

Comparison of the Inflammatory Response to Periodontal Treatment in Pre and Postmenopausal Women

Jammula Surya Prasanna, Chinta Sumadhura

Department of Periodontics,
Panineeya Institute of Dental
Sciences and Research
Centre, Dilsuck Nagar,
Hyderabad, Telangana, India

ABSTRACT

Context: Menopause is an overall increase in body's response to inflammation. Periodontium is no such exception leads to periodontitis, tooth loss may occur if not treated timely. Pre and postmenopausal conditions are more or less critical for inflammatory changes. This study aimed to determine both conditions which one was oppressive? and which reciprocated more to scaling?

Materials and Methods: This is a cross-sectional interventional study. Sixty female subjects aged between 40 and 50 years with periodontitis were recruited. Equated into two groups of 30 patients each, Group I being premenopausal and Group II postmenopausal women. Plaque Index, Periodontal Index (PDI), and Sulcular Bleeding Index were compared at baseline and 3 months after scaling. IBM SPSS version 21 software was used. An independent sample *t*-test was applied for percentage decrement and intergroup comparison with paired *t*-test.

Results: Significant reduction in all the above parameters in both the groups was noted based on intragroup comparison from baseline to 3 months ($P < 0.001$). However, the intergroup showed no significance except PDI at baseline.

Conclusions: There was a remarkable effect of scaling on inflammatory conditions such as menopause and periodontitis. If women undergo periodontal therapy in premenopause stage, it can prevent future aggressive inflammatory changes in the postmenopausal stage.

KEYWORDS: *Gingivitis, inflammation, menopause, periodontitis, scaling*

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INTRODUCTION

The menopausal transition leading to postmenopause is not a disease or disorder but a natural process as a result of the diminution of ovarian reserves because of aging. Even though it is a natural process, it influences the systemic and oral health manifestations. As a sequel of menopause, salivary flow as well as sex steroidal hormones dwindle slowly and eventually affect the periodontal and other oral structures leading to chronic inflammation of the gingiva concurrently causing periodontitis.^[1]

Gingivitis is a nondestructive type of periodontal disease, commonly occurring because of the accumulation of bacterial plaque in and around the teeth. This is characterized by the propensity of bleeding on provocation. If it is not attended in early stages, it might develop into an advanced stage called periodontitis,

which is typically characterized by destruction of underlying connective tissue and bone loss, ultimately leading to tooth loss.^[2] Conjointly, along with plaque, many other factors also influence the provocation of the inflammation; depletion of hormonal balance in menopause state is one among them.^[3]

Several studies reported that an interlink existed between menopause and increased inflammation and progression of bone loss.^[4,5] A few more studies explored the difference in the intensity of inflammation in pre and postmenopause.^[6,7] To substantiate this statement,

Address for correspondence: Dr. Jammula Surya Prasanna,
Department of Periodontics, Panineeya Institute of
Dental Sciences and Research Centre, Dilsuck Nagar,
Hyderabad – 500 060, Telangana, India.
E-mail: surya.prasanna@yahoo.com

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some studies specified that resolution of the gingival inflammation was seen after scaling,^[2,8] but the opinions are still in dilemma. The formulated hypothesis of this study was that the severity of inflammation and its response to treatment might be the same or no change in both groups. Hence, this study was aimed to assess the severity of inflammation in both pre and postmenopausal women with periodontitis by comparing periodontal and bleeding indices along with pre and postoperative response to treatment.

MATERIALS AND METHODS

This cross-sectional study was completed in the Department of Periodontology. Sixty female subjects aged between 40 and 50 years were examined in this study. The sample size was predicted by setting α value at 0.05 and power to 80% ($1-\beta = 0.8$). The lowest sample size recommended for this was 46. To make the results of this pioneer research stable, the sample size was increased to 60. All these patients meeting the selection criteria were sequentially recruited from January 2019 to August 2019, and this was a 3 months follow up study. The study design was explained to all the subjects and obtained informed consent before the procedure was carried out. World Medical Association Declaration of Helsinki^[9] consonance was followed throughout the study. Prior approval was taken for this study from the institutional ethical committee (No. 0006) and was also registered under clinical trial (<https://clinicaltrials.gov>; NCT02357745). The complete study was executed by a single physician. Patients were categorized into two groups after confirming the menstrual status by a gynecologist. Periodontitis patients were enlisted based on the 2017 American Academy of Periodontology classification.^[10] Fulfilling all the criteria, allotted subjects were categorized into two groups, 30 in each group. Group I consisted of 30 premenopausal women with chronic periodontitis, whereas Group II had 30 postmenopausal women with chronic periodontitis.

