



ijcrr

Vol 04 issue 12

Category: Research

Received on:20/05/12

Revised on:24/05/12

Accepted on:27/05/12

CORRELATION OF PERIODONTAL DISEASE SEVERITY WITH RHEUMATOID DISEASE ACTIVITY AMONG RHEUMATOID ARTHRITIS PATIENTS IN CHENNAI: A CROSS SECTIONAL STUDY

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ABSTRACT

Aim: The current study aims to determine whether there is a relationship between Rheumatoid arthritis disease activity and severity of chronic periodontitis in the study population. **Methods:** 100 patients aged 20-70 years, diagnosed with Rheumatoid arthritis and Chronic periodontitis were selected for the study. The rheumatoid disease activity was assessed using DAS 28 and severity of periodontitis was classified based on clinical attachment loss. Physical disability was elicited using Indian Health Assessment Questionnaire and Oral hygiene status was measured using Oral Hygiene Index. **Results:** Among the 100 Rheumatoid Arthritis patients with periodontitis, 11 were males (11%) and 89 were females (89%). Rheumatoid disease activity showed no correlation with periodontal disease severity (r value 0.01,p value>0.05) . Functional disability of the patients showed a significant correlation with their oral hygiene status (r value 0.232,p value<0.05). The number of missing teeth showed significant correlation with clinical attachment loss (r value 0.511,p value<0.001) and functional disability(r value 0.259,p value<0.001). **Conclusion:** It can be concluded from the results of our study that severe rheumatoid disease activity impairs the functional ability of the patients in maintaining good oral hygiene which in turn leads to periodontitis

Keywords: Functional disability, Oral hygiene status, Periodontitis, Rheumatoid arthritis

INTRODUCTION

Periodontal medicine is an emerging branch of Periodontology that has been establishing a strong relationship between periodontal and systemic health or disease¹. Studies have shown significant association between Periodontal Disease (PD) and coronary heart disease², diabetes³, stroke⁴, respiratory disease⁵, preterm low birth weight delivery⁶. Rheumatoid Arthritis (RA) has been included in the group of systemic diseases known to influence the periodontium.

Periodontitis is a chronic destructive inflammatory disease of the supporting structures of the teeth. RA is a progressive inflammatory disorder characterised by proliferation of the synovial membrane and persistent uncontrolled inflammation resulting in chronic destructive polyarthritis⁷. Both the diseases are chronic inflammatory diseases with excessive level of proinflammatory cytokines, Matrix MetalloProteinase (MMP) and prostaglandins and decreased level of Tissue Inhibitors of MMPs, eventually leading to destruction of hard and soft tissues. They are of

different etiology but share similar pathologic, immunologic, environmental and genetic factors. Smoking and HLA-DRB1 shared epitope alleles are common risk factor for both the diseases^{8, 9}. Porphyromonas gingivalis, an important periodontal pathogen possesses a unique enzyme Peptidyl Arginine Deiminases (PAD) that causes citrullination of proteins, generating citrullinated peptides leading to generation of autoantigens that could possibly initiate autoimmunity in RA¹⁰ and link both the diseases. Periodontopathic bacteria like Porphyromonas gingivalis, Tannerella forsythensis, and Prevotella intermedia have been identified in Rheumatoid Arthritis synovial fluid¹¹. While causal relationship is unlikely there is a possibility of common dysregulation of host inflammatory response in both the diseases which needs to be established.

