

Oral Health Status in Outpatients with Rheumatoid Arthritis: The OSARA Study

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Abstract

Background: Observational studies and clinical trials are increasingly highlighting significant associations between periodontitis (chronic, infectious, inflammatory disease affecting tooth supporting tissues) and rheumatoid arthritis (chronic systemic autoimmune disease).

Objective: The aim of the study was to describe the dental, periodontal and oral prosthetic status of outpatients with Rheumatoid Arthritis (RA).

Material and methods: The study was conducted from June 2010 to March 2011 in the Rheumatology Day Care Department of the University Teaching Hospital, Toulouse. Activity of the RA was defined according to disease activity score 28 (DAS28). 74 subjects with RA were included. Periodontal status was determined using measurements of pocket depth, bleeding on probing and attachment loss. Periodontal Epithelial Surface Area (PESA) and Periodontal Inflamed Surface Area (PISA) were calculated.

Results: The study population was 60.3 ± 11.9 years old with 75.7% women. 48.6% of the subjects had moderate RA ($3.2 < \text{DAS28} \leq 5.1$) and 22.2% high RA activity ($\text{DAS28} > 5.1$); 93.2% were treated by biotherapy. The mean number of natural teeth was 18.9 ± 9.7 . The mean number of teeth replaced by removable prostheses was 7.1 ± 10.5 . The mean PISA was $291.9 \text{ mm}^2 \pm 348.7$ and the PISA:PESA ratio was $33.2\% \pm 24.2$. 94% of patients had periodontitis, which was moderate in 48% and severe in 46%.

Conclusion: This study highlights the need for prevention and for adequate dental care to improve global and oral quality of life of subjects with rheumatoid arthritis. Given the frequency of periodontitis and some physiopathological hypotheses, clinical trials are needed to assess if periodontal treatment could improve RA biological and clinical parameters.

Introduction

Observational studies and clinical trials are increasingly highlighting significant associations between periodontitis (chronic, infectious, inflammatory disease affecting tooth supporting tissues) and cardiovascular events, unbalanced glycaemic conditions preterm low birth weight, induced preterm birth for pre-eclampsia, and rheumatoid arthritis [1-3].

It has been shown that, in people with RA, the risk of developing periodontitis is increased by a factor of 1.82 compared with people without RA [4]. The two diseases share common aetiology and pathology [5]. Some previous studies have suggested that RA could trigger and/or worsen periodontitis and, inversely, periodontitis could add to the inflammatory state and maintain systemic inflammation in RA [6]. The periodontopathogen *Porphyromonas gingivalis* could be implicated in this physiopathology by inducing the citrullination of host proteins, which could cause a breakdown of immune tolerance [6]. *Porphyromonas gingivalis* is the only known bacterium able to produce PAD enzyme, homologue of the human PAD and responsible for conversion of arginine to citrulline [7].

Rheumatoid Arthritis (RA) is a chronic systemic autoimmune disease. The clinical picture is dominated by inflammation of the synovial lining of the joints, tendons and peri-articular structures, with symmetric arthritis and destructive synovitis [8]. If untreated, RA leads to destruction of cartilage and bone tissues of the joints, causing pain, deformity and functional limitation [8]. Although the role of infectious agents in RA pathology remains unclear, it has been considered as a serious hypothesis for decades [9].

Periodontium is made up of superficial periodontium (free and

attached gingiva) and deep periodontium (alveolar bone, periodontal ligament and radicular cement). Periodontal diseases are divided into gingivitis and periodontitis. Gingivitis is an inflammatory response to bacterial colonization of tooth areas next to the gingiva, reversible with hygiene and limited to the superficial periodontium [10]. If untreated, gingivitis can sometimes lead to periodontitis, a multifactorial infectious disease, permanently affecting deep periodontium. Periodontitis is characterized by gingival inflammation and bleeding, alveolar bone loss, periodontal pocket formation, gingival recession and, in later phases, tooth mobility and loss [10]. In Europe, attachment loss of at least 3 mm is prevalent in about 32.7% of subjects, while about 9.2% have attachment loss of 5 mm or more, and 1% of 6 mm [11].

Besides the putative biological relationship between RA and periodontitis, RA could also be associated with adverse oral conditions such as edentulism or tooth decay, with a significant impact on oral health quality of life. Indeed, finger mobility is often limited and oral hygiene thus compromised de facto [12]. Nevertheless, it is necessary to maintain teeth on their support, to maintain tooth integrity (decay treatment), explaining their importance to the patient [13], and to replace missing teeth to improve the coefficient of masticatory effectiveness. Thus, it could be important to prevent tooth decay and periodontitis and to prevent its consequences before it adds adverse effects to an already compromised condition. Such action would improve general and oral quality of life [14].