Inclusion criteria: 1) Subjects with chronic moderate periodontitis pocket depth ≥ 4 mm or loss of attachment ≥ 3 mm. 2) Minimum 15 natural teeth remaining. 3) Nonsmokers. 4) Naturally occurred menopausal stage women were only considered. And 5) Systemically healthy from preceding 6 months.

Exclusion criteria: 1) Present or past smokers. 2) Oral pathological conditions or tumors. 3) Patients on long-term steroid medication and if using any other medications for any other systemic diseases. 4) Subjected to Hormone therapy. 5) Patients who underwent any dental treatment in the past 6 months. And 6) Any systemic conditions or any medications that affect the

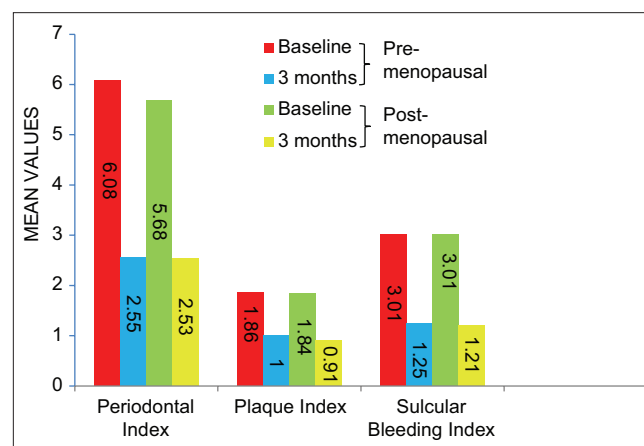
periodontal status were eliminated from the study. A total of 60 patients were examined at baseline and 3 months intervals before and after scaling to compare the indices, Plaque Index (PI),^[11] Periodontal Index (PDI),^[11] and Sulcular Bleeding Index (SBI).^[12] University of North Carolina-15 probe (UNC-15, Hu-Friedy, USA) was used for measurements. Patient selection criteria was explained in [Figure 1]. Strict instructions were given to not rinse with mouthwash on the day of examination. The primary outcome measured was inflammatory changes by SBI and secondary outcomes measured were plaque and periodontitis changes.

RESULTS

IBM SPSS version 21 software was used for statistics. Intergroup correlation and percentage reduction were completed using an independent sample *t*-test and paired *t*-test for intragroup. $P < 0.05$ is considered to be statistically significant. The group (Intra) correlation has shown significant P value ($P < 0.001$) in both groups in all parameters. The mean values of PDI, PI, and SBI in the premenopausal groups at baseline was 6.08 ± 0.46 , 1.86 ± 0.24 , and 3.01 ± 0.27 and for postmenopause 5.68 ± 0.64 , 1.84 ± 0.17 , and 3.01 ± 0.21 , reciprocally. At 3 months, premenopause values were 2.55 ± 0.12 , 1.86 ± 0.24 , and 1.21 ± 0.13 and postmenopause 2.53 ± 0.13 , 0.91 ± 0.13 , and 1.21 ± 0.13 , respectively [Table 1]. When the changes from baseline to 3 months in both the groups were compared, only PDI has shown a significant reduction from premenopause 3.53 ± 0.46 to postmenopause 3.14 ± 0.64 : the significant reduction was 0.009 [Table 2 and Graph 1].

DISCUSSION

Every woman experiences definite hormonal disproportion in life starting from puberty to menopause. This is a