The relationship between Rheumatoid Arthritis and Periodontitis is hypothesised to be bidirectional with RA affecting the progression of periodontal disease and vice versa but results are not confirmatory. Self reported epidemiological studies^{12,13}, cross sectional and case control studies^{14,15,16} have shown that RA patients have a higher prevalence of periodontitis, more number of missing teeth and severe periodontal destruction with deeper pockets and attachment loss. Ribeiro et al¹⁷, Havemose-Poulsen et al¹⁸, Al Katma et al¹⁹, Ortiz²⁰ et al have reported that Periodontitis exacerbates the severity of rheumatoid arthritis and could be a possible risk factor for development of RA. Clinical trials^{19,20} have provided evidence that non surgical treatment of periodontal disease can reduce the severity of rheumatoid disease severity. Data from First National Health and Nutrition Examination Survey²¹ and ARIC²² study suggests that periodontitis patients have an increased risk of incident or prevalent RA but findings from the Nurses Health Study²³ study found no such

association. As limited studies are available and conflicting results have been published, this study was undertaken, to determine whether there is a relationship between the severity of rheumatoid arthritis and severity of periodontitis.

Aims of the study were

1. To assess the severity of RDA and to correlate it with the severity of periodontitis, oral hygiene status, and functional disability among the RA patients with periodontitis.
2. To correlate the oral hygiene status with the functional disability of the RA patients
3. To correlate the number of missing teeth with clinical rheumatologic variables.

MATERIALS AND METHODS

This observational study was conducted in the outpatient clinic of Rheumatology department, Government General Hospital, Chennai. Ethical clearance was received from the Ethical committee of Madras Medical College, Chennai. 100 patients presenting for the first time to the outpatient clinic and diagnosed with RA were selected for the study. The patients were diagnosed with Rheumatoid Arthritis based on the 1987 Revised American Rheumatism Association Criteria for the classification of Rheumatoid Arthritis²⁴.

Patients aged between 20 – 70 years were selected for the study. RA patients with Clinical Attachment Loss (CAL) associated with periodontal inflammation were selected and periodontal disease was defined as ≥ 2 sites with interproximal CAL ≥ 4 mm, not on the same tooth or ≥ 2 sites with interproximal Probing Pocket Depth (PPD) ≥ 4 mm, not on the same tooth²⁵. Patients were included in the study if they had at least 8 teeth in the oral cavity, not taken antibiotics within the past 6 months and had no oral prophylaxis or periodontal therapy before. Patients who had CAL associated with malpositioned tooth, improper restorations or

crowns, aggressive tooth brushing were not included. Patients were excluded from the study if they were under medication with drugs like anticonvulsant, calcium channel blockers, immunosuppressant that can influence the periodontium, gave a history of hypertension, diabetes mellitus and xerostomia, had medical conditions requiring antibiotic prophylaxis before periodontal examination, smokers, pregnant, lactating women and refused to give informed consent. Written informed consent was obtained from all the patients.

Rheumatoid Disease Activity (RDA) was measured using Disease Activity Score₂₈ (DAS₂₈). DAS is a clinical index developed, to evaluate the status and course of RA disease activity; it combines information from swollen joints, tender joints, acute phase response and general health into one continuous measure of rheumatoid inflammation. DAS₂₈₍₄₎ consists of 28 Tender joint count (TJC), 28 swollen joint count (SJC), Erythrocyte sedimentation Rate (ESR) and General health on visual analogue Scale (VAS). The rheumatologic examinations were performed by specialist rheumatologist and the periodontal examination was performed by a single Periodontist. The swollen joint count reflects the amount of inflamed synovial tissue and it influences the range of joint motion. Tender joint count is associated more with the level of pain. VAS is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured. It is usually a horizontal line, 100 mm in length, marked 0 at left extreme to 100 on the right extreme. The patient marks on the line the point that they feel represents their perception of their current state of health. The VAS score is determined by measuring in mm from the left hand end of the line to the point that the patient marks.

All the RA patients were referred for routine haematological lab investigations in the same hospital. ESR and Rheumatoid Factor (RF) titre was recorded from the lab for the study patients. ESR was measured using Westergren Method and the results are given in millimetre value. RF was measured using latex agglutination method.

Functional Disability was elicited Using Indian Health Assessment Questionnaire (HAQ)²⁶. RA patients develop difficulty in doing their daily activities and measurement of this disability is routinely done in all outcome studies. Majority of the patients were not educated and also in view of their physical disability, the questionnaire was explained to the patients by the Periodontist and the response was recorded and scoring was given.

