ORIGINAL RESEARCH

Rheumatoid Arthritis among Periodontitis Patients in Ankleshwar Industrial Estate of Gujarat, India: A Cross-sectional Study

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ABSTRACT

Background and objective: Periodontal disease may be related to a number of systemic diseases. Periodontitis is an extrasynovial chronic inflammatory condition, which has been proposed to be inter-related with rheumatoid arthritis. The aim of the study to determine whether there is a relationship between rheumatoid arthritis and periodontal disease.

Materials and methods: A total of 1600 individuals of 30 to 70 years of age and residents of Ankleshwar industry estate in Gujarat, India, were assessed for the prevalence of rheumatoid arthritis and periodontal disease. The prevalence and severity of periodontitis was determined by recording the community periodontal index (CPI) with loss of attachment based on WHO guidelines (1997). The criteria for diagnosis of rheumatoid arthritis are as given by the American Rheumatism Association 1988. Frequency distributions for bivariate analysis and logistic regression for multivariate analysis were used for assessment of statistical association between variables.

Results: In patients referred for periodontal treatment, the prevalence of rheumatoid arthritis was 4.5%. Females and subjects aged above 50 years showed a significantly higher prevalence in comparison to their counterparts ($p < 0.05$). The odds of rheumatoid arthritis in females were nearly three times (OR = 2.78) higher than males which was also statistically significant ($p < 0.05$).

Conclusion: The findings provide evidence for a relationship suggesting that individuals with moderate to severe periodontal disease are at higher risk of suffering from rheumatoid arthritis and vice versa.

Keywords: Dental health, Extrasynovial, Periodontitis, Rheumatoid arthritis.

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INTRODUCTION

Periodontitis (PD), the most common oral disease, is a destructive inflammatory disease of the supporting tissues of the teeth and is caused by specific microorganisms. Periodontal diseases are not only a threat to dentition, but may also be a threat to general health. There are reports suggesting increased prevalence of diabetes, atherosclerosis, myocardial infarction, stroke and rheumatoid arthritis (RA) in patients with periodontal disease. There is a growing awareness of the link between periodontal and systemic inflammatory conditions, such as RA and coronary artery disease based on common etiopathogenic mechanisms.[1-4] All forms of inflammatory periodontal diseases are associated with chronic inflammation, resulting in the destruction of periodontal ligament and bone.[4] In addition to other chronic conditions of altered connective tissue metabolism, hormone imbalance and altered immune function have likewise been associated with increased risk of periodontal disease.[5] A number of studies have pointed toward a correlation between periodontal disease and various systemic conditions, including preterm low-birth weight, coronary heart disease and diabetes mellitus. PD has been proposed as having an etiologic or modulating role in cardiovascular and cerebrovascular disease, diabetes, and respiratory disease and adverse pregnancy outcome, and several mechanisms have been proposed to explain or support such theories.[6]

Rheumatoid arthritis is characterized by chronic synovitis with the resultant damage to joint cartilage and bone which in turn is accompanied by joint pain and

reduced mobility affecting 1% of the adult population.[7] Chronic periodontitis, initiated by bacterial plaque,[8] is prevalent in a third of the population beyond the age of 50 years and 10 to 15% of all adults,[9] being the main cause of tooth loss in adults. Although the etiologies of these diseases are distinctly separate, the underlying pathological processes are of sufficient similarity to warrant consideration of the hypothesis that individuals at risk of developing RA may also be at risk of developing periodontitis or vice versa.[10,11] Both periodontitis and RA present an imbalance between proinflammatory and anti-inflammatory cytokines, which is deemed responsible for the tissue damage. There is documented evidence of the link between periodontal disease and arthritis.[12,13]

The similarities between RA and PD have prompted several studies on the periodontal status of patients with RA although the relationship between RA and PD that emerged from those studies are controversial. Furthermore, reports emerged to suggest that reduction of extrasynovial chronic inflammation associated with periodontal treatment may have a beneficial effect on established RA.[14,15]

The literature regarding the relationship between periodontal disease and RA is controversial. The methodologies applied in the studies are as diverse as their results and conclusions. Hence, this study was conducted with an objective of ascertaining the correlation between RA and periodontal disease in the population of Ankleshwar Industry State in Gujarat, India.

