IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 13, Issue 8 Ver. IV (Aug. 2014), PP 12-15
www.iosrjournals.org

Periodontal Disease as a Risk Factor for Preterm Delivery and Low Birth Weight

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Abstract:
Objective: *The objective of the present study was to evaluate the association between chronic periodontitis of mother with preterm delivery and low birth weight.*
Study design: *Two hundred subjects who reported to Department of Obstetric and Gynecology, Kasturba Hospital, Manipal, Karnataka were included in the study. Subjects were divided into cases and controls based on pregnancy outcome. General information on socioeconomic status, obstetric history, dental history, oral hygiene, gingival status and probing pocket depth were also recorded.*
Results: *Poor oral hygiene,moderate to severe gingivitis and increased probing pocket depth was significantly higher in those who delivered small babies (preterm and small for gestational age) than the average sized (74% vs. 11%; x2 81.2, p<0.001). (x2 92.8, p<0.001). (60% vs. 3%; x2 97.9, p<0.001).*
Conclusion: *There was significant co-relation of poor hygiene, gingival inflammation, probing pocket depth to Preterm Delivery and Low Birth Weight.*
Key Words: *Preterm Delivery, Low Birth Weight, Periodontal disease.*

I. Introduction

"Periodontal Disease" is an all encompassing term relating to the destructive inflammatory disorders of the hard and soft tissues surrounding teeth. Evidence emerging in the last decade has shed light on the relationship between oral health and various systemic conditions like coronary heart disease, stroke, adverse pregnancy outcomes, and acute exacerbation of chronic obstructive pulmonary disease, aspiration pneumonia and diabetes. The infected periodontium can represent an endocrine like source of potentially deleterious cytokines and lipid mediators which may increase the likelihood of adverse pregnancy outcomes. Several studies have shown that periodontal disease can increase the risk of preterm low birth weight babies. Offenbacher and colleagues in 1996 reported that prevalence of maternal periodontal infection could be associated with preterm low birth weight, controlling for known risk factors and potential covariates.[1]Differing opinions from different authors in different populations, it is thought necessary to explore the relationship in other populations. Present communication is an effort to correlate in those mothers, the outcome of delivery of low birth weight babies with the severity of different periodontal parameters.

II. Materials And Methods

Immediate postpartum periodontal examination was carried out on 200 women. Cases included 100 women delivering before 37 weeks of pregnancy (preterm, 30 cases) or small for gestational age babies (70 cases). One hundred women who delivered an average sized baby (>2500g) at term on the same day or in the next two days as the case were studied as controls.

All these women were the ones who volunteered to sign informed consent, admitted in spontaneous labor, delivered singleton babies, had not had periodontal treatment nor had received antibiotics for any infection in the last six months. Pregnancies complicated by heart disease or hypertension, were not included. (Table-1) Only women with known last menstrual period and first trimester dating scan were enrolled for study (Table-2) by the resident obstetrician, who checked the labor room birth register everyday in the morning to note down the cases who delivered preterm or small for gestation age babies and immediate next entry to that of case who delivered average sized baby.

Prior approval to carry out the study was obtained from the Institutional Ethics Committee. Oral examination was carried out at the bedside within 72 hours ofthe delivery by specialist periodontist who was blinded to the case-control status of the recruited. Oral hygiene of the individual was evaluated using the simplified oral hygiene index (Green and Vermillion, 1964)[2] and inflammatory condition of the gingiva using gingival index as suggested by Loe and Silness (1963).[3] Periodontal pocket depths were recorded using Williams's periodontal probe.

Periodontal infection was considered positive if any of the following were present: poor oral hygiene index (simplified), gingival index ofabove1 (moderate to severe gingivitis), or periodontal pocket depth of≥4

mm.

Analysis of Variances (ANOVA) performed group comparison for continuous variables. Chi- square test was used to compare the frequency data. Multivariate logistic regression analysis was applied for variables of periodontal parameters – oral hygiene index, gingival index and periodontal pocket depth. Probability of occurrence of 0.05 or less was considered as statistically significant.

III. Results

Proportion of women with poor oral hygiene was significantly higher in those who delivered small babies (preterm and small for gestational age) than the average sized (74% vs. 11%; x^2 81.2, $p<0.001$). No case with severe gingivitis was noted among controls. There were 79% of women with moderate to severe gingivitis who delivered small neonates (x^2 92.8, $p<0.001$). Probing pocket depth of 7-9 mm was also significantly higher in these women (60% vs. 3%; x^2 97.9, $p<0.001$).

