



## Maternal Periodontitis and Preterm Delivery: Hospital Based Case-Control Study

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### Abstract

**Background:** To find out the association between preterm delivery and maternal periodontitis among pregnant women visiting a tertiary teaching hospital located in eastern Nepal this case control study was done in between 2013-2015 AD.

**Methods:** Those women who underwent spontaneous vaginal preterm delivery of less than 37 weeks of gestation were cases group and women who undergo vaginal delivery at term of equal or more of 37 weeks of gestation on the same day of preterm delivery were considered as control group. Estimation of gestational age was based on the last menstrual period which was recorded in the patient's medical record.

**Results:** The result of this study showed that for preterm delivery periodontal disease is an independent risk factor. Extension of disease, increased probing depths have been associated with a higher risk for progression of periodontal disease.

**Conclusion:** This study will be beneficial to those women with periodontal disease who have higher chances of preterm delivery for early detection and for making treatment planning.

The promotion of the early detection and treatment of periodontal disease in women before and during pregnancy will be beneficial especially for women at risk for preterm delivery.

**Keywords:** Clinical Attachment Loss; Gingival Index; Preterm Delivery; Periodontitis; Plaque Index

### Introduction

Periodontitis is defined as "an inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms or group of micro-organisms resulting in progressive destruction of periodontal ligament and alveolar bone with pocket formation, recession or both" [1]. According to the WHO, a preterm birth is a birth, regardless of birth weight which occurs up to 37 menstrual

weeks of gestation. The clinical importance of the time of onset of the last menstrual period is for determining fetal age because it is usually known and when spontaneous and regular in past, it most often is followed by ovulation and fertilization after 2 weeks [2]. Preterm birth also has long-term consequences for neonant which includes an increased risk of neurological impairments and behavior disorders and higher rates of chronic health disorders as compare to the children born at term.

**Methods**

The study populations were patients getting admitted in the department of Obstetrics and Gynecology Bpkihs, Dharan, Nepal who fulfilled the inclusion criteria. Only those patients who were willing to participate were included for the examination.

Those women who underwent spontaneous vaginal preterm delivery of less than 37 weeks of gestation were cases group and women who undergo vaginal delivery at term of equal or more of 37 weeks of gestation on the same day of preterm delivery were considered as control group. 100 women were included in case group and 100 women were included in control group. Estimation of gestational age was based on the last menstrual period, which was in medical record of patient. Patients with irregular cycle or not sure of date and also not having early trimester scan were excluded from the study. Periodontal examinations were performed at the maternity ward. Questions includes socio demogrphic profile, past medical history, past dental history, personal history and oral hygiene habits.

The periodontal examinations included oral hygiene index, dental plaque, gingival condition, clinical attachment loss and probing pocket depth.

The Plaque index was taken for recording the presence of plaque. The modified gingival index<sup>1</sup> was used for recording gingival condition. The third molar were not examined or scored in the upper or lower arch. The examination for plaque index was preceded the examination for the gingival index.

The clinical periodontal examinations were carried out manually by using UNC-15 probe (Hu-Friedy, IL, USA). The CAL and PD were measured in 4 sites (mesio-facial, mid-facial, disto-facial and palatal/lingual) per tooth. All the clinical data were collected by a single investigator. After clinical examination, the patients were given self-reporting questionnaires to collect the data regarding socio-economic and personal history.

The instrument used were Plane mouth mirror, UNC-15 probe, Explorer, Tweezer, Kidney tray, Gauze and cotton, Gloves and mouth mask, Disinfectant solution for hand washing – Betadine 5.5% Cloth hand towel.

**Ethical clearance**

Ethical clearance was obtained from institutional ethical review board prior to start of this investigation. Written consent was taken from patient.

**Statistics**

Statistical *Analysis by* evaluating the existence of an association between periodontal disease and preterm delivery which was obtained by means of a multivariate logistic regression model also considering other risk factors for preterm delivery.

Collected data was entered in Microsoft excel 2007 and converted it into Statistical package for social science (SPSS) version 11.5 for statistical analysis.

Descriptive statistics was calculated by mean, percentage, proportion and tabular. Graphical presentation was done.

For inferential statistics Chi square test, odd ratio, independent t-test were applied to find out significance between case and control and other variables at 95% CI where p= 0.05. p-value less than 0.05 were considered statistically significant.

**Results**

The age of population ranged from 18 to 43 with mean age 22.34 ± 4.158.

Maximum numbers of population were 20-34 age group whereas minimum numbers were more than 34 age group. Results of different parameters which were taken are as follow in Table I, II, III, IV, V, VI.

CAL	Severity
Localized mild periodontitis	If CAL 1 to 2 mm and involvement in less than 30% site
Generalized mild periodontitis	If CAL 1 to 2 mm and involvement more than 30 % site
Localized moderate periodontitis	If CAL 3 to 4 mm and involvement less than 30% site
Generalized moderate periodontitis	If CAL 3 to 4 mm and involvement more than 30% site
Localized severe periodontitis	If CAL ≥ 5 mm and involvement less than 30 % site
Generalized severe periodontitis	If CAL ≥ 5mm and involvement more than 30% site

**Table I.** Severity of CAL and extent of involvement (AAP).

CAL: Clinical attachment loss AAP: American academy of periodontology

Religion	Control group	Case group
Hindu	69%	70%
Muslim	12%	4%
Christian	4%	4%
Buddhist	10%	6%
Kirant	5%	16%

Table II: Religion of mother in percentage.

CAL	Control group	Case group
0-1mm	79%	63%
1-2mm	17%	26%
2-3mm	4%	11%

Table III: CAL measurement.

Plaque index	Control group	Case group
Good	74%	57%
Fair	25%	32%
Poor	1%	11%

Table IV: Plaque index.

Gingival index	Control group	Case group
Mild gingivitis	73%	64%
Moderate gingivitis	26%	24%
Severe gingivitis	1%	12%

Table V: Gingival index.

Oral hygiene status	Control group	Case group
Good	57	74
Fair	32	32
Poor	11	1

Table VI: Oral hygiene status of mother.

Summary of results showing association or non-association between different parameters which were taken are shown in Table VII.

Character	p-value	Remark
Difference in age	0.163	Non – significant
Religion	0.037	Non –significant
Living area	0.044	Significant *
Occupation	0.036	Significant *
Difference in education	0.001	Significant *
Smoking	0.052	Non-significant
Use of tobacco	0.425	Non – Significant
Heavy physical exertion	0.002	Significant *
Husband smoking	0.02	Significant *
Diet difference	0.041	Non –significant
Multiparity	1	Non-significant
Previous PT/LBW	0.12	Non-significant
Stress during pregnancy	0.004	Significant *
Anemia	0.316	Non-significant
Toilet facility	0.012	Significant *
Cooking fuel used	0.095	Non –significant
Plaque index	0.009	Significant *
Gingival index	0.117	Significant *
Clinical attachment loss	0.021	Significant *
Probing depth	0.05	Significant *
Family income	0.006	Significant *
Previous abortion	0.30	Non-significant

	Number	Mean	St deviation
Age term	Case	22.26	4.320
	Control	22.41	4.010
Week term	Control	39.29	1.21
	Case	34.6	2.07
Plaque index	Case	1.30	0.539
	Control	0.8079	0.452
Gingival index	Case	1.36	0.527
	Control	0.77	0.436
CAL	Case	0.824	0.607
	Control	0.405	0.574
PD	Case	1.9004	0.6625
	Control	1.385	0.614

Table VII: p-value<0.05 considered statistically significant.

## Discussion

Potential link between periodontal disease and pregnancy outcomes have been investigated for many years. In 1996 Offenbacher, *et al.* published the first clinical investigation into links between pregnancy outcome and periodontitis in human [4].

Our study found statistically association between maternal periodontitis and preterm delivery (CAL  $p=0.021$ ) which was statistically significant and thus the hypothesis that for undesirable pregnancy outcomes periodontal disease is not a risk factor was rejected.

Age group between 20-34 years is suggested to be the most appropriate age for giving birth to children [5]. In our study mean age of mothers were  $22.34 \pm 4.158$  years which falls within this range of fertile age.

Mothers belonging to different religion group have been included in the study (Table II). 80% of the mothers were Hindus, 6% Buddhist, 5% Kirant, 4% Christian, 5% Muslim. Among them, Muslim and Kirant population showed more prevalence of preterm delivery which indicate that ethnicity play a role in preterm delivery similar to the studies by Horton, *et al.* [6] and Offenbacher, *et al.* [7]. However in contrasts to our study Bassani, *et al.* [8] and Mitchell-Lewis, *et al.* [9] had shown different results.

The type of diet was not significant among the group where 95% were non-vegetarian and 5% were vegetarian (Table VII).

In our study, parity was not significant for preterm delivery (Table VII) similar to study done by Alexis Shub, *et al.* [10] who found there is no difference between the controls and cases group with respect to difference between marital status, parity and age [11]. However, similar to our study there are many studies which have shown parity as a significant risk factor for preterm delivery like Mumghamba, *et al.* [12].

For both periodontitis and adverse outcomes of pregnancy smoking is considered as one of the principal risk factor [13]. The rate of smoking among pregnant women fluctuates between 10% and 20% [14]. In our study 4% of the total population smoked cigarette. Among cases 5% were smokers and 3% were smokers among controls.

Our study showed no significant association of smoking with preterm delivery (Table VII) which is as similar to the research

done by Bosnjak, *et al.* [15]. However, this study is in contrast to the study done by various researchers [14,15] who showed significant relation between preterm delivery and smoking.

The difference in result may be due to lack of sufficient definition criteria for smoking habits and severity, for example the number of cigarettes per day and period of smoking like during or prior to pregnancy [16].

Since passive smoking has role in adverse pregnancy outcome participants were assessed for it. Based on the self-reported answer it was found that 23% of the husband of case group smoked and the pregnant mothers were exposed to passive smoking. Our study showed significant relationship of passive smoking in pregnancy outcome (Table II) which is similar to the study done by Rajapakse, *et al.* [16] but in contrast to this study no association has been seen in the study by Toygar, *et al.* [17].

The insignificant association of smoking to preterm delivery found in our study was may be due to hesitation to report self-smoking since it was questionnaire based study (Table VII).

Regarding prenatal care, no significant association with preterm delivery was found in our study (Table VII) which is similar to study done by Basanjak, *et al.* [17]. The level of prenatal care among the groups of mothers giving birth to full term normal weight infants and mothers giving birth to preterm low birth weight infants was similar. In contrast to our study, various authors have shown that mothers delivering low birth weight infants or preterm low-birth weight infants has been provided insufficient prenatal care [17,18]. Lunardelli AN and Peres MA also showed association between prematurity and fewer prenatal consultations. Likewise, in a study conducted by Vettore MV, *et al.* [19] showed that periodontal disease was the risk factor for low birth weight but inadequate prenatal care showed association with adverse birth outcome which was significant.

No significant difference was obtain regarding prenatal care like visiting to a dentist last year, taking advice from health professional (Table II). This finding of ours was similar to the findings reported by Offenbacher, *et al.* Majority of Nepalese population still lack of basic facility like toilet which is related to the socio economic status. 17.5% population showed lack of toilet facility, 62% population utilized firewood as the cooking fuel.

Regarding alcohol use no significant association with preterm delivery has been found in our study (Table II) which is similar to the study done by Bassani, *et al* [9].

In our study, no difference in the level of tobacco use among case group and control group mothers was seen (Table VII) which is similar to the study done by Offenbacher, *et al.* [2] who showed no difference in the level of tobacco use among preterm low birth weight group and normal birth weight group mothers. However, in contrast to these studies, Goldenberg, *et al.* 2008 and Bosnjak, *et al.* found significant association between preterm birth infants and normal birth weight infants.

Previous history of preterm delivery, low birth weight baby and previous abortion were not associated with preterm delivery in our study (Table II). The results of our study are in difference to the study done by Baskaradoss [10] Augeda, *et al.* [19] and Davenport, *et al.* [20] who found significant association between them.

For preterm delivery physical exertion during pregnancy is an important risk factor. Based on the workload, hours of work per day and carrying heavy load analysis was made. Significant association has been found in this study (Table II) similar to the study done by Baskaradoss. In contrast to this study Pompeii, *et al* [15]. did not find any kind of association between the two.

Stress has been also associated with pre-term birth of infants. There may be different kind of stress like violence, financial situation, family problems, problems at work place [19]. Similar to these findings, stress was found significantly associated with preterm birth in our study (Table II) which is in agreement with the study done by Noack, *et al* [21], Pompeii, *et al* [22] and Eskenazi, *et al* [23].

This is explained on the basis that stress stimulate pituitary gland which release cortisol hormone. Cortisol enters into saliva and cause reduction of inflammatory cells inhibiting the immune response and thus causing the periodontitis [24].

Elevated percentages of pregnant women with no education or only primary education are frequently associated with PTB and/ or LBW [17,19] and periodontitis [21]. Education in relation to preterm delivery was found highly significant in our study (Table II) which is similar to the studies done by Sequeria, *et al* [16].

and Toygar, *et al.* Mother with no education or primary education or middle school level education has higher chances for preterm delivery in our study (table III). On the contrary, an insignificant difference ( $P>0.05$ ) between preterm delivery and maternal periodontitis was found in the study by Davenport, *et al* [20].

In the present study, socioeconomic status was scored based on scoring criteria which included education, occupation and family income according to the scale given by Kuppuswamy. Various studies revealed that lower socioeconomic status group had higher chances of giving birth to low birth weight child. The result of our study showed significant association between low birth weight children and different socioeconomic status of mothers (Table II), which is in agreement with study done by Lunardelli, *et al* [14]. However, in contrast to this study the level of socioeconomic status failed to show any significant difference among the two groups of mother in studies done by Moore S, *et al* [25] and Noack, *et al* [21].

Majority of our population were from medium socioeconomic class with low education level similar to the studies done by Rajapakse, *et al* [17] and Lopez, *et al* [26].

Our study showed that 84% of subjects brushed their teeth once a day and rest brushed twice in a day. Among case group, 95% gave history of brushing the teeth once a day and 5% brushing teeth twice in a day. Among them 19.5% gave the history of bleeding while brushing.

Oral hygiene status was measured with the help of PI and gingival index GI. An efficient index system should be quick and easy to use with minimal instrumentation. It must be reproducible and must reflect accurately degrees of pathology [27].

Severity of periodontitis was measured with the help of PD and CAL (Table I). Extent and severity of PD corresponds with periodontal disease progression and increased probing depths have been associated with a higher risk for periodontal disease progression the combination of PD and CAL identifies the subjects with true periodontal pockets. The rationale behind using PD and CAL in combination for measuring periodontal disease severity is that PD suggests the presence of active disease and CAL represents a cumulative measure of periodontal tissue destruction throughout life [29].

In our study chronic disease like diabetes mellitus, chronic hypertension was excluded. Diabetes mellitus is known to be associated with more severe periodontal disease and higher low birth weight. The exclusion of women with chronic hypertension avoided bias of confounding caused by the continuous use of anti-hypertensive medications, strongly related to periodontal status changes [30].

Despite apparent conflicting data, the majority of studies report that periodontal treatment is safe for pregnant women and improves periodontal status. The pregnant woman is a particular patient, so in order to decrease the impact of periodontal disease on preterm birth incidence, the early diagnosis and treatment of periodontal disease in them should be recommended. The preventive oral care is the best way to prevent oral diseases and their consequences on pregnancy.

### Conclusion

The results of our study showed that periodontal disease is an independent risk factor for preterm delivery. Caution must be taken in interpreting the applicability of current data until these finding can be confirmed by larger, prospective studies. Cooperation between obstetricians or general practitioners and periodontists should be developed. The promotion of the early detection and treatment of periodontal disease in women before and during pregnancy will be beneficial especially for women at risk for preterm delivery.

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