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Assessment of Periodontal Status during Pregnancy and Post-Partum: A Case-Control Study

Dr. Rajesh K S[1], Dr. Tazeen [2], Dr. Hridya Jayaprakash[3], Dr. Shashikanth Hegde[4], Dr. Arun Maiya[5]

[1]*(Professor, Department Of Periodontology, Yenepoya Dental College, Mangalore, Karnataka, India)*
[2]*(MDS, Private Practitioner, Qatar Prime Dental, Doha, Qatar)*
[3]*(Postgraduate, Department Of Periodontology, Yenepoya Dental College, Mangalore, Karnataka, India)*
[4]*(HOD & Professor, Department Of Periodontology, Yenepoya Dental College, Mangalore, Karnataka, India)*
[5]*(Professor, Department Of Periodontology, Yenepoya Dental College, Mangalore, Karnataka, India)*

Abstract: *Pregnancy has been shown to increase susceptibility to gingival inflammation. It is unclear whether pregnancy gingivitis proceeds to periodontitis .The aim of this study was to determine the severity of periodontal changes during pregnancy and post partum and to compare the findings with an age matched group of non - pregnant women .*

Methodology: 64 systemically healthy pregnant and non pregnant women were included. Pregnant women were examined at 12-14, 25-27, 34-38weeks of pregnancy and 4-6 weeks post-partum. Non -pregnant women were examined four times once per subsequent month. Plaque index, gingival index and community periodontal index was recorded.

Results: *In the pregnant group, bleeding on probing and periodontal pocket depth increased between second and third trimesters, decreased during post partum period. In the non-pregnant group, BOP and PPD decreased during the follow-up period. The results of the study showed that increased levels of estrogen and progesterone during pregnancy could give rise to a florid response to the effects of the oral deposits causing severe gingivitis. Hence the gingival changes during pregnancy are reversible and pregnancy gingivitis may not proceed to periodontitis.*

Keywords: *Gingivitis, Periodontitis, Post-partum, Pregnancy.*

I. Introduction

The oral health is an integral part of general health. Physiological conditions such as pregnancy, puberty, menstrual cycle, menopause and non physiological conditions such as hormonal contraception and hormonal therapy all influence women's oral health. Pregnant women have special oral health needs due to hormonal fluctuations which have a strong influence on the oral cavity. In 1874, Coles first described the prevalence of gingivitis in the pregnant women. Pure clinical observations suggested that gingiva was in some way influenced by pregnancy. In addition to generalized gingival changes, pregnancy may also cause a tumor like growth called "pregnancy tumor" or "epulis gravidarum" which may occur interproximally during the course of pregnancy and which usually regresses on its own after delivery. [1],[2]

Gingival changes usually occur in association with poor oral hygiene and local irritants. Although the bacterial flora of dental plaque is the main etiological factor in periodontal diseases the hormonal and vascular changes that accompany pregnancy often exaggerate the inflammatory response to the local irritants[1],[3],[4] .The gingival changes are often noticeable from the second month of gestation reaching a maximum in the eighth month. Others claim that the greatest increase in the severity of gingivitis occurs between the first and second trimesters. The severity of gingival disease is reduced after child birth [4] .There may be residual effect which may continue and ultimately lead to severe condition and loss of teeth. The periodontal changes such as pocket formation, increased tooth mobility and loss of attachment may lead to deterioration of oral health and loss of teeth.

The gingival and periodontal health assessment during the pregnancy has not received sufficient attention so far. The present study is undertaken to assess the gingival and periodontal tissue changes in pregnant and non pregnant women. An attempt is made to assess the severity of gingivitis & periodontitis during three trimesters of pregnancy and during postpartum.

II. Materials and Methods

A total of 64 systemically healthy subjects between the age group of 20- 40 years were recruited from outpatient Department of Periodontology Yenepoya Dental College & Department of Gynecology ,Yenepoya Medical College Hospital, Mangalore who gave consent to participate in the study.

The subjects were divided into two groups: The group 1 consisted of 32 pregnant women at an early phase of pregnancy (case) & group 2 consisted on 32 non-pregnant women (control). Ethical clearance for the study was obtained from the institutional ethical committee of Yenepoya University .Subjects with 10±1 week of pregnancy ,patients with mild to moderate periodontitis (pocket depth 4-6mm) and those who had not undergone any periodontal therapy from last six months were included in the study. Subjects using systemic, topical antimicrobial, anti-inflammatory therapy within previous 3months, history of systemic disease, smoking or with severe periodontitis (pocket depth >6mm) were excluded from the study.