Similar oral hygiene status and gingival status were noted among the cases. The significance of poor oral hygiene index (x^2 81.8, $p< 0.001$), gingivitis (x2 93.6, $p<0.001$) and deeper probing pocket depth (x2 99.7, $p<0.001$) was also reflected when studied in the two constituents of low birth weight, preterm and SGA. More women who delivered preterm had the probing pocket depth of 4-6 mm than the mothers of SGA neonates. (Table.3 & 4)

The clinical parameters considered to indicate periodontal infection have shown significant association in women with preterm and SGA deliveries. Patients with the poor oral hygiene showed to have increased frequency of preterm and SGA deliveries (OR 21.9; 95% CI 10.2 – 47.9). Increased gingival inflammation was seen more often in mothers of low birth weight neonates, with severe gingivitis showing the higher risk than for other forms (OR 17.1; 95% CI 8.5 – 34.7). Similarly, the measurements of probing pocket depth showed that increases were associated with increase in low birth weight outcome. Probing pocket depth of 7-9 mm had higher association (OR 3.9; 95% CI 2.1-7.0) than the 4-6 mm of recorded depth (OR 1.2; 95% CI 0.62 - 2.13). The mean probing depth in low birth weight group was 6.4 ±1.6 mm and in preterm group 6.3±1.5 mm.

Multiple logistic regression analysis applied to study the association of individual periodontal clinical parameter with obstetric outcome suggested significant association of gingival index and periodontal pocket depth ($p=0.006$) and moderate relationship of oral hygiene index ($p=0.125$) with poor obstetric outcome. (Table 5)

IV. Discussion

Periodontal disease is a chronic infection the natural history of the disease is characterized by episodic periods of quiescence and progression[4]. As a remote gram-negative infection, periodontal disease may have the potential to affect pregnancy outcome. During pregnancy, the ratio of anaerobic gram-negative bacterial species to aerobic species increases in dental plaque in the second trimester[5]. The gram-negative bacteria associated with disease which can produce a variety of bioactive molecules that can directly affect the host.

Pregnancy can influence gingival health. Changes in hormone levels during pregnancy promote an inflammation termed pregnancy gingivitis[6]. This type of gingivitis may occur without changes in plaque levels[5]. Furthermore, pregnancy increases the onset of new periodontal disease[7]. If the preexisting periodontal disease becomes active during the pregnancy, it may pose a significant concomitant infectious or inflammatory exposure during the current pregnancy, as would the onset of new disease.

The present study reports that periodontal infection was seen more in cases when compared to controls. Similar association has been reported by Offenbacher (1996)[1] Offenbacher (1998)[8], Lopez et al (2002)[9], Dasanayakae (1998)[10] and Radani et al (2004)[11]. On the other hand reports of association has not been consistent with some of authors refuting it by Davenport et al (2002) [12], Moore et al (2004)[13] studied larger sample of 734 and 3738 cases respectively and Hoolbrook et al (2004)[14] studied based on their diagnosis of periodontal infection on pocket depth ≥ 4mm and culture of gingival crevicular fluid sample.

The clinical parameters considered in the present study to indicate periodontal infection have shown significant association with preterm deliveries and low birth weight. These parameters when they were used individually and when inferred together were indicative of periodontal infection and correlated with the adverse pregnancy outcome. The results in the present study are in accordance with the study conducted by Moore et al (2005)[15] who found the mean probing depth of 3.85 mm, Offenbacher (1996)[1] reporting the mean probing depth of 3.17 mm. In the study conducted by Lopez et al (2002)[9] examined all the teeth that were present in the dental arch with the mean probing pocket depth of 2.17 – 2.94 mm. In the present study the mean probing depth of 6.4 ±1.6 in low birth weight, 6.3 ± 1.5 in preterm delivery group and controls 3.3 ± 1.4, suggests that as the probing depth increases, there is a chance for adverse pregnancy outcome.