MATERIALS AND METHODS

Study Design and Study Population

This cross-sectional study was conducted from February 2014 to July 2014 among 1600 individual attending Sarvajanik Hospital, Ankleshwar, India. All the eligible subjects who were residents of Ankleshwar industrial estate in Gujarat formed the study population.

The exclusion criteria were: smoking, diabetes mellitus, individuals who had undergone periodontal treatment (including prophylaxis) and/or antibiotic therapy over the last 3 months, systemic diseases that require prophylactic antibiotic therapy and females pregnant and lactating.

Brief Profile of the Study Area

Ankleshwar (sometimes written Ankleshwar) is a city and a municipality in the Bharuch district of the state of Gujarat, India. The city is located ten kilometers from Bharuch. The town is known for its industrial township called GIDC (Gujarat Industrial Development Corporation). Ankleshwar has an office of the Oil and Natural Gas Corporation Limited (ONGC). Ankleshwar has over 1000 chemical plants, producing products, such as pesticides, pharmaceuticals, chemicals and paints.[16]

Ethical Considerations

Prior to commencement of this study, ethical approval was obtained from the Institutional Ethics Committee of the Pacific Dental College and Hospital, Udaipur. An official permission from the CMO of the hospital and informed consent from those participating in the study were obtained.

Methodology

Within the study, two groups were identified. The periodontal group (PG) was derived from the 800 patients referred for periodontal treatment and the remainder 800 were the general group (GG) subjects referred for general dental treatment (other than referred for periodontal treatment). The prevalence and severity of periodontitis was determined by recording the community periodontal index (CPI) with loss of attachment based on WHO guidelines (1997).[17]

To determine the prevalence of RA, the patients' latest medical-dental questionnaires were evaluated. The criteria for diagnosis of RA are as given by American Rheumatism Association 1988. The new criteria are as follows: (1) morning stiffness in and around joints lasting at least 1 hour before maximal improvement, (2) soft-tissue swelling (arthritis) of 3 or more joint areas observed by a physician, (3) swelling (arthritis) of the proximal interphalangeal, metacarpophalangeal, or wrist joints, (4) symmetric swelling (arthritis), (5) rheumatoid nodules, (6) the presence of rheumatoid factor and (7) radiographic erosions and/or periarticular osteopenia in hand and/or wrist joints. Criteria 1 through 4 must have been present for at least 6 weeks. Rheumatoid arthritis is defined by the presence of 4 or more criteria, and no further qualifications (classic, definite or probable) or list of exclusions are required. There new criteria have demonstrated 91 to 94% sensitivity and 89% specificity for RA when compared with non-RA rheumatic disease control subjects.[18]

Preceding the commencement of the study, examiner was standardized and calibrated in the department of public health dentistry by a senior faculty member to ensure uniform interpretations, understanding and application of the codes and criteria for the diseases to be observed and recorded and to ensure consistent examination. The examiner first practiced the examination on a group of 10 subjects with the wide range of levels of disease condition. The data on periodontal status was

entered on a WHO Oral Health Assessment Form (1997). Then a group of 20 subjects with varying levels of oral diseases were examined on two successive days and the results were compared to know the diagnostic variability. Agreement for assessment was 90% for CPI.

STATISTICAL ANALYSIS

The recorded data were compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor of SPSS version 15.0 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages, means and standard deviations. The Chi-square (χ^2) test was used to assess the differences in the prevalence of periodontal diseases and RA between the groups. Multiple logistic regression was performed estimating values of odds ratio (OR) and the respective 95% confidence interval (CI). A p-value of less than 0.05 indicated statistical significance.

RESULTS

The study sample comprised of 1600 adults, aged 30 to 70 years with mean age of 45 ± 2.6 years (Table 1). Of these, 848 (53%) were males and 652 (40.7%) were females. They included 800 (50) subjects from periodontal group (PG) and 800 (50%) subjects from GG. Majority of the subjects (35.3%) belonged to the 30 to 40 years age group and a few (10.5%) were aged over 60 years.