Pregnant women were examined at the following intervals: Examination 1: At 12-14weeks, Examination 2: At 25-27weeks, Examination 3: At 34-38weeks of pregnancy, Examination 4: At 4-6 weeks post partum. Non pregnant women were examined four times once per subsequent month. Each visit was scheduled around the same time of subject's menstrual cycle excluding the menstruation days. Subjects received general oral hygiene instructions & were instructed not to rinse or brush with any anti microbial compound, such as chlorhexidine or triclosan. They were also recommended to use regular tooth paste and tooth brush during study period.

The clinical examination and an interview was carried out .Plaque Index (PI) (Silness P. & Loe H. 1964), Gingival index (GI) (Loe H and Silness P (1963)), Community Periodontal Index (CPI), Loss of attachment were recorded.

III. Statistical Analysis

Friedman test was performed for statistical analysis within the groups. Wilcoxan signed rank test was done to compare the difference between the follow up visits. Mann-Whitney test was used for comparison between the groups. p value <0.05 was considered statistically significant.

IV. Results

The present study was conducted at Yenepoya Dental and Medical Hospital, Mangalore among 64 patients to assess the periodontal changes during pregnancy and post-partum. The number of subjects in the case and control group was 32 each with a mean age of 27.69 years and 26.53 years respectively. Majority of the subjects in the case group 22 and control group 26 brushed their teeth with tooth brush and tooth paste and others brushed their teeth with tooth powder and fingers, neem stick and charcoal for cleaning their teeth. Most of the subjects both in case group 24 and controls 21 cleaned their teeth once daily. The various clinical parameters were assessed in both the study groups at different time intervals.

IV.1Plaque index scores

In the first trimester, second trimester and third trimester the mean plaque score of the subjects in the case group were 0.841, 1.203 and 1.496 respectively. In the controls the mean plaque score was 1.541, 1.078 and 0.844 during the first, second and third trimesters respectively. During post partum the mean plaque score of the subjects in the case group and control group was 0.694 and 0.813 respectively. The Friedman test value for the case & control group in all the trimesters and post partum was highly significant (Table 1).

Table 1: Distribution of plaque index score in case & control group

Group	Plaque score	N	Minimum	Maximum	Mean	Std. Deviation	Median	Friedman Test Value	d.f	p value
Case	1st	32	.5	2.0	.841	.3068	.800	44.295	3	p<0.0001
	2nd	32	.5	2.0	1.203	.4631	1.050			HS
	3rd	32	.3	2.3	1.496	.7745	2.000			
	postpartum	32	.3	1.3	.694	.2382	.700			
Control	1st	32	.8	2.5	1.541	.4264	1.500	66.616	3	p<0.0001
	2nd	32	.5	1.8	1.078	.3190	1.000			HS
	3rd	32	.5	1.8	.844	.2770	.950			
	4th	32	.3	1.8	.813	.4014	.800			

IV.1.1Comparison of mean plaque index score within the case and control groups in various trimesters and postpartum

In the case group, when the 1st trimester was compared with the 2nd trimester, 3rd trimester & post partum the Z value was 4.03, 3.34, 2.63 and p values were was also statistically significant. In the control group, when the 1st month was compared to the 2nd , 3rd & 4th month the Z value was 4.39, 4.56, 4.57 and the p value <0.0001, <0.001, < 0.0001 respectively which was statistically highly significant.

In the case group, when the 2nd trimester was compared with the 3rd trimester the Z value was not statistically significant and when compared to post partum it was statistically highly significant. In the control group, when the 2nd month was compared with the 3rd and 4th month the Z value were statistically significant (Table 2).

Table 2: Comparison of mean plaque index score within the case and control groups in various trimesters and postpartum.

	Group			Wilcoxon Signed Ranks Test Z value	p value	
Plaque score	Case	1st	2nd	4.03	p<0.0001	HS
			3rd	3.34	.001	sig
			postpartum	2.63	.008	sig
		2nd	3rd	2.39	.017	NS
			postpartum	4.79	p<0.0001	HS
		3rd	postpartum	4.38	p<0.0001	HS
	Control	1st	2nd	4.39	p<0.0001	HS
			3rd	4.56	p<0.0001	HS
			4^{th}	4.57	p<0.0001	HS
		2nd	3rd	3.60	p<0.0001	HS
			4th	2.99	.003	sig
		3rd	4th	.81	.421	NS

IV.2 Gingival Index score

The mean gingival index score in the case group was 1.100, 1.834, 2.122 and 1.006 during first trimester, second trimester, third trimester and post partum respectively. The Friedman test value was statistically highly significant. The mean gingival index score in the control group was 1.869, 1.319, 1.119 and 1.022 during first trimester, second trimester, third trimester and post partum respectively. The Friedman test value was 70.447, p value was <0.0001 which is statistically highly significant (Table 3).