Periodontitis and preterm delivery have been associated with certain characteristic polymorphisms in genes that code for cytokines[16].One hypothesis is that persons with the mutant or polymorphic genotypes produce more of the inflammatory cytokines in the presence of inflammatory stimuli, resulting in preterm labor. This suggests that the enhanced host response may mediate and link both conditions. Prostaglandins play

important role of in human labor. Amniotic fluid levels of PGE2 increase steadily throughout pregnancy until a critical threshold level is reached to induce labor. It has been suggested that periodontal infections, which serve as a reservoir of inflammatory mediators, including PGE2, may pose a threat to the fetal–placental unit.9 The data collected by this study indicated that the periodontal disease is associated with preterm delivery and low birth weight. However a larger prospective and intervention studies are required before periodontitis is considered as causal factor for negative outcome of pregnancy like preterm delivery and low birth weight.

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Table 1: Exclusion Criteria.

Mothers who had undergone periodontal treatment six months prior to delivery.
Mothers who had taken antibiotics recently for any infection prior to delivery
Multiple gestation
Twin deliveries
Induced labor
Placental or uterine abnormalities
Past history of congenital heart disease
Past history of diabetes and Gestational diabetes
Past history of hypertension
Renal failure
Other systemic and genetic disease

Table 2:Inclusion Criteria.

Mothers who underwent pre-term labor and delivered low birth weight baby.
Mothers who delivered at term with a healthy baby weighing 2,500 g or more were taken as controls

Table 3: Quantitative analysis (Mean ± SD) of cases and controls

Groups	n	Gestational Age	Birth Weight	OHI - S	Gingival Index	Pocket Probing Depth	Age	Body Mass Index
Low Birth Weight	70	37.1 ± 1.8	2090 ± 316	3.5 ± 1.1	1.55 ± 0.73	6.4 ± 1.6	26.7 ± 3.8	19.7 ± 1.0
Preterm Delivery	30	33.5 ±2.0	2209 ± 374	3.9 ± 1.1	1.57 ± 0.64	6.3 ± 1.5	26.8 ± 4.1	20.3 ± 1.0
Controls	100	38.6 ± 1.1	3065 ± 362	2.0 ± 0.7	0.43 ± 0.6	3.3 ± 1.4	26.8 ± 3.6	20.0 ± 1.1
ANOVA: F P		127.7 < 0.001	182.6 < 0.001	72.3 < 0.001	75.1 < 0.001	106.1 < 0.001	0.28 0.75	4.43 < 0.05

One Way Anova:
P< 0.001 = Highly Significant (HS)
P< 0.05 = Significant (S)
P> 0.05 = Not Significant (NS)

Table - 4: Distribution Of Cases And Controls According To Ohi – S, Gingival Index, Probing Pocket Depth Data.

Periodontal parameters	Category	Low Birth Weight (LBW) (N - 70)	Preterm Delivery (PTD) (N – 30)	Chi square test p value	Cases n=100	Controls n=100	Chi square test p value
OHI - S	Fair	20 (28.6%)	06 (20.0%)	X^2 = 81.8 p<0.001 (HS)	26 (26%)	89 (89%)	X^2=81.2 P<0.001 (HS)
	Poor	50 (71.4%)	24 (80.0 %)		74 (74%)	11 (11)	
Gingival index	Mild	15 (21.5%)	6 (20.0%)	X^2=93.6 p<0.001 (HS)	21 (21%)	82 (82%)	X^2=92.8 P<0.001 (HS)
	Moderate	36 (51.4%)	14 (46.7%)		50 (50%)	18 (18%)	
	Severe	19 (27.1%)	10 (33.3 %)		29 (29%)	0 (0%)	
Probing pocket depth	2 – 3mm	07 (10.0%)	02 (6.7%)	X^2=99.7 p<0.001 (HS)	09 (09%)	69 (60%)	X^2=97.9 P<0.001 (HS)
	4 – 6mm	19 (27.1%)	12 (40.0 %)		31 (31%)	28 (28%)	
	7 – 9mm	44 (62.9%)	16 (53.3%)		60 (60%)	03 (03%)	

Table 5: Results of Multivariate logistic regression analysis

Effect	Likelihood Ratio tests			
	Model Fitting criteria	Likelihood Ratio Tests		
	-2 log likelihood of reduced model	Chi - square	df	Significance
Intercept	59.3	0.0	0	-----
OHI - S	61.7	2.35	1	0.125 *
Gingival Index	71.9	12.63	3	0.006** VS
Periodontal Pocket Depth	69.7	10.36	2	0.006** VS