Table 1: Distribution of the study population based on gender and age

Variables	*Periodontal group*	*General group*	*Total*
Gender			
Male	460 (57.5)	488 (61)	848 (53)
Female	340 (42.5)	312 (38)	652 (40.7)
Age (years)			
30-40	290 (36.2)	275 (34.3)	565 (35.3)
40-50	234 (29.2)	248 (31)	482 (30.1)
50-60	196 (24.5)	189 (23.6)	385 (24.06)
60-70	80 (10)	88 (11)	168 (10.5)
Total	800	800	1600 (100)

Table 2 presents the percentages of persons according to the highest score recorded for each person. Around 22% of the subjects in the GG scored healthy. Bleeding was confined to 62.6% and calculus was recorded among 15.3%. Shallow pockets and deep pockets were recorded as 33.1 and 16.8% respectively, in the periodontal group. According to gender, females were affected by severe periodontal diseases (deep pockets) more than males and the difference observed was statistically significant ($p \leq 0.05$). Almost half of the study subjects (50.8%) in periodontal group demonstrated the loss of attachment to be 4 to 5 mm followed with 0 to 3 mm in 30.8% population. Between the gender, the loss of attachment was also found to be more in females which was statistically significant ($p \leq 0.05$).

The overall prevalence of RA was 4.5% (36 out of 800) in the PG group. In relation to gender and age groups, females (3.2%) and subjects aged above 50 years (11.2%) showed a higher prevalence in comparison to their counterparts. This observed difference between gender and all the age groups for RA was statistically significant (Table 3).

We estimated the OR and their 95% confidence intervals for variables affecting RA in our study population (Table 4). The odds of RA in adults aged over 50 years were nearly 1.2 times higher than those for adults aged less than 50 years. In females, the odds were nearly three times (OR = 2.78) higher than males. These observations were also statistically significant.

DISCUSSION

The relationship between RA and the progression of inflammatory conditions elsewhere in the body, such as chronic periodontitis (CP), is controversial. The host

Table 2: Prevalence of periodontal disease among the study population according to groups and gender (n = 1600)

	Periodontal group			χ	*General group*			χ
Variables	*Male n (%)*	*Female n (%)*	*Total*	*p-value*	*Male n (%)*	*Female n (%)*	*Total*	*p-value*
Community periodontal index (CPI)								
Healthy	0	0	0		96 (54.4)	80 (45.4)	176 (22)	
Bleeding	0	0	0	25.4	285 (56.8)	216 (43.1)	501 (62.6)	2.34
Calculus	0	0	0	<0.05*	107 (86.9)	16 (13)	123 (15.3)	0.81
Pocket (4-5 mm)	300 (56.6)	230 (43.3)	530 (66.25)		0	0	0	
Pocket (6-8 mm)	160 (59.2)	110 (40.74)	270 (33.75)		0	0	0	
Loss of attachment								
0-3 mm	145 (55.7)	115 (44.2)	260 (32.5)		0	0	0	
4-5 mm	238 (58.2)	169 (41.5)	407 (50.8)	72.1	0	0	0	
6-8 mm	65 (62.5)	39 (37.5)	104 (13)	<0.05*	0	0	0	–
9-11 mm	12 (41.3)	17 (65.3)	29 (3.25)		0	0	0	
Total	460 (57.5)	340 (42.5)	800 (100)		488 (61)	312 (40.1)	800 (100)	

Test applied—Chi-square test; *Statistical significance at $p < 0.05$

Table 3: Distribution of RA in the periodontal group based on gender and age

Variables	Rheumatoid arthritis	No rheumatoid arthritis	Total	χ p-value
Gender				
Male	8 (1.7)	452 (53.0)	460 (54.2)	19.41
Female	28 (3.2)	312 (42.6)	340 (45.8)	<0.05*
Age (years)				
30-40	1 (0.34)	289 (99.6)	290 (36.25)	12.6
40-50	3 (1.2)	231 (98.2)	234 (29.25)	<0.05*
50-60	22 (11.2)	174 (88.7)	196 (24.5)	
60-70	10 (1.2)	70 (87.5)	80 (10)	
Total	36 (4.5)	764 (95.5)	800 (100)	

Test applied—Chi-square test; *Statistical significance at p < 0.05

Table 4: Estimates of multiple logistic regressions for variables affecting RA

Variables	Category	Odds ratio	95% confidence interval
Age in years	≤50 >50	1.21*	0.812-1.51
Sex	Male Female	2.78*	0.84-1.47

*Statistical significance at p ≤ 0.05

defence response to foreign material is generally considered to be a protective process whereby innate and acquired mechanisms are activated to dilute, destroy or negate damaging agents and initiate tissue repair. This response involves the coordinated activation of numerous biologic pathways of inflammation, resolution and repair, all of which may be observed in the chronically inflamed periodontium. If appropriately regulated, then tissue repair ensues; however, if not appropriately controlled, the inflammatory response becomes chronic and persistent, leading to further tissue destruction and progression of disease. It is this lack of control (dysregulation) that is thought to contribute to the pathogenesis of other chronic inflammatory diseases, such as RA.