Graph 1: Comparison of all the parameters in between two groups

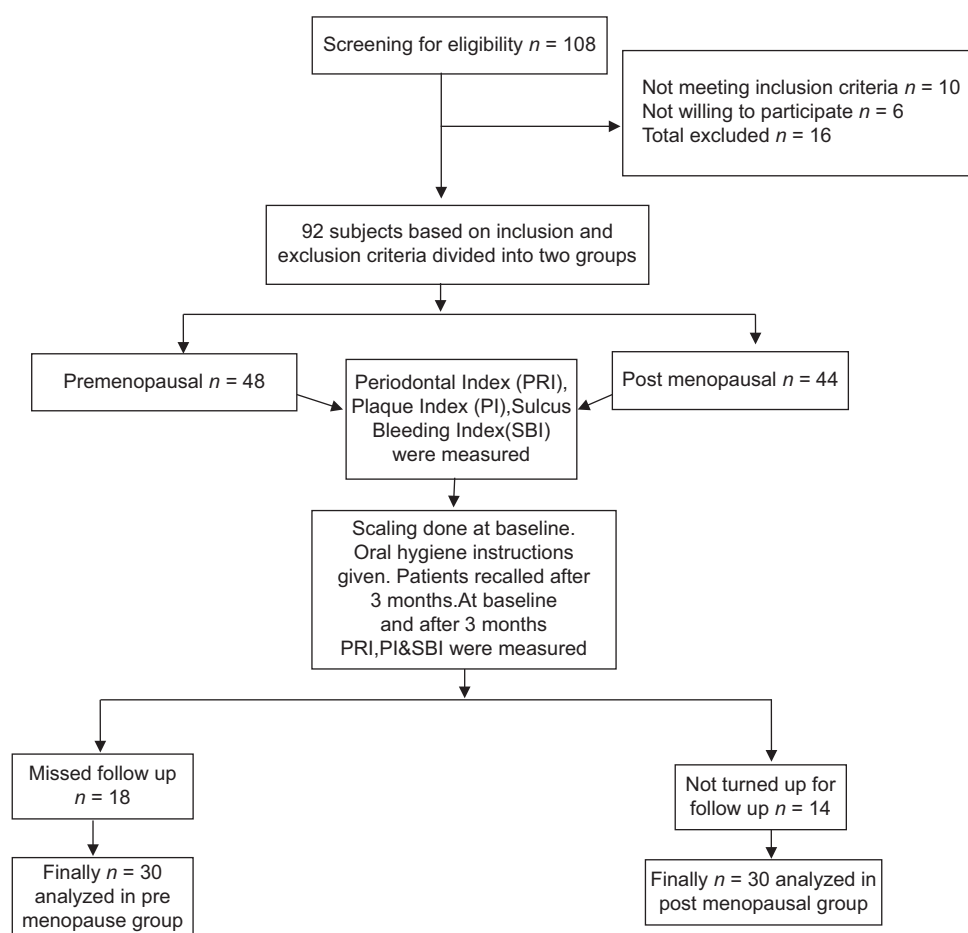


Figure 1: Selection criteria of patients and study design

turning point for physical, emotional, and psychological changes in a woman's life where the activity of ovarian follicle is ceased, resulting in hormonal deficiency. This leads to various systemic diseases apart from vascular diseases. Recent studies have shown to have a positive correlation of menopause with inflammation, because of an increase in pro-inflammatory cytokines, such as interleukin (IL)-1, IL-6 or tumor necrosis factor α (TNF- α), etc. Concurrently, anti-inflammatory cytokines are immunoregulatory molecules that control pro-inflammatory cytokine response and activity, but the relationship of these cytokines with menopause is not yet clearly understood.^[7,13]

Menopause affects one's physical condition, particularly the condition of the oral cavity. Many inflammatory changes occur in the oral cavity; periodontitis is one among them and is a very severe form of the inflammatory condition. The incidence increases with age. This could be because of the biological and hormonal changes that occur in the body. Sex steroid hormones play a lead role in affecting the immune system, making the individuals susceptible to periodontitis. Research has proven that these variations are more severe in the premenopausal

stage than postmenopause.^[14] Hormone deficiencies in menopause stage worsen the clinical signs and symptoms of gingiva, such as thinning of gingival epithelium or atrophic and inflammatory changes that lead to bleeding of the gingiva. The severity increases with alteration in the salivary flow rate.^[15]

There is a downturn in estrogen secretion, triggering inflammation during menopausal transitional stages. Because of this process, pro-inflammatory cytokines increase in number in view of this further diminution of physical functions. Periodontium is composed of high expression of estrogen receptors, thus pre and postmenopausal hormonal inequality significantly affect the periodontium.^[16] Estrogen insufficiencies directly hamper the osteoclastic activity that is further responsible for the reduction of bone height in postmenopausal women.^[17,18]

In this study within the groups (intra), comparison found statically significant results in all the parameters from baseline to 3 months in both the groups. PDI, PI, and SBI all showed significant values $P < 0.001$. But when they were compared among pre and postmenopausal

Table 1: Intra group comparison at baseline and three months

	<i>n</i>	Mean	SD	Mean Difference (95% CI)	<i>t</i>	df	<i>P</i>
Premenopause							
PDI							
Baseline	30	6.08	0.46	3.53 (3.36, 3.70)	42.29	29	<0.001*
3 months	30	2.55	0.12				
PI							
Baseline	30	1.86	0.24	0.86 (0.76, 0.97)	16.55	29	<0.001*
3 months	30	1.00	0.24				
SBI							
Baseline	30	3.01	0.27	1.76 (1.58, 1.94)	20.22	29	<0.001*
3 months	30	1.21	0.13				
Postmenopause							
PDI							
Baseline	30	5.68	0.64	3.14 (2.90, 3.38)	26.91	29	<0.001*
3 months	30	2.53	0.13				
PI							
Baseline	30	1.84	0.17	0.93 (0.87, 0.99)	32.20	29	<0.001*
3 months	30	0.91	0.13				
SBI							
Baseline	30	3.01	0.21	1.80 (1.72, 1.88)	45.43	29	<0.001*
3 months	30	1.21	0.13				