Clinical oral examination consisted of recording the number of teeth present, number of missing teeth, Oral Hygiene Index (OHI), PPD and CAL. The cumulative end point of periodontal disease is CAL. It is the distance between the base of the pocket and fixed point on the crown, such as cemento-enamel junction and is a valid method for assessment of loss of attachment of junctional epithelium from the cemento-enamel junction. CAL was measured manually using Williams periodontal probe. Attachment loss was recorded at 6 sites around all teeth. Mean CAL was calculated and based on 1999, American Academy Of Periodontology criteria for chronic periodontitis²⁷, the patients were classified as mild, moderate and severe periodontitis.

OHI given by Greene and Vermillion, Waggner²⁸ was used to measure existing debris and calculus as an indicator of oral cleanliness.

Data collected was analysed statistically using Microsoft SPSS 15 package. Association between the variables was studied using Pearson chi square test and correlation was done using Pearson correlation coefficient.

RESULTS

Among the 100 Rheumatoid Arthritis patients with periodontitis, 11 were males (11%) and 89 were females (89%). Mean age of the study population was 41.94 years (SD±11.85). Mean and standard deviation of the variables assessed in the study were number of tender joints 20.89(SD±6.86), swollen joints 12.45(SD±8.28), DAS 28(4) 6.87(SD±0.98), RF 208.1(SD±105.2), PPD 2.49(SD±0.70), CAL 2.99 (SD±1.61), DIS 1.49 (SD±0.79) and OHI score 6.97(SD±2.66). Based on DAS 28(4), the patients were classified as having mild, moderate or severe RDA (Table1). Majority of patients had severe RDA. Based on CAL, patients were categorised as having mild, moderate or severe periodontitis. 50% of the patients had mild periodontitis (Table1). Frequency distribution of study population based on severity of periodontitis and RDA is shown in Table 2 .Five patients had moderate RDA of which 3 had mild periodontitis and 2 had moderate periodontitis. Among patients with severe RDA, 47 patients had mild periodontitis, 38 had moderate and 10 had severe periodontitis. Distribution of study population based on severity of Functional disability and oral hygiene status is also shown in Table 2. Among the patients with different degree of functional disability majority of the patients had poor oral hygiene. RDA showed no correlation with CAL (Table 3). Functional Disability and the number of swollen joints showed a significant correlation with oral hygiene status (Table 3). Mean number of missing teeth among RA patients was 5.22 (SD±5.38). DIS and ESR showed a significant correlation with the number of missing teeth (Table 3).

Non parametric test was also done to test the association between variables as they were ranked based on severity. Patients with severe rheumatoid arthritis showed a significant association with periodontal disease (chi square

23.5, df 2, p value<0.001). Functional disability of the RA patients showed a highly significant association with oral hygiene status p value <0.01 (statistics not shown).

DISCUSSION

In the past few years association between Rheumatoid Arthritis and Periodontal Disease has gained greater attention and numerous studies have been done, to establish this relationship, but results have been contradictory. Studies have put forth a significant association between RA and PD and that patients with moderate to severe periodontitis are at higher risk of suffering from Rheumatoid Arthritis and vice versa. In accordance with the previous studies^{9,12,1,15,16}, the present study was done to determine the severity of periodontitis in patients with RA and to check whether there is a correlation between severity of periodontitis and Rheumatoid Disease Activity. The functional disability of the RA patient was also measured and correlated with their oral hygiene status.