In the present study, it was reported that the individuals referred for periodontal treatment had a higher prevalence of RA (4.5%). This is a very high prevalence compared to the 1% prevalence reported in the normal population.[18] This finding was consistent with other reports of the association of RA and periodontitis and its severity.[19,20] The increased prevalence of RA in the periodontitis group in the present study suggests a possible link between the manifestations of these two chronic inflammatory diseases.

To date, only a few studies have examined the extent of the association between RA and periodontal disease and among these studies, the results have been conflicting.[21,22] The lack of uniformity in classifying the various forms of periodontal disease and RA in these studies has made it difficult to compare the above studies.

Indeed, there are remarkable similarities in the pathogenesis of these two conditions at both the cellular and molecular level. Cytokines are believed to play a pivotal role in both periodontal tissue destruction and destruction of joints in RA. The most important of these cytokines are TNF and IL-1, both are probably produced by macrophages that are activated by T-cells. The TNF and IL-1 in turn stimulate synovial cells and periodontal ligament cells to proliferate and produce various mediators of inflammation and MMPs that contribute to cartilage destruction in joint and alveolar bone destruction in periodontium. Thus, a chain of events is set up that leads to progressive damage.[23-25] Most of these associations can also be explained in part by the excessive production of proinflammatory cytokines and other inflammatory mediators, of which prostaglandin E2 (PGE2), tumor necrosis factor (TNF) a and interleukin (IL-6) appear to dominate.[6,26]

In the present study, the prevalence of RA increased with increasing age in both the periodontal and general practice patients. This is in agreement with other studies reporting that the prevalence of systemic diseases in these population increases with increasing age.[27,28]

Periodontal pocket measurements and attachment loss are used to assess periodontal disease, but cannot accurately measure inflammation or predict future outcomes. According to Kao et al, much of the focus of dentists and dental hygienists is on periodontal pocket depth. They caution that we should also measure clinical attachment level CAL, the presence and prevalence of gingival inflammation and radiographic evidence of alveolar bone loss.[29] If we believe that decreasing the oral inflammatory load can support oral and systemic health, we must be able to accurately assess risk and disease and be able to detect changes in the inflammatory process. It is likely that in the future, periodontal disease may be added to the list of factors that are used to assess patients risk profiles and, in addition, treatment of periodontal disease may become a standard part of the therapy for patients with the systemic diseases, like coronary heart disease, stroke, diabetes and other diseases.

The main limitation of the present study is its cross-sectional nature which poses problems in relation to hypothesis testing since data on risk factors and outcome are assessed at the same time, but this particular issue does not seem to affect our results. In addition as our sample represented only one resident area—the Nalagarh-Baddi industrial estate in Himachal Pradesh, the generalizability of the findings obtained is questionable.

CONCLUSION

The findings of the present study indicate that moderate to severe periodontitis is an independent risk factor for RA. Patients referred for periodontal practices have a higher prevalence of RA compared with the general practice population. In general, it seems that patients referred for periodontal care are less healthy than their counterparts in the general dental population. However, there is a need for further and more detailed investigation to ascertain the exact corelation between two (RA and periodontal disease) of the most common debilitating chronic inflammatory conditions affecting humans.