NS = Not significant, *n*= No of patients, SD= Standard Deviation, CI= Confidence Intervals, df= Degrees of freedom; *t*= *t*-score; *P*= Probability or population proportion, PI= Plaque Index, SBI= Sulcular Bleeding Index, PDI= Periodontal Index. Paired *t* test; **P* <0.05 statistically significant, *P* >0.05 statistically significant

groups (inter), only PDI showed significant results 0.007. This was solely at the baseline, and at 3 months, it was not significant. Change from baseline to 3 months in between groups also only showed significant PDI co-relation 0.009. The remaining two parameters PI and SBI have no significant correlation. This indicates that periodontitis was in a severe form in premenopause compared to postmenopause. Many studies had correlated inflammatory markers in pre and postmenopausal conditions, but none of the studies correlated these clinical parameters with periodontitis.

These study results were consistent with the study done by Alves *et al.*,^[4] intergroup comparison for PI that showed the non-significant difference (*P* > 0.376), indicating that menopause does not have any direct correlation with plaque formation. These results were also analogous with the study by Alves *et al.*^[4]; intergroup comparisons for the gingival index had also shown an insignificant difference (*P* > 0.161). In this study, SBI was also not significant. When compared to inflammatory cytokines in between menopause stages, there was a difference between pre and postmenopause.^[7] Even though the systemic inflammatory cytokines and inflammatory markers differ in pre and postmenopause, SBI was not significant in this study. This might be because the systemic cytokine changes that are not as influential as local factors on gingival bleeding. The systemic influence of menopause might be masked

because of the persuasive effect of the local factors. There is not much literature review comparing the same type of clinical parameters related to this study, therefore, unable to give a much-related reference.

Limitations of this study, menopause duration were not standardized.

This study concluded that there is a correlation between menopause and periodontitis, but the underlying mechanism was still unclear. A conflict of opinions exists about the relation. The findings of this study suggested that when periodontal parameters such as PDI, PI, and SBI are compared in pre and postmenopausal women, significant variations divulged from baseline to 3 months after scaling. But compared between the two groups, only PDI showed significance at baseline, and PI and SBI had no significance. This suggests that menopause may have no correlation with plaque formation and sulcus bleeding. In addition, it is indicative that periodontitis is significantly more in the premenopause group. Because of a multitude of risk factors involved, it is very difficult to establish the correlation between these two conditions. Further longitudinal studies with molecular correlation might be beneficial.

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Table 2: Changes from base line to 3 months in both the groups

	<i>n</i>	Mean	SD	Mean Difference (95% CI)	<i>t</i>	df	<i>P</i>
Baseline							
PDI							
Pre meno	30	6.08	0.46	0.40 (0.11, 0.69)	2.79	58	0.007*
Post meno	30	5.68	0.64				
PI							
Pre meno	30	1.86	0.24	0.02 (-0.09, 0.13)	0.37	58	0.71 (NS)
Post meno	30	1.84	0.17				
SBI							
Pre meno	30	3.01	0.27	0.001 (-0.12, 0.13)	0.02	58	0.98 (NS)
Post meno	30	3.01	0.21				
Three months							
PDI							
Pre meno	30	2.55	0.12	0.01 (-0.05, 0.08)	0.38	58	0.70 (NS)
Post meno	30	2.53	0.13				
PI							
Pre meno	30	1.00	0.24	0.09 (-0.01, 0.19)	1.82	58	0.07 (NS)
Post meno	30	0.91	0.13				
SBI							
Pre meno	30	1.25	0.27	0.04 (-0.07, 0.15)	0.72	58	0.47 (NS)
Post meno	30	1.21	0.13				
Change from baseline to 3 months							
PDI							
Pre meno	30	3.53	0.46	0.39 (0.10, 0.68)	2.71	58	0.009*
Post meno	30	3.14	0.64				
PI							
Pre meno	30	0.86	0.29	-0.07 (-0.19, 0.05)	-1.18	58	0.24 (NS)
Post meno	30	0.93	0.16				
SBI							
Pre meno	30	1.76	0.48	-0.04 (-0.23, 0.15)	-0.40	58	0.68 (NS)
Post meno	30	1.80	0.22				

NS=Not significant, *n* = No of patients, SD= Standard Deviation, CI= Confidence Intervals, df= Degrees of freedom; *t*= *t*-score; *P*= Probability or population proportion, PI= Plaque Index, SBI= Sulcular Bleeding Index, PDI= Periodontal Index. Independent sample *t* test; **P* < 0.05 statistically significant, *P* > 0.05 statistically significant, NS,

Ethics approval statement

Submitted.

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Conflicts of interest

There are no conflicts of interest.

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