Table 3: Distribution of case and control groups as per the gingival index score

	Group		N	Minimum	Maximum	Mean	Std. Deviation	Median	Friedman Test Value	d.f	p value
gingival score	Case	1st	32	.6	2.0	1.100	.2712	1.000	84.505	3	p<0.0001
		2nd	32	1.3	2.3	1.834	.2509	2.000			HS
		3rd	32	1.5	2.5	2.122	.1862	2.100			
		Postpartum/4^{th}	32	.5	2.1	1.006	.3555	1.000			
	Control	1st	32	1.0	2.5	1.869	.3364	1.950	70.447	3	p<0.0001
		2nd	32	.8	1.8	1.319	.3514	1.300			HS
		3rd	32	.5	1.8	1.119	.4123	1.000			
		Postpartum/4^{th}	32	.3	1.8	1.022	.5034	1.000			

4.2.1Comparison of mean gingival index score within the case and control groups in various trimester and postpartum

In the case group, when the 1st trimester was compared to the 2nd, 3rd trimester, the Z value was statistically highly significant. But when compared to post partum the Z value was statistically not significant. In case group, when 2nd trimester was compared to the 3rd trimester, the Z value was statistically highly significant. In case group, when the 3rd trimester was compared with post partum, the Z value is also statistically highly significant.

In control group, when the 1st month was compared to the 2nd, 3rd, 4th months the Z value was statistically highly significant. In control group, when 2nd month was compared to the 3rd month, the Z value was statistically significant. But when the 3rd month was compared to the fourth month the Z value was not statistically significant (Table 4).

Table 4: Comparison of mean gingival index score within the case and control groups in various trimesters and postpartum

	Group			Wilcoxon Signed Ranks Test Z value	p value	
Gingival score	Case	1st	2nd	4.95	p<0.0001	HS
			3rd	4.88	p<0.0001	HS
			Postpartum	2.10	.036	NS
		2nd	3rd	4.14	p<0.0001	HS
			Postpartum	4.94	p<0.0001	HS
		3rd	Postpartum	4.96	p<0.0001	HS
	Control	1st	2nd	4.79	p<0.0001	HS
			3rd	4.79	p<0.0001	HS
			4th	4.79	p<0.0001	HS
		2nd	3rd	3.21	.001	sig
			4th	3.07	.002	sig
		3rd	4th	1.96	.050	NS

IV.3 Community periodontal index scores

In the case group the CPI score 3 was maximum during 1st trimester, 2nd trimester, 3rd trimester and post partum when compared with CP1score 2 and 4 .The Friedman test value was statistically highly significant (Table 5).

Table 5: Distribution of community periodontal index scores between various trimesters and postpartum in the case groups

			Period			
Group			1st	2nd	3rd	Postpartum
Case	CPI	2	0	1	0	25
			.0%	3.1%	.0%	78.1%
		3	32	31	15	7
			100.0%	96.9%	46.9%	21.9%
		4	0	0	17	0
			.0%	.0%	53.1%	.0%
	Total		32	32	32	32
			100.0%	100.0%	100.0%	100.0%

In the control group, the CPI score 1 was 0, 7, 9 and 12 during the 1st, 2nd, 3rd and 4th month. The CPI score 2 was 0, 11, 15 and 7 during the 1st, 2nd, 3rd and 4th month. The CPI score 3 during first month was 30, 14, 8 and 4 during the 1st, 2nd, 3rd and 4th month. The CPI score 4 during first month was 2, 0, 0 and 0 during the 1st, 2nd, 3rd and 4th month. The Friedman test with p value <0.0001 was statistically highly significant. (Table 6)

Table 6: Distribution of community periodontal index scores between various trimesters and postpartum in the control groups

			Period			
Group			1st	2nd	3rd	4th
Control	CPI	1	0	7	9	12
			.0%	21.9%	28.1%	37.5%
		2	0	11	15	16
			.0%	34.4%	46.9%	50.0%
		3	30	14	8	4
			93.8%	43.8%	25.0%	12.5%
		4	2	0	0	0
			6.3%	.0%	.0%	.0%
	Total		32	32	32	32
			100.0%	100.0%	100.0%	100.0%

IV.3.1Comparison of community periodontal index scores distribution in the various trimesters and postpartum between the case and control groups

