Inter- Relationship Between Rheumatoid Arthritis and Periodontitis

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ABSTRACT

Background

Periodontal medicine defines a rapidly emerging branch of Periodontology focusing on establishing a strong relationship between periodontal health and systemic health. It is speculated that the major common dysregulation which links Periodontitis with Rheumatoid arthritis (RA) is being played by the mediators of immune inflammatory response.

Objectives

To determine whether there is any relationship between periodontal disease and Rheumatoid arthritis.

Methods

A total of 100 patients were included for the present study which was divided into two groups: one group (cases) included 50 patients attending the Department of Orthopedics, Kasturba Medical College, Manipal who were diagnosed of Rheumatoid arthritis. Another subject population included 50 patients as controls attending the Department of Oral Medicine, Manipal College of Dental Sciences, Manipal with age and gender matched with those of rheumatoid arthritis group. Specific measures for periodontitis included plaque index, gingival index, number of missing teeth, and radiographic alveolar bone loss scores. Measures of rheumatoid arthritis included health assessment questionaires, levels of C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR). Various periodontal parameters were compared between the cases and controls.

Results

The average alveolar bone loss was statistically more severe in Rheumatoid arthritis (RA) group than in the controls although there were similar plaque index in both the groups. The gingival index was statistically higher in the RA group. The Erythrocyte Sedimentation Rate (ESR) and C- Reactive Protein (CRP) levels of RA patients were also significantly associated with the severity of periodontal disease.

Conclusion

There was a significant association between Rheumatoid arthritis and Periodontitis which may be due to a common underlying deregulation of the inflammatory response in these individuals.

KEY WORDS

Periodontitis, rheumatoid arthritis, inflammatory disease, ESR, CRP

INTRODUCTION

Rheumatoid arthritis is a chronic destructive inflammatory disease characterised by the accumulation and persistence of inflammatory infiltrate in the synovial membrane that leads to synovitis and destruction of joint architecture. It affects 0.5-1% of the world population and is most frequent during the fourth and fifth decades of life affecting women around three times more than men.[1]

Periodontitis is defined as chronic inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms or a group of specific microorganisms, resulting in progressive destruction of periodontium. It can affect 90% of the adult population, with 10- 15% of affected individuals having the most severe form of periodontal disease.[2]

It is believed that tissue destruction of the supporting periodontal tissues is mediated by an overreactive immune inflammatory response to bacteria in the subgingival environment. Tissue destruction in periodontitis occurs by the stimulatory action of pro inflammatory cytokines and proteolytic enzymes released by neutrophils, macrophages, and the action of bone resorption mediators which are being regulated by B and T cells.[3] Similar tissue destruction as periodontitis has been observed in rheumatoid arthritis wherein there is local destruction of hard and soft tissues due to host immune inflammatory response and there is an excessive production of pro-inflammatory cytokines. Furthermore, low levels of tissue inhibitors of metalloproteinases (TIMP) and high levels of matrix metalloproteinases (MMPs) secreted by macrophages, fibroblasts characterize the active stage of both the diseases.[4] As the relationship between rheumatoid arthritis and periodontitis is still controversial, the present study was undertaken to know if there is any association between rheumatoid arthritis and periodontitis.

METHODS

This case- control study was conducted in Manipal Hospital. The data for this research was collected by interviews, clinical oral health examination as well as physical examination for the rheumatoid arthritis groupA total number of 100 subjects were considered for the study which included both males and females in the age range of 30–65years. Cases included 50 patients diagnosed of rheumatoid arthritis according to the parameters of American Rheumatology Association.[5] Controls included 50 patients with age and gender matched with those of rheumatoid arthritis group. Inclusion criteria were partially or fully dentate subjects with at least eight teeth present. Exclusion criteria were subjects suffering from systemic diseases including diabetes mellitus, osteoporosis, increased risk of bacterial endocarditis, smokers, subjects having conditions that may alter the serum CRP levels like trauma or infection or that might alter ESR levels like kidney disease, tuberculosis, etc., subjects with a history of systemic antibiotic therapy, pregnant females or those who had undergone oral prophylaxis during last three months.