RA has a peak incidence in fourth and fifth decade of life⁷, but can occur at any age, so patients aged 20-70 were selected for the current study. In this study, the number of female patients were more than males, this is as expected because RA has a higher prevalence among females⁷, and our findings are in agreement with the previous studies. Secondary Sjogrens syndrome more commonly develops in RA patients, it is characterised by dry eyes and xerostomia .The effect of xerostomia on the periodontium is controversial^{29, 30} hence patients giving a history of xerostomia were not included for the study. Only newly diagnosed RA patients not under treatment were included to eliminate the confounding effect of drugs like NSAIDs, DMARDs and steroid on the periodontium. Some patients were taking analgesics occasionally. NSAIDs have analgesic and anti inflammatory properties and have been shown to

limit periodontal destruction³¹ similarly DMARDs are also anti inflammatory but their effect on the periodontium is uncertain. Glucocorticoids have been shown to induce secondary osteoporosis³², and osteoporosis has been shown to be a risk factor for periodontal disease. As the present study was carried out among the Indian population, Indian HAQ was utilised to measure physical disability, it was obtained by modification of the Multi Dimensional Health Assessment Questionnaire by Pincus et al.

In the present study, there was no correlation between rheumatoid disease activity and clinical attachment loss, a probable indication that both the disease processes do not influence the progression of each other directly. Similarly, Addie et al¹⁶, Helminen et al³³, Rosamma et al³⁴ found no association between periodontitis status and measures of RA disease activity. It has been observed in the current study that majority of the patients had severe RDA and mild periodontitis. The results are in contrast to the findings by Mercado et al⁹, Ishi et al¹⁷, Pischon et al³⁵ and similar to the findings by Sjostrom et al³⁶, Basak et al³⁷, Bozkurt et al³⁸, Yavuyilmaz et al³⁹ that lesser periodontal destruction is seen among RA patients. Non parametric analysis showed that patients with severe Rheumatoid disease activity had a significant association with periodontal disease than moderate RDA patients, this is similar to the observation by Mercado et al⁹.

In our study, Indian HAQ was used to assess physical disability and it was significantly correlated with OHI indicating that, with increasing physical disability, the oral hygiene status of the patients deteriorated with more accumulation of plaque and calculus. This finding is unique for our study and could be crucial for establishing the relationship between functional disability, oral hygiene status and periodontal disease in patients with rheumatoid

arthritis. Our analysis also showed that functional disability was not correlated with the severity of periodontal disease in agreement to the findings by Pischon et al³⁵ but contradicting the findings of Mercado et al⁹. Rheumatoid Factor contributes to tissue injury and tends to correlate with disease activity and severity in RA. Rheumatoid Factor titres and severity of RDA significantly correlated with the functional disability of the RA patients in this study suggesting that the functional disability of these patients were affected by the severity of RDA. Oral hygiene status of these patients showed a strong positive correlation with the clinical attachment loss. This implies that the poor oral hygiene status of these patients could be responsible for the periodontal destruction. Pischon et al³⁵ in his study evidenced similar finding wherein plaque and gingival index markedly associated with CAL and accounted for 13.4% of association between RA and periodontal disease. Studies by Pischon et al³⁵, Ishi et al¹⁷, De Pablo et al⁴⁰ have shown that RA patients have poor oral hygiene contrary to findings by Mercado et al⁹, Abdelsalam et al⁴¹. Our analysis showed that the number of missing teeth in these RA patients positively correlated with the clinical attachment loss. Those patients who had severe attachment loss had more number of missing teeth (mean 11.5) than those with lesser attachment loss (mean 4.3). Studies^{42,43} have reported that periodontitis and tooth mortality are closely associated and that tooth mortality on a lesser extent could be a predictor for attachment loss. Based on our findings we can suggest that severe periodontal destruction could have been a significant contributing factor for tooth loss in this sample but cannot be conclusive because patients could not clearly state the reason for tooth loss and there are multiple reasons for missing teeth like tooth decay, trauma, extraction for orthodontic treatment, congenitally absent. The results from

this study also indicated that patients with severe periodontitis had more number of missing teeth and elevated ESR. Ali Saad Thafeed Al Ghamdi⁴⁴ in his study among chronic periodontitis patients showed that elevated level of ESR was seen in severe periodontitis patients and it positively correlated with the number of missing teeth. Currently the effect of such an association between ESR, tooth loss and periodontal destruction is uncertain.