The CPI score 1 increased during 2nd trimester, 3rd trimester and post partum in both case and control groups. The CPI score 2 also followed a similar trend. The CPI score 3 was 32 and 30, 31 and 14, 15 and 8 and 7 and 14 in the case and control group during 1st trimester, 2nd trimester, 3rd trimester and post partum respectively. The CPI score 4 was maximum during 2 nd trimester in case group. (Table 7)

Table 7: Comparison of community periodontal index score distribution in various trimesters and postpartum between the case and control groups

		Period							
		1st		2nd		3rd		Postpartum/4th	
		Case	Control	Case	Control	Case	Control	Case	Control
CPI	1	0	0	0	7	0	9	0	12
		.0%	.0%	.0%	21.9%	.0%	28.1%	.0%	37.5%
	2	0	0	1	11	0	15	25	16
		.0%	.0%	3.1%	34.4%	.0%	46.9%	78.1%	50.0%
	3	32	30	31	14	15	8	7	4
		100.0%	93.8%	96.9%	43.8%	46.9%	25.0%	21.9%	12.5%
	4	0	2	0	0	17	0	0	0
		.0%	6.3%	.0%	.0%	53.1%	.0%	.0%	.0%
Total		32	32	32	32	32	32	32	32
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The Mann-Whitney U Z value for CPI score during 1st trimester between case and control group was not statistically significant. The CPI score between case & control during 2nd, 3rd trimester & post partum were 4.61, 6.33, 3.12 with p value <0.0001, <0.0001, 0.002 respectively which is statistically highly significant (Table 8).

Table 8: Significance of community periodontal index scores in between the case and control group

	Mann-Whitney U Z value	p value	
CPI 1st	1.43	.154	NS
CPI 2nd	4.61	p<0.0001	HS
CPI 3rd	6.33	p<0.0001	HS
CPI postpartum/4th	3.12	.002	HS

V. Discussion

A loss of tooth for every pregnancy is a "popular notion" attracting the attention of everyone concerned. [2]. Abundant literature and studies are available regarding the changes in gingival and periodontal health during pregnancy. The inflammation, swelling, bleeding gums, bad breath and loose teeth are common features noticed. Whether these are normal physiological features or conditioned by the presence of soft and hard deposits or associated with hormonal changes during pregnancy has to be known.

Silness & Loe reported in their cross-sectional study that the plaque index increased from the second month to the eighth month of pregnancy, which is in confirmatory with our study [5]. In contrast, in an experimental study by Raber-Durlacher et al, the plaque index appeared to be nearly identical at all phases during pregnancy & post-partum. Most women in the pregnant group reported that tooth brushing was nearly impossible, especially in premolar & molar areas because of the pregnancy-related nausea [6]. Taani et al reported a significant connection between pregnancy-related vomiting & increased gingival inflammation in their cross-sectional study, & speculated that the main reason for this was impaired capability for proper brushing [7]. Similar findings were observed in the present study.

There is gradual increase of gingivitis as the pregnancy advances until the parturition. The results of the present study revealed that more pregnant women exhibited significantly higher levels of gingivitis than the non pregnant women. There was a progressive increase in the gingival inflammation as the pregnancy advanced. After parturition gingivitis seems to gradually decrease, such observation has been reported by Loe H, Loe and Silness [8], Hugoson [9], O' Neil [10] .However the severity of gingivitis was reduced after parturition and similar to that in early pregnancy implying incomplete resolution even after child birth .Cohen et al [11] , Ravi Verma and Peter Sequeira [12], Soori [13], Tilakaratne et al [14] observed that pregnancy did not affect periodontal changes. They contend that elevated levels of hormones during nine months period was insufficient to cause significant periodontal breakdown. However, the existence of periodontal inflammation in pregnancy cannot be totally ruled out.

Samant et al in their cross sectional study found that, in the pregnant group, the increased mean BOP values (≥ 30%) during pregnancy were associated with the simultaneous, considerable increase in PPD. Furthermore, the decrease in mean BOP values (≤20%) during post-partum was associated with diminished

prevalence of periodontal pockets [15]. These results are in agreement with earlier studies by Lang & colleagues the only difference was that in the present study we did not find any correlation between gingival bleeding & CAL [16]. Periodontal pocket depths significantly increase during pregnancy & decrease at the end of pregnancy or after parturition.[8], [17], [15]. Miyazaki H et al found that the percentage of pregnant women having 4mm or deeper periodontal pockets increased with the month of pregnancy, reached a maximum in the 8th month & recovered to the control level in the 9th month. He concluded that the increase in pocket depth during pregnancy is caused by enlargement of gingival tissue rather than periodontal destruction [18].