A standard proforma was prepared for the case as well as the control group. All participants underwent a clinical oral examination in which plaque index (Silness and Loe 1964), gingival index (Loe and Silness 1963), missing teeth, and radiographic bone loss were assessed. Full mouth periapical radiographs were taken for both tests as well as control groups. The extent of bone loss was calculated using the modified Hugoson and Jordan classification method wherein the distance from the cemento- enamel junction (CEJ) to the tooth apex was measured.[6] The most severe bone loss was used to classify the status of each patient. The scoring was as follows: P0: no bone loss; P1: 1/3rd- mild bone loss; P2 : 2/3rd- moderate bone loss and P3: >2/3rd- severe bone loss.

A health assessment questionnaire was computed and graded as follows- grade 1 -no assistance needed, grade 2 -use of an aid or device,grade 3 -assistance from another person. RA patients were also evaluated for C- reactive protein (CRP) and Erythrocyte sedimentation rate (ESR). Statistical analysis was done using SPSS version 16 for windows.

RESULTS

The mean age of RA group was 44·54± 7·81 and that of NRA group was 44·02± 6·23 and this difference was not statistically significant (p> 0·714).

Comparison of missing teeth, plaque index, and gingival index in RA and NRA(Table 1) -There was no statistically significant difference between the median value of missing teeth in RA group and the NRA group (p>0·05). Similarly there was no statistically significant differences between the median value of plaque index for RA and NRA group (p>0·05). But the median value of gingival index for RA subjects was found to be statistically higher than the NRA group. (p<0·05)

Comparison of bone loss between RA and NRA: 30 subjects (60%) in RA and 43 subjects (86%) in the NRA subjects had none to mild periodontitis (P0-P1). Similarly 20 subjects (40%) in RA and 7 (14%) in NRA group had

Table 1. Comparison of median values of variables between RA and NRA groups.

Variables	RA subjects (cases)		NRA subjects (controls)		P value
	Median	IQ range	Median	IQ range	
Missing teeth	2·00	4·00	1·00	2·00	0·071
Plaque Index (PI)	0·64	0·62	0·45	0·71	0·562
Gingival Index (GI)	0·43	0·58	0·35	0·61	0·035