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REFERENCES

1. Offenbacher S, Katz VL, Fertik GS. Periodontal infection as a risk factor for pre-term low birth weight. J Periodontol 1996; 67(10 Suppl):1103-1113.
2. Saini R. Periodontitis a true infection. J Glob Infect Dis 2009; 1(2):149-151.
3. Beck JD, Garcia R, Heiss G, Vokonas PS, Offenbacher S. Periodontal disease and cardiovascular disease. J Periodontol 1996;67(10 Suppl):1123-1137.
4. Ebersole JL. Systemic humoral immune response in periodontal disease. Crit Rev Oral Biol Med 1990;1:283-331.
5. Bartold, PM. Connective tissues of the periodontium. Research and clinical implications. Austral Dent J 1991;36(4): 255-261.
6. Salvi GE, Lawrence HP, Offenbacher S, Beck J. Influence of risk factors on the pathogenesis of periodontitis. J Periodontol 2000, 1997;14(1):173-201.
7. Firestein GS. Aetiology and pathogenesis of rheumatoid arthritis. In: Kelley WN, Harris ED Jr, Ruddy S, Sledge CB, editors. Textbook of Rheumatology. 6th ed. Philadelphia, PA: Saunders; 2001. p. 921-966.
8. Darveau RP, Tanner A, Page RC. The microbial challenge in periodontitis. Periodontol 2000, 1997;14(1):12-32.
9. Brown LJ, Loe H. Prevalence, extent, severity and progression of periodontal disease. Periodontol 2000, 1993;2(1):57-71.
10. Ogrendik M, Kokino S, Ozdemir F, Bird PS, Hamlet S. Serum antibodies to oral anaerobic bacteria in patients with rheumatoid arthritis. Medscape General Med 2005;7(2):1-7.
11. Bozkurt FY, Yetkin AZ, Berker E, Akkus S. Anti-inflammatory cytokines in gingival crevicular fluid in patients with periodontitis and rheumatoid arthritis: a preliminary report. Cytokine 2006;35(3-4):180-185.
12. Abou-Raya A, Abou-Raya S. Periodontal disease and rheumatoid arthritis: is there a link. Scand J Rheum 2005; 34(5):408-410.
13. Soory M. Periodontal diseases and rheumatoid arthritis: A coincident model for therapeutic intervention. Curr Drug Metab 2007;8(8):750-757.
14. Ribeiro J, Leao A, Novaes AB. Periodontal infection as a possible severity factor for rheumatoid arthritis. J Clin Periodontol 2005;32(4):412-416.
15. Havemose-Poulsen A, Westergaard J, Stoltze K, Skjødt H, Danneskiold-Samsøe B, Locht H, et al. Periodontal and hematological characteristics associated with aggressive periodontitis, juvenile idiopathic arthritis and rheumatoid arthritis. J Periodontol 2006;77(2):280-288.
16. Ankleshwar. Available at: http://en.wikipedia.org/wiki/Ankleshwar.
17. World Health Organization. Oral Health Surveys, Basic methods. 4th ed. World Health Organization, Geneva; 1997.
18. Arnett F, Edworthy S, Bloch DA, McShane DJ, Fries JF, Cooper NS, et al. The American Rheumatism Association 1987 revised criteria for the classification of rheumatoid arthritis. Arthritis Rheum 1988;31(3):315-324.
19. Mercado FB, Marshall RI, Klestov AC, Bartold PM. Is there a relationship between rheumatoid arthritis and periodontal disease? J Clin Periodontol 2000;27(4):267-272.
20. Mercado FB, Marshall RI, Klestov AC, Bartold PM. Relationship between rheumatoid arthritis and periodontitis. J Periodontol 2001;72(6):779-787.
21. Kasser UR, Gleissner C, Dehne F, Michel A, Willershausen-Zönnchen B, Bolten WW. Risk for periodontal disease in patients with long standing rheumatoid arthritis. Arthritis Rheum 1997;40(12):2248-2251.
22. Tolo K, Jorkend L. Serum antibodies and loss of periodontal bone in patients with rheumatoid arthritic. J Clin Periodontol 1990;17(5):288-291.
23. Offenbacher S, Heasman P, Collins J. Modulation of host PGE2 secretion as determinant of periodontal disease expression. J Periodontol 1993;64(5 Suppl):432-444.
24. Kornman KS, Crane A, Wang HY, Di Giovine FS, Newman MG, Pirk FW, et al. The interleukin-1 genotype as a severity factor in adult periodontal disease. J Clin Periodontol 1997;24(1):72-77.
25. Reynolds J, Meikle M. Mechanisms of connective tissue matrix destruction in periodontics. Periodontol 2000, 1997;14: 144-157.
26. Abou-Raya S, Abou-Raya A, Naim A, Abuelkheir H. Rheumatoid arthritis, periodontal disease and coronary artery disease. Clinical Rheumatology 2007;27(4):421-427.
27. Dunne SM, Clark CG. The identification of the medically compromised patient in dental practice. J Dent 1985;13(1): 45-51.
28. Peacock ME, Carson RE. Frequency of self-reported medical conditions in periodontal patients. J Periodontol 1995;66(11): 1004-1007.
29. Kao RT, Lee S, Harpenau L. Clinical challenges in diagnosing and monitoring periodontal inflammation. J California Dent Assoc 2010;38(4):263-268.