The association between periodontitis and adverse pregnancy outcomes, particularly preterm birth and low birth weight, has been the subject of extensive research in recent years. Evidence suggests that periodontal pathogens can traverse the placental barrier, inciting a local inflammatory response within the placental tissues. For instance, the release of pro-inflammatory cytokines and prostaglandins by the periodontal pathogens can stimulate uterine contractions, potentially triggering preterm labour.[6] Furthermore, the chronic inflammatory state associated with periodontitis may compromise placental function, impeding adequate nutrient and oxygen exchange to the fetus, consequently resulting in fetal growth restriction and low birth weight.[7] Therefore, from a clinical standpoint, recognizing the link between periodontitis and PLBW highlights the importance of integrating oral health assessments and interventions into routine prenatal care. Identifying and addressing periodontal disease during pregnancy can potentially mitigate the risk of adverse outcomes, thereby improving maternal and neonatal health.

The first case control study involving 124 postpartum women, reported by Offenbacher et al in 1996 has confirmed an association between periodontal inflammation and adverse pregnancy outcomes. Their research revealed that women who delivered preterm or low birth weight newborns exhibited notably poor periodontal health[4] .This could be because of poor oral hygiene which results in increased plaque accumulation especially during the first trimester, due to vomiting, which is in accordance to our study which revealed higher OHI scores in the test group compared to the control group (Table 1,Comparison of mean OHIs Scores between test & control).

Gingival bleeding stands out as the primary factor linked to pregnancy outcomes. Wimmer and Pihlstrom in their study highlighted that clinical parameter like bleeding on probing (BOP), was elevated in preterm birth cases which is in accordance with our study [8] (Table 2 Comparison of mean BI Scores (%)). They suggested that increased levels of estrogen and progesterone could induce increased vascular permeability and thinning of epithelium, which leads to gingival edema and increased tendency to bleed. Genco et al. and Lindhe's research also underscored the significance of increased vascular permeability in gingival tissue during pregnancy, facilitating translocation of periodontal pathogens like Prevotella intermedia. This organism

consumes estrogen as an alternative source of nutrition instead of vitamin K and their endotoxins reaches uterus and causes uterine contractions.9

Mitchell-Lewis et al. in 2001 found that pregnant women with advanced periodontal disease were more likely to have preterm deliveries. It was observed that PD was significantly higher in the preterm group compared to the full-term group which is similar to our study [10](Fig 1. Mean PD between test & control).The reason for this could be due to impaired function of PMNs that causes increased susceptibility of periodontal tissues to inflammation. Pocket formation starts as an inflammatory change in the connective tissue wall of the gingival sulcus. The cellular and inflammatory exudate causes degeneration of the surrounding connective tissue, including the gingival fibers just apical to the junctional epithelium which results in the apical migration of JE and subsequent pocket formation.[2]

López et al. in 2002 analyzed the periodontal health status of 329 delivered women, and found out that CAL and PI were notably higher in preterm group which aligns with our study [11](Fig 2- Mean CAL between test & control). This could be due to increased production of inflammatory mediators like prostaglandins and cytokines, which can exacerbate periodontal inflammation to plaque and contribute to tissue destruction and attachment loss. [12]

Our study shows that periodontitis is a significant risk factor associated with preterm low birth weight infants.

Limitations:

1) The small number of subjects enrolled in the study has limited statistical power.
2) Microbial analysis of subgingival plaque samples using techniques like polymerase chain reaction, or checkerboard hybridization could be beneficial

CONCLUSION:

Periodontitis is a risk factor for preterm low birth weight. Our study, alongside existing literature, emphasizes the importance of early detection and treatment of periodontal disease in pregnant individuals especially during second trimester where pregnancy gingivitis is usually most severe, so that incidence of pregnancy complications like preterm births can be reduced.

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