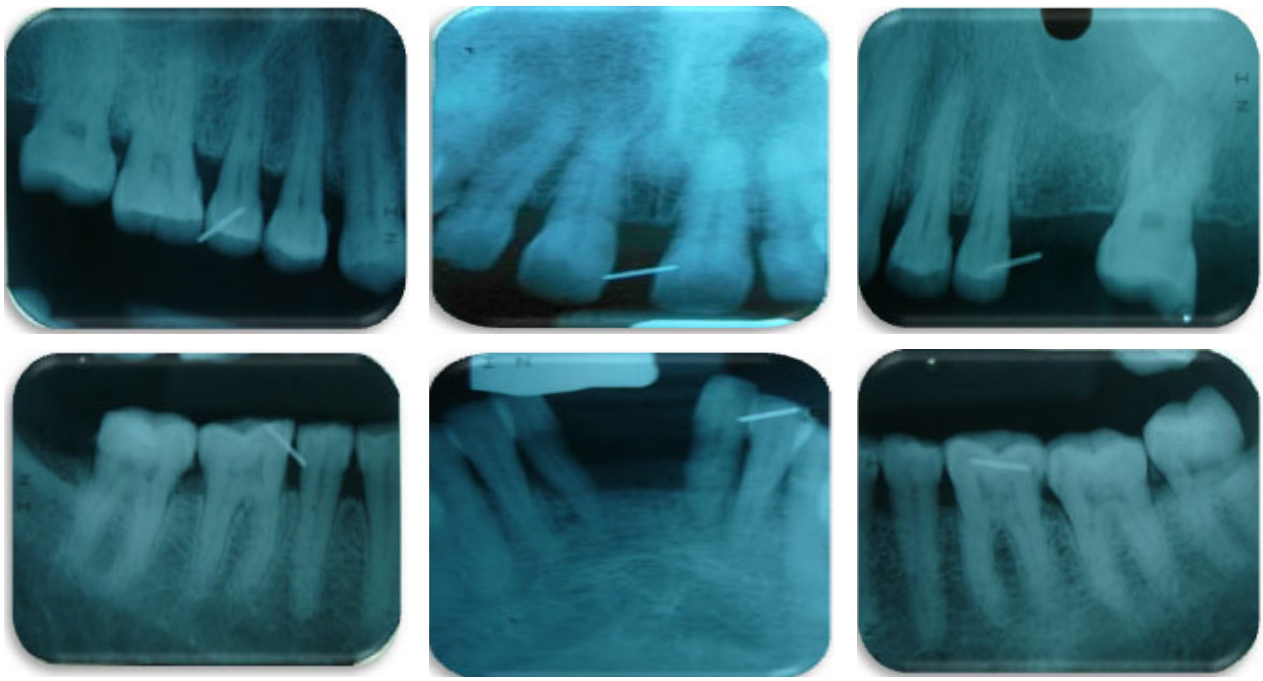

Figure 1. **Full mouth IOPA showing alveolar bone loss of one RA patient.**

Table 2. **Bone loss in RA and controls**

Variables	Bone loss		Total	P value
	P0-P1	P2-P3		
RA subjects	30 60.0%	20 40.0%	50 100%	0.003
NRA subjects	43 86.0%	7 14.0%	50 100.0%	
Total	73 73.0%	27 27.0%	100 100.0%	

Table 3 **Comparison between periodontal bone loss with HAQ.**

Variables	Bone loss		Total	P value
	P0-P1	P2-P3		
HAQ1	16 53.3%	8 40.0%	24 48.0%	0.145
HAQ2	11 36.7%	12 60.0%	23 46.0%	
HAQ3	3 10.0%	0 .0%	3 6.0%	
Total	30 100.0%	20 100.0%	50 100.0%	

Table 4. **Comparison of periodontal bone loss and CRP.**

Bone loss	Median	Interquartile range	p-value
P0 -P1	7·95	18·00	0·016
P2- P3	16·60	9·65	

Table 5. **Comparison of periodontal bone loss and ESR.**

Bone loss	Median	Interquartil range	p-value
P0 -P1	27·50	32·50	0·008
P2- P3	57·50	44·50	

moderate to severe periodontitis (P2-P3). More RA subjects were affected with severe forms of periodontal disease as compared to NRA subjects. (p<0.05) (Table 2) (Fig. 1)

Health assessment questionnaire and periodontal bone loss (HAQ and P0-P3). Out of 24 patients with HAQ1 (less functional debilitation), 16 patients had none to mild periodontitis (P0- P1= 53.3%) compared to 8 patients who had moderate to severe periodontitis (P2- P3= 40.0%). In 23 patients with HAQ2 (moderate functional debilitation), 11 patients (36.7%) had none to mild periodontitis (P0-P1) as compared to 12 patients (60%) who had moderate to severe periodontitis (P2-P3). Basically, there was no statistically significant association between the degree of functional debilitation due to RA and periodontal disease severity (p >0.05). (Table 3)

Periodontal bone loss and CRP: In the present study a positive co-relation was seen between the CRP levels and periodontal bone loss and this was statistically significant (p<0·05). (Table 4)

Bone loss and ESR: The present study also showed that subjects with moderate to severe periodontitis group had statistically higher serum ESR levels than subjects with none to mild periodontitis (p<0·05). (Table 5)

DISCUSSION

The association between RA and periodontal disease has been studied in a few studies but with inconsistent results. Sjostrom et.al suggested that the periodontal findings in RA patients were similar to those of control groups.[7] In contrast, Tolo et.al indicated increased alveolar bone loss in RA patients as compared to the healthy controls.[8] The

present study was thus undertaken to test the hypothesis that individuals with rheumatoid arthritis are more likely to experience periodontal disease.