The aim of the present study was to describe the dental, periodontal and oral prosthetic status of people with RA who visited a Regional Hospital Rheumatology Department as outpatients.

Materials and Methods

Study population

The OSARA (Oral Status and Rheumatoid Arthritis) study was conducted from June 2010 to March 2011 in the Rheumatology Department of the University Teaching Hospital of Purpan, Toulouse. This department is a reference service for RA surveillance for the South West of France.

OSARA was an observational cross-sectional study where all patients who came to consultation in the day care section of the Rheumatology Department were consecutively screened for possible inclusion.

Selection criteria

Rheumatologists checked the inclusion criteria. Subjects had to be aged 18 or older, affiliated to a public health system, and have rheumatoid arthritis (defined according to the ACR 1987 revised criteria [15]), with a Disease Activity Score 28 [16] measured less than one month previously. Subjects with known risk of bacterial endocarditis or difficulties in understanding French were not included. Pregnant women were not eligible for the study. All outpatients gave their written consent and the study was authorized by the French hospital ethics authorities (Toulouse Hospital Ethics Committee, agreement n°29-10 10).

Study assessments

Each subject completed the French validated Health Assessment Questionnaire (HAQ) [17]. This is a self-administered questionnaire suitable for measuring disease severity of RA (reflection of disability due to RA progression). Outpatients were asked for socio-demographic data (date of birth to compute age, sex, educational level, professional activity, smoking habits) and medical data (weight and height to compute body mass index, antibiotic treatment during the previous 3 months, RA activity and severity, RA treatments). RA activity was separated into 3 classes according to DAS28: low disease activity if $DAS28 < 3.2$, moderate activity if $DAS28$ was between 3.2 and 5.1, and highly active disease if $DAS28 > 5.1$ [16]. Severe disease was defined when $HAQ > 0.5$. Medical files were consulted to obtain any missing information.

Three trained and standardized dentists performed the oral examination in two steps within the same encounter: first a dental examination, then a periodontal examination. Examiners disposed of gloves, masks and a frontal light. Mirrors and probes had been pre-packaged in autoclaved bags. Each subject underwent the dental examination in his medical room while waiting for his medical consultation or during his treatment perfusion. Dental variables were recorded according to the European Global Oral Health Indicators Development Project [18]. Numbers of decayed, missing and filled teeth were recorded according to the World Health Organisation (WHO) diagnosis criteria [19]. The number of natural teeth (with or without fixed prosthesis) and the presence of dental plaque were noted. For each tooth, prosthetic characteristics were evaluated (normal tooth, absent/non-functional tooth not replaced by prosthesis, fixed prosthetic replacement, and removable prosthetic replacement). Dental prosthetic treatment needs was determined; for each jaw, patients were classified as: “no need for prosthesis”, “need for a single-tooth fixed prosthesis” when only one tooth had to be reconstructed; “Plural prosthesis” when more than one tooth had to be replaced (with a fixed or removable prosthesis); “Combination of single-tooth fixed prostheses (presence of at least two individual

teeth to be reconstructed by dental crown) and plural prosthesis”; or “Complete prosthesis” (all teeth were to be replaced on a same prosthesis).

Investigators were calibrated for periodontal assessment before the beginning of the study ($\kappa=0.9$). Full-mouth periodontal probing was done using a constant pressure probe (Florida Probe®; Gainesville, FL, USA), with 6 measurements per tooth. The clinical examination included Clinical Attachment Level, or CAL, in mm (distance between the bottom of the periodontal pocket and the edge of the marginal gingiva), Periodontal Pocket Depth, or PPD, in mm (distance between the bottom of the periodontal pocket and the cemento-enamel junction) and Bleeding on Probing, or BOP, (yes/no). No X-rays were taken.

Data analysis

The DMFT score was calculated as the sum of decayed, missing and filled teeth [19]. The number of missing teeth was mainly representative of the consequences of carious and periodontal diseases whereas the number of decayed teeth was mainly representative of a need for care. O’Leary’s plaque index was calculated as the number of surfaces with plaque in the dento-gingival zone divided by the overall number of surfaces, 4 surfaces per tooth [19]. The number of dental couples, with prostheses in place, was calculated where premolars or molars were in physiological antagonism. The number of Functional Tooth Units was thus calculated (1 FTU for premolars, 2 FTUs for molars, 12 FTUs for complete dentition) [20]. The coefficient of masticatory effectiveness was also calculated according to WHO recommendations, as the sum of points attributed to each tooth when they constituted a couple.