The strength of our study is that we used a composite index for RA disease activity(DAS 28), original OHI was used for oral hygiene status assessment hence all the teeth were assessed for debris and calculus rather than index teeth, and Indian HAQ was used for assessment of physical disability, which is more relevant for Indian population and shown to have high reliability and validity. Limitations of the study were cross sectional design, small sample size, osteoporosis a possible risk factor for periodontal disease was not excluded.

CONCLUSION

From the results of our study, it can be concluded that severe rheumatoid disease activity impairs the functional ability of the patients leading to difficulty in brushing their teeth and maintaining good oral hygiene which in turn leads to possible destruction of the periodontium and attachment loss. The periodontal destruction seen in these patients could be attributed to the poor oral hygiene due to limited dexterity rather than the RA disease process itself therefore RA patients should be educated on oral health and motivated to maintain good oral hygiene. Powered tooth brushes can be advised along with the use of chemical plaque control agent like mouthwash and consultation with a dentist or a Periodontist should be encouraged at frequent intervals. More number of longitudinal prospective cohort studies with larger sample size is needed, to

further establish the relationship between both the disease activity and severity of rheumatoid arthritis and periodontal disease.

ACKNOWLEDGEMENT

Authors would like to acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to the authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

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Table 1: Categorizations of the variables and their frequency in the study population

VARIABLE	CATEGORY	FREQUENCY IN THE STUDY SAMPLE	
		N	(%)
GENDER	MALE	11	11
	FEMALE	89	89
RDA [†]	MILD	0	0
	MODERATE	5	5
	SEVERE	95	95
SEVERITY OF PERIODONTITIS	MILD	50	50
	MODERATE	40	40
	SEVERE	10	10
DIS [‡]	MILD	33	33
	MODERATE	39	39
	SEVERE	28	28
OHI [§]	GOOD	7	7
	FAIR	32	32
	POOR	61	61

[†]Rheumatoid Disease Activity

[‡]Disability Index Score

[§]Oral Hygiene Index

**Table 2: Distribution of study population based on
A. Severity of RDA and Periodontitis (CAL) and
B. Severity of Functional Disability (DIS) and Oral hygiene status (OHI)**

VARIABLE		SEVERITY OF PERIODONTITIS		N
RDA [†]	MODERATE (N=5)	MILD	3	
		MODERATE	2	
		SEVERE	0	
SEVERE (N= 95)		MILD	47	
		MODERATE	38	
		SEVERE	10	
ORAL HYGIENE STATUS				
DIS [‡]	MILD (N=33)	GOOD	1	
		FAIR	13	
		POOR	19	
MODERATE (N=39)		GOOD	5	
		FAIR	14	
		POOR	20	
SEVERE (N=28)		GOOD	1	
		FAIR	5	
		POOR	22	

[†] Rheumatoid Disease Activity [‡] Disability Index Score

Table 3: Pearson correlation (r value) and chi square test (p value) among the variables assessed in the study population

VARIABLES	PEARSON CORRELATION (r value)	CHI SQUARE TEST (P value)
DAS 28 [†] and CAL [‡]	0.010	0.923
DIS [§] and OHI [¶] score	0.232*	0.020*
ESR [°] and CAL	0.247*	0.13*
CAL and OHI score	0.539**	0.000**
Number of swollen joints and OHI	0.208*	0.038*
DAS 28 and DIS	0.586**	0.000**
RF [€] value and DIS	0.253*	0.41*
CAL and number of missing teeth	0.511**	0.000**
DIS and number of missing teeth	0.259**	0.009**
ESR and number of missing teeth	0.295**	0.003**

**correlation is significant at the 0.01 level, *correlation is significant at the 0.05 level (2tailed)

[†]Disease Activity Score

[‡]Clinical Attachment Loss

[§]Disability Index Score

[¶]Oral Hygiene Index

[°]Erythrocyte Sedimentation Rate

[€]Rheumatoid Factor