In the present study, RA group had more number of missing teeth than NRA group though it was not statistically significant. The median value of plaque index for RA and NRA group on comparison did not any statistical significant difference. Thus, the general concept that the functional upper limb disabilities in patients with RA contributed to poor manual dexterity, resulting in the cause of poor oral hygiene was not validated in the present study. Similar results were seen in other studies.[9] But contradictory results were seen in some studies, which showed plaque index score higher in RA than NRA subjects which attributed to poor manual dexterity and a lower oral hygiene status in RA patients.[10]

Significantly higher value of gingival index found in RA patients as compared to the controls could be attributed to the increased secretion of proinflammatory mediators in the RA group.

In the present study bone loss was classified according to modified Hugoson and Jordon classification and was classified as mild, moderate and severe. The results in our study stating that RA group was affected with more moderate to severe form of periodontal bone loss was consistent with other studies.[11] The increased occurrence and severity of periodontitis in RA subjects maybe due to the common features of an underlying dysregulation of the inflammatory mechanism which predisposes these individuals to advanced and severe form of either disease. Periodontitis has similar cytokine profile to RA consisting of persistent high levels of proinflammatory cytokines, including IL-1β and TNF-α and low levels of anti inflammatory cytokines such as IL-10 and TGF –β. These cytokines together with low levels of TIMPs and high levels of MMPs and PGE2 are associated with active periods of tissue destruction in both the diseases.

Clinical parameters like health assessment questionnaire (HAQ), when compared with severity of periodontitis, showed no statistically significant association. The lack of significant co relation between the clinical parameters of RA with periodontal bone loss could be attributed to the small sample size in our study. Further studies with larger sample size are required to establish if there is a possible relationship between the severity of the disabilities occurring in RA and periodontitis.

Serum CRP levels and ESR is considered to be a reliable measure of radiographical joint erosions in RA.[12] Measurements of both CRP and ESR were more helpful than either alone, but CRP was probably the more informative as it was more specific measure of inflammation. ESR may be considered a less specific measure of the acute-phase response as it is influenced by many factors other than systemic inflammation, including age, sex, red-blood-cell morphology, haemoglobin concentration, and serum levels of immunoglobulins and rheumatoid factor.[13] In our study, there was significant co relation between periodontal disease with higher CRP and ESR levels. The median of CRP levels in none to mild periodontal bone loss group (P0-P1) was 7.95 with interquartile range of 18.00 as compared to CRP levels of 16.60 with interquartile range of 9.65 in moderate to severe bone loss (P2-P3). The median of ESR level of none to mild bone loss group (P0-P1) was 27.50 with interquartile range of 32.50 as compared to ESR levels of 57.50 with interquartile range of 44.50 in moderate to severe bone loss group (P2-P3). FB Mercado et al 2001 also showed significant association between ESR and CRP levels with periodontal status of the RA patients.[14]

After discussing the observations of the present study, it can be said that RA group had higher prevalence and more severe form of periodontal disease than their non RA counterparts. This may be due to the common disregulation of the host inflammatory response. This may also be due to common genetic predisposition since both RA and progressive periodontitis are associated with HLA complex in addition to the common underlying dysregulation of the host inflammatory response. A monocyte hypersecretory triat has been described for both RA patients and periodontal disease susceptible patients. Thus it appears to be the common pathologic link between periodontal diseases and RA. Both RA and periodontitis are associated with this HLA complex. So it is proposed that this provides a common genetic basis for the observed monocyte triat, linking RA with periodontitis.