Referring to the literatures [21,22], severe periodontitis was defined when at least 2 interproximal sites (not on the same tooth) had $CAL \geq 6$ mm and at least 1 interproximal site had $PPD \geq 5$ mm; a moderate disease was defined as at least 2 interproximal sites (not on the same tooth) having $CAL \geq 4$ mm or 2 interproximal sites having $PPD \geq 5$ mm (not on the same tooth); elsewhere, periodontitis was considered as absent. Based on the 5th European Workshop in Periodontology, sensible periodontitis was defined as the presence of proximal $CAL \geq 3$ mm on at least 2 non-adjacent teeth, and specific periodontitis as the presence of $CAL \geq 5$ mm on at least 30% of teeth [23]. The number and proportion of periodontal sites affected by periodontitis (quantitative definition) were also investigated. A meta-analysis showed that the studies reviewed used a minimum diagnostic threshold defining a periodontitis-affected site as $CAL \geq 2$ mm and $PPD \geq 3$ mm [21]. Periodontal inflammatory burden was also estimated, taking into account severity, extent and activity. The Periodontal Inflammation Surface Area - PISA was calculated in mm^2 [24]. It represents the total surface area of gingiva that is affected by inflammation (bleeding on probing sites). The Periodontal Epithelial Surface Area - PESA represents the gingival epithelium surface, the overall surface area of gingiva whether affected by inflammation or not. The PISA/PESA ratio highlights the percentage of inflammatory surface area over total gingival epithelium surface.

Patients were asked to evaluate the hardship caused by the periodontal probing, taking into account the discomfort and pain they experienced, on a visual analogue scale (0 to 10). Pain was considered as severe if the Visual Analogue Score (VAS) was greater than 4 or when periodontal probing had to be stopped because of pain.

Descriptive statistics were provided as mean \pm SD for continuous variables and as n (%) for categorical variables with STATA®11.0 (StataCorp; Tx, USA). The sample size was specified for each outcome.

Results

Eighty-three subjects were asked to participate in the study and 74 subjects agreed and were included. The refusal rate was 11%. Periodontal probing was done on only 57 patients because 11 patients did not have time for it, and 6 patients were completely edentulous. Periodontal probing could be completed on only 52 patients because 5 could not stand the pain and probing had to be stopped.

The socio-demographic characteristics of the study population are presented in *Table 1*. The mean age of the study population was 60.3 ± 11.9 years, with a sex ratio of 1:3 between men and women (24.3% vs. 75.7%). 70.4% of the population had not completed high school and 80.8% were inactive. 15.1% of patients were smokers, having a mean consumption of 8.9 ± 5.3 cigarettes per day.

The mean DAS28 of subjects was 3.8 ± 1.3 and the mean one-hour Erythrocyte Sedimentation Rate (ESR) was 18.5 ± 15.2 . RA activity was moderate in 48.6% of subjects, while 22.2% had high activity disease. RA was observed to be evolving since, after an average of 15.2 ± 9.5 years, the disease had become severe in 86.3% of subjects (HAQ score > 0.5) (*Table 2*). 31.1% of patients had received antibiotherapy during the 3 months before recruitment. At the time of the study, all the patients were receiving treatment for RA. 53 subjects (71.6%) were treated with a conventional Disease-Modifying Anti-Rheumatic Drug (DMARD): methotrexate (n=42), leflunomide (n=6), sulfasalazine (n=2) or another drug (n=3). In many cases (48 subjects, 64.9%), DMARD was associated with a biological agent. 93.2% of patients had received biotherapy: abatacept (n=17), rituximab (n=9), tocilizumab (n=22), infliximab (n=21).

Table 3a presents probed patients' characteristics. The percentage of sites that bled on probing was $31.9\% \pm 28.8$ and the PISA/PESA ratio (Percentage of Inflamed Gingival Area over total gingival area) was $33.2\% \pm 24.2$. The mean PISA was $291.9 \text{ mm}^2 \pm 348.7$. Mean recession was 0.7 ± 0.8 mm and mean pocket depth was 2.2 ± 0.6 mm; the mean global discomfort or pain was 2.2 ± 0.4 and 38.6% of patients reported severe pain (*Table 3b*).

The frequency of patients with periodontitis, according to two qualitative definitions, is presented in *Table 4a*. Based on periodontitis severity definition, 96% of patients had periodontitis, which was severe in 46% of patients. According to the sensible definition, 100% of patients had periodontitis and 42.9% subjects responded to the specific definition, with more than 30% of teeth

affected. On average, $21\% \pm 18.2$ of sites (*Table 4b*) were affected by periodontitis (based on Savage's revision).

A mean $56.4\% \pm 27.7$ of dental zones were covered by dental plaque. 35.3% of dentate subjects had not had scaling for at least 2 years, 26.5% declared brushing their teeth once a day or less. 78.3% of dentate patients did not use an electric