In the present study it is also evident that there is strong correlation of plaque score and gingival score. It has been fairly well established that gingivitis in pregnancy is due to hormonal changes. Accumulation of dental plaque in association with gingivitis can be a precipitating factor in the production of pathologic changes. Further, Arafat [17], Silness and Loe [5], Hartzer et al [19] argued that the gingivitis in pregnancy is due to decreased antibody activity against the streptococcus mitis antigens. This phenomenon maybe responsible for enhanced pathogenicity of omnipresent microorganisms. Cohen DW observed that calculus score increased from 1st trimester to 3 rd trimester [11]. Studies conducted by Arafat et al [17] and Peter Sequeira [12] found calculus scores to increase among pregnant women as the pregnancy advanced and higher are the gingival and periodontal scores. The physiological hormonal changes during pregnancy are considered as a predisposing factor for gingival and periodontal changes among pregnant women. Our study also suggests a positive correlation between the increasing plaque, calculus and gingival scores. The studies of Steinberg [2] and Harry[1] revealed that hormonal and vascular changes are normal physiological changes that accompany pregnancy and often exaggerate the inflammatory response to irritants such as plaque and calculus.

Nonetheless, it is still unclear whether pregnancy affects periodontal attachment levels or not, mainly because in most studies carried out on pregnant women the clinical attachment level measurements were not included in the study protocol. Certain levels of periodontal attachment loss, which do not completely revert after delivery, may occur [11]. Our study suggests that pregnancy does not necessarily result in irreversible periodontal breakdown but in reversible gingivitis without any loss of periodontal attachment. Machuca et al states that during pregnancy there are alterations in psychology and behavior with the tendency towards lack of personal care. Further systemic health, social and cultural characteristics, educational levels and previous periodontal maintenance are some of the significant factors which can lead to exaggerated gingivitis during pregnancy [20]. It was clear that poor oral hygiene & accumulation of plaque leads to possible development of periodontal lesion & confirmed that gingivitis is the principal clinical manifestation of periodontal disease in pregnant women. It is said that the hyperdynamic circulation, hormonal changes and behavioral changes towards oral hygiene maintenance might create a complex and conducive oral environment among pregnant women resulting in gingivitis and related problems. Further systematic research is required to discern the exact role of several etiologic factors associated with pregnancy related gingival and periodontal changes. One potential explanation could be due to elevated levels of circulating oestrogen & progesterone. Elevated circulating progesterone levels have been suggested to contribute to enhanced gingival vascular permeability resulting in enhanced gingival exudates [21],[9]. Sex hormones, especially progesterone but also oestradiol in higher concentrations, can increase the prostaglandin E2 production by lipopolysaccharide stimulated human monocytes which is considered to increase the inflammatory reaction [22]. Furthermore, a defensive neutrophil chemotactic responsiveness can be disturbed by elevated progesterone levels [3].

The levels of MMP-9 (gelatinase B) among pregnant women were found to be consistent & stable during pregnancy, & also that the degree of activation of pro-MMP-9 remains unchanged, supporting the conjecture that the periodontium of pregnant women was affected by gingivitis but hardly by periodontitis [23],[24].

VI. Conclusion

It is pertinent to note the belief that loss of teeth due to pregnancy has not gained support for lack of enough scientific data. In spite of some evidence of periodontitis in the present study, conclusive evidence could not be gathered for association between pregnancy and tooth loss as the prevalence of periodontitis was less. The role of plaque and calculus in producing gingivitis in pregnant women was established in our study indicating poor oral hygiene maintenance or the influence of hormones in exaggerating the level of gingivitis.

Following conclusions were drawn:

1. Severity of gingivitis progressively increased from 1st trimester to 3 rd trimester among pregnant women and decreased during postpartum period. Number of pregnant women with severe gingivitis was maximum in the 3 rd trimester of pregnancy.

2. There was an appreciable increase in the plaque score and calculus deposits among pregnant women as pregnancy advanced compared to non pregnant women.

3. A strong positive correlation was seen between gingival index and oral deposits.

4. Lack of periodontal maintenance is directly related to the accumulation of bacterial plaque, which may result in gingival bleeding & periodontal inflammation.
5. Changes in clinical parameters during pregnancy are reversible, indicating that pregnancy gingivitis may not predispose or proceed to periodontitis.
The gingival and periodontal diseases during pregnancy are well preventable. In pregnancy, the emphasis should be on preventing the disease before it becomes worse.

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