Periodontal bacterial DNA (PBDNA) has also been identified in subgingival dental plaque (SDP), serum and synovial fluid (SF) of RA patients with periodontitis demonstrating 100% of patients showing PBDNA in SDP and SF which showed that PBDNA could have a role on RA etiology.[15]

CONCLUSION

The present study showed that the prevalence of periodontitis was more in RA subjects as compared to healthy individuals and individuals suffering from moderate to severe RA are more likely to suffer from moderate to severe forms of periodontal breakdown as compared to age and gender matched healthy controls. Hence, the present study showed that although there was no significant difference in the plaque scores between the two groups, subjects with RA are more likely to suffer from more severe form of periodontal disease as compared to NRA subjects of comparable age and gender.

REFERENCES

1. Arnett FC, Edworthy SM , Bloch DA. The American Rheumatism Association 1987 revised criteria for the classification of rheumatoid arthritis. *Arthritis Rheum* 1988; 31: 315-324.
2. Peterson PE, Ogawa H. Strengthening the prevention of periodontal diseases: The WHO approach. *J Periodontol* 2005; 75 (12): 2187- 2193.

3. Han X, Kawai T, Eastcott JW, Taubman MA. Bacterial responsive B lymphocytes induce periodontal bone resorption. *J Immunol* 2006; 176: 625-631.
4. Bartold PM, Marshall RI, Haynes DR. Periodontitis and rheumatoid arthritis : A Review. *J Periodontol* 2005; 76: 2066- 2074.
5. Pinho NM, Oliveira RD, Novaes AB Jr., Voltar JC elli. Relationship between periodontitis and rheumatoid arthritis and the effect of non-surgical periodontal treatment. *Braz Dent J* 2009; 20(5): 355-364.
6. Kaber UR, Gleissner C, Dehne F, Michel A, Willershausen- Zonnchen B, Bolten WW. Risk for periodontal disease in patients with longstanding rheumatoid arthritis. *Arthritis Rheum* 1997;40: 2248-51.
7. Sjostrom L, Laurell L, Hugoson A, Hakansson JP. Periodontal conditions in adults with rheumatoid arthritis. *Community Dent Oral Epidermol* 1989; 17: 288-291.
8. Tolo, K., and Jorkend, L. Serum antibodies and loss of periodontal bone in patients with rheumatoid arthritis. *J Clin Periodontol* 1990; Dec 2 (4): 253-62.
9. Laurell L, Hugoson A, Hakansson J, Peterson B,Sjostrom L, Berglof FE, et al. General oral status in adulats with rheumatoid arthritis. *Community Dent Oral Epidemol* 1989;17:230- 233.
10. Sjostrom L, Laurell L, Hugoson A, Hakansson JP. Periodontal conditions in adults with rheumatoid arthritis. *Community Dent Oral Epidermol* 1989; 17: 288-291.
11. Fathima Y, Berker E, Akkus S, Bulut S. Relationship between IL-6 levels in gingival crevicaular fluid and periodontal status in patients with rheumatoid arthritis and adult periodontitis. *J Periodontol* 2000. Nov; 71(11): 1756-60.
12. Ollier W, Thomson W. Population genetics of rheumatoid arthritis. *Rheum Dis Clin N Am* 1992; 18: 741- 759.
13. Garrison SW, Nichols FC. LPS elicited secretory response in monocytes: altered release of PGE2 but not IL-1 beta in patients with adult periodontitis. *J Periodontol Res* 1989; 24: 88- 95.
14. Mercado FB, RI Marshall, A.C Klestov, P.M Bartold. Relationship between rheumatoid arthritis and periodontitis. *Journal of Periodontology* 2001; 72: 779-786.
15. Martinez-Martinez RE, Abud-Mendoza C, Patiño-Marin N, Rizo-Rodríguez JC, Little JW, Loyola-Rodríguez JP. Detection of periodontal bacterial DNA in serum and synovial fluid in refractory rheumatoid arthritis patients. *J Clin Periodontol* 2009; 36: 1004–1010.