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Assessment of two-way relationship between periodontal disease and gestational diabetes mellitus: A case-control study

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) is glucose intolerance which begins during pregnancy. Few studies have examined the association between periodontal disease and GDM.

Aim: The aim of this study was to assess the association between periodontal disease and GDM.

Materials and Methods: The study population comprised ninety patients, out of which thirty were cases and sixty were controls. All cases underwent a laboratory screening test for GDM between 24 and 30 weeks of gestation based on the recommendation of the obstetricians and gynecologists. To assess the periodontal status, a full-mouth periodontal examination assessing the probing depth, periodontal depth, bleeding on probing, clinical attachment level, and gingival recession was performed on all study participants by a single trained examiner. Tests for associations were performed using Chi-square statistics and multivariate logistic regression analysis.

Results: None of the periodontitis conditions was found to be a significant predictor of GDM. In GDM patients, 70% of females were having periodontal disease whereas non-GDM patients 77% of patient had periodontal disease.

Conclusion: The present study did not show any positive association between periodontal disease and GDM.

Key words: Gestational diabetes mellitus, periodontal disease, pregnancy

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In the life-course of a female, an important milestone is a pregnancy with the dual factors of oral health affecting the pregnancy outcome and pregnancy affecting oral health. Pregnant women are more prone to common chronic oral diseases such as dental caries and periodontal disease; if proper oral health care is not provided and maintained during pregnancy, there are negative implications later in life for the mother.^[1] The relation between periodontal inflammation and the hormonal changes in women has been well-known for many years. Vermeeren in 1778 described “tooth pain” in pregnant women, and Pitcairn discussed enlargement and gingival inflammation during

pregnancy. The Pinard in 1877 recorded case of pregnancy gingivitis.^[2]

Periodontal diseases include gingivitis, i.e., inflammation of the gingiva which can be prevented and reversed by proper oral hygiene and periodontitis, i.e., inflammation extends and results in tissue destruction ultimately leading to alveolar bone resorption. Periodontitis being a slowly progressing disease with largely irreversible tissue destruction and alveolar bone loss can result from diabetes which is considered as major risk factor for periodontitis. About approximately threefold increase in risk of periodontitis was estimated in diabetic individuals when compared with nondiabetic individuals.^[3]

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Gestational diabetes mellitus

Gestational diabetes mellitus (GDM) is glucose intolerance that is first reported during pregnancy. The definition applies whether the diabetic condition persists after pregnancy and whether only diet modification or insulin can be used for treatment.^[4] Pregnant mother with GDM is more prone for developing type 2 diabetes in the future.^[5] GDM complicates approximately 7% of all pregnancies, which leads to an annual number of cases greater than 200,000.^[4] Untreated GDM results in poor maternal and fetal health. Women suffering from GDM are more likely to suffer preeclampsia, stillbirth, suzerain delivery, preterm delivery and macrosomia or large for gestational age, which is associated with birth injury, respiratory distress, and neonatal hypoglycemia. Further, children born to mothers with GDM are at greater risk of obesity, and these infants are at higher risk of type 2 diabetes in later life.^[6]

Scarce availability of literature focusing on the specific relationship between periodontal disease and GDM led to researcher's interest in this field. Considering all this, the present study was designed to assess the association between periodontal disease and GDM in our population.

MATERIALS AND METHODS

Study population

The study population consisted of ninety patients, a total of thirty cases of GDM and sixty controls were included in the study visiting the outpatient department of Teerthanker Mahaveer Medical College and Research Centre from July 2015 to September 2015. For carbohydrate intolerance screening of all the pregnant women were done by performing:

- 1-h, 50-g oral glucose challenge test (GCT), a standard test for GDM
- Women with GCT positive, i.e., glucose level >135 mg/dl, were diagnosed with GDM and were considered as cases
- Women who passed the GCT, i.e. glucose levels <135 mg/dl and no other types of diabetes were considered as controls.

Inclusion and exclusion criteria

Inclusion criteria

1. Patient at the gestational age between 24th and 30th weeks
2. Patients who have undergone complete GDM screening
3. Patients above 18 years of age
4. Patients who consent to participate.

Exclusion criteria

1. Patients with history of pregestational diabetes
2. Patients having any heart disorders
3. Patients suffering from HIV
4. Patients who had undergone any oral prophylaxis or periodontal treatment within last 3 months.

Definitions and periodontal disease measurements

Before the dental examination, a personal interview of all the participants was done to obtain other information, including age, gestational age, education, occupation, body mass index (BMI), previous history of GDM, treatment history of periodontal disease, family history of diabetes, frequency of dental care visit, dental cleaning like brushing teeth.

A full-mouth periodontal examination was performed on all study participants, and at six sites per tooth, measurements were taken. The clinical measures of periodontal conditions consisted clinical attachment loss (CAL), probing depth (PD), bleeding on probing (BOP), and gingival recession were taken.

BOP was recorded while probing to the base of the sulcus, six surfaces per tooth, and is expressed as the percentage of bleeding sites over the total tooth surfaces.

Gingival recession was recorded as the distance from the cemento-enamel junction to the gingival margin in millimeters.

Simplified oral hygiene index was recorded to assess the oral health status of the cases and controls.

To assess the simplified oral hygiene index, each of the six preselected teeth was examined first for debris and then for calculus. The criteria for scoring for each tooth surface was same as that described by John C. Green and Jack R. Vermillion (JADA 1964).

All periodontal measurements were performed by a single examiner, to eliminate inter-examiner variability. Before the commencement of examination; this dentist was calibrated on five volunteer patients by an experienced periodontist as the standard examiner. There is no universally accepted standard for periodontal disease diagnosis. In such previous studies on periodontal disease and pregnancy outcomes, criteria that combined PD and CAL over a certain threshold, i.e., ≥ 4 mm have been used.

In addition, the criteria from the study by Offenbacher *et al.* was used in which mild periodontal disease was defined as any site with PD ≥ 4 mm and CAL ≥ 3 mm and severe periodontal disease as minimum four sites with PD ≥ 5 mm and four sites with CAL ≥ 3 mm.^[7]

Statistical analysis

Data collected was categorized and tabulated into Microsoft 2013 excel sheet and was subjected to statistical analysis using IBM SPSS software vs. 22 for windows (New York, USA) and tests for proportions and associations were performed using Chi-square test. Multivariate logistic regression analysis was performed to strengthen the results.

RESULTS

A total of ninety pregnant women participated in the study, which was designed to assess the relationship between periodontal disease and GDM. Out of these, thirty women were taken as cases with a history of GDM and remaining sixty women with no GDM were included as controls. The mean age of cases and controls was 27.83 ± 4.60 years and 30.48 ± 4.95 respectively. Similarly, the mean BMI for cases and controls was calculated and it was found to be 26.63 ± 1.35 and 24.92 ± 0.88 respectively [Table 1].

Further, Table 2 describe the characteristic of study subjects. In terms of oral hygiene habits, 15 out of 90 participants have a habit of brushing their teeth twice daily whereas 75 out of 90 participants brush their teeth once a day. Not even a single participant was found with the habit of not brushing her teeth. Significantly higher proportion of GDM group had a history of diabetes mellitus compared to the non-GDM group.

Simplified oral hygiene index was taken as a measure of oral health status of these women, and it was reported that out of total 90 participants 53 had a good oral hygiene whereas 33 of them had a fair score and only 4 had a poor oral hygiene. When assessed with respect to BOP, mean number of teeth with BOP was found to be 2.40 ± 0.49 and 2.15 ± 0.40 respectively for GDM and non-GDM ($P = 0.012$). In GDM patients, 70% of females were having periodontal disease whereas non-GDM patients 77% had periodontal disease. Hence, no significant association was found between GDM and periodontal disease ($P = 0.535$) [Figure 1].

Application of multivariate logistic regression analysis, only family diabetic history, and simplified oral hygiene index score was found to be significantly associated with GDM ($P = 0.50$ and $P = 0.009$, respectively) [Table 3].

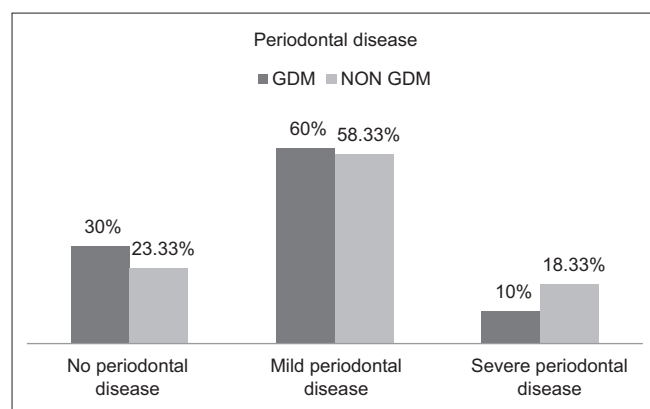


Figure 1: Comparisons of periodontal disease in gestational diabetes mellitus and non-gestational diabetes mellitus patients

Table 1: Characteristics of study subjects

Mean	GDM	Non-GDM
Mean age	27.83±4.60	30.48±4.95
Mean gestational age	27.46±1.83	27.90±1.52
Mean BMI	26.63±1.35	24.92±0.88

BMI=Body mass index, GDM=Gestational diabetes mellitus

Table 2: Periodontal disease measurements

Condition	GDM, n=30 (%)	Non-GDM, n=60 (%)	P
Brushing			
Once daily	18 (20)	57 (63)	0.001*
Twice daily	12 (13)	3 (4)	0.003*
Last dental visit			
Within 6 month	1 (1)	2 (2.2)	0.743
6-12 months	29 (32.3)	58 (64.5)	0.694
Family history of diabetes			
Present	22 (24.4)	11 (12.2)	0.001*
Education			
Educated	19 (21)	35 (38.9)	0.412
Uneducated	11 (12.3)	25 (27.8)	
Employment			
Employed	16 (17.8)	13 (14.5)	0.003*
Unemployed	14 (15.5)	47 (52.2)	
BOP			
Mean	2.40±0.49	2.15±0.40	0.012*
No BOP	0 (0)	1 (1.1)	0.045*
BOP in 1-2 teeth	18 (20)	49 (54.4)	0.021*
BOP in >3 teeth	12 (13.4)	10 (11.1)	0.062
Generalized recession			
Present	18 (20)	30 (33.3)	0.251
Periodontal disease			
No periodontal disease	9 (10)	14 (15.5)	0.535
Mild periodontal disease	18 (20)	35 (38.9)	0.296
Severe periodontal disease	3 (3.4)	11 (12.2)	0.532
OHI-S score			
Good	9 (10)	44 (48.9)	0.000*
Fair	17 (18.9)	16 (17.8)	
Poor	4 (4.4)	0	

*Statistically significant. Percentage mentioned under heading "family history of diabetes" and "generalized recession" may not add up to 100% because only positive finding had been reported. OHI-S=Simplified oral hygiene index, GDM=Gestational diabetes mellitus

Table 3: Logistic regression analysis of gestational diabetes mellitus

Independent variable	ODDS	P	95% CI	
			Lower	Upper
Educational status	2.810	0.094	1.27	3.58
Occupation status	2.628	0.105	0.63	4.20
Brushing	0.437	0.061	0.38	1.07
Last dental visit	0.001	0.973	0.79	1.02
Diabetic history	3.757	0.050*	1.24	5.2
BOP	3.670	0.160	2.24	4.2
Generalized recession	0.011	0.918	-0.46	1.03
Periodontal disease	0.451	0.798	0.01	1.22
OHI-S	9.325	0.009*	7.24	10.60

*Statistically significant. The dependent variable in this analysis is GDM so that 0=No GDM and 1=GDM. GDM=Gestational diabetes mellitus, OHI-S=Simplified oral hygiene index, CI=Confidence interval, BOP=Bleeding on probing, ODDS=Odds ratio

DISCUSSION

The present study was designed to study the association between periodontal disease and GDM in our population. A total of ninety pregnant women participated in this study, thirty were cases and remaining sixty women considered as controls with gestation age between 24 and 30 weeks.

The result of this study showed that periodontal disease is not associated with GDM with a $P=0.0535$. Mishra *et al.* conducted a study in 2014 and in their study they did not find any significant association between GDM and periodontal disease with generalized chronic periodontitis ($P=0.475$) and localized chronic periodontitis ($P=0.538$).^[8] Whereas Dasanayake *et al.* found an increased risk of periodontal disease in women with GDM when compared to women without GDM, but the increase did not reach any statistical significance.^[9]

Moreover, in the present study, BOP was found to be more in GDM patients and was statistically significant with a $P=0.045$. Same results were found in a study conducted by Xiong *et al.* who conducted a study on 53 cases and 106 controls at Woman's Hospital, Baton Rouge, USA and reported that the percentage of sites and number of sites involving BOP which are measures of gingivitis were relatively higher in cases as compared to controls. Both these studies support the hypothesis that gingivitis is associated with GDM.^[10]

Oral hygiene index simplified was also recorded in the present study and the results showed that 70% of cases had fair and poor score whereas only 26% of controls had a fair and poor score. These results were statically significant and showed a positive association between oral hygiene and GDM. Regarding GDM, 5 reports were analyzed; one report only involved women with GDM at 34–36th gestation weeks and was compared to a control group. The results of the study suggest that women with GDM were more prone to gingivitis as compared to healthy pregnant women, and the plaque accumulation can be the leading cause of gingival inflammatory condition.^[11] Another study was conducted in 2013 in which Bagis and Bostanci concluded that differences in GI and BOP were statistically significant, although the mean values of plaque index and PD values were higher in the case group, the differences were not statistically significant.^[12]

The presence of periodontal pockets can lead to more chances of harboring pathogenic microorganisms and may evoke a host response leading to a systemic effect.^[13] Periodontal treatment reduces local inflammation which in turn decreases the level of chemical mediators which are involved in inflammation to a below threshold level where the chemical mediators may evoke a response, among them, C-reactive protein and interleukin-6, positively contribute to glycemic control.^[14] The presence of

periodontal pockets was found to be linked with low-density lipoprotein (LDL)-cholesterol and total cholesterol. Knopp *et al.* reported that females with gestational diabetes had a higher level of triglyceride and lower levels of high-density lipoprotein concentration, whereas Koukkou *et al.* reported an increase in total triglyceride whereas LDL-cholesterol was less.^[15,16]

A study population in the present study may appear periodontally healthy compared to other study populations that examined such relationship of periodontal disease to adverse pregnancy outcome. This may be due to the education status as in our study population 63% of GDM women were educated whereas 58.33% of women with no GDM were educated, so awareness can be a reason for better oral health or may be due to socioeconomic status because, in previous studies, study sample was from a relatively low socioeconomic status.

A positive correlation was found between diabetic history of the family and simplifies oral hygiene index scores with GDM in the present study. Almost 70% of pregnant women with GDM had a family history of diabetes whereas in non-GDM patients only 18% had a family history of diabetes. Furthermore, it was observed that patients who were brushing once daily were 9.32 times more prone to develop GDM as compared to patients who brushed twice daily. Results of the study conducted by Mishra *et al.* also support the result of this study in the case of family history.

Periodontal disease is preventable and curable. In future studies, if periodontal disease is confirmed as a risk factor for GDM, this will open the doors to intervention studies. Before or during pregnancy, improving oral health and treating periodontal disease will not only reduce infant and maternal morbidity associated with GDM but will also prevent the risk of type 2 diabetes later in life.

CONCLUSION

Periodontal diseases are distributed worldwide representing a major oral health concern. Diabetes has been proved as a major risk factor for periodontitis. The physician and dentist should make a combined effort to encourage periodic assessment of the oral hygiene status and to educate the patients regarding the implications of poor oral health status on preterm deliveries and low birth weight deliveries even before pregnancy. Further, prospective controlled trials with a larger number of patients are warranted to establish these relationships; their etiology and the results that treating periodontal disease can positively reduce the burden of diabetes-related complications in life.

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Conflicts of interest

There are no conflicts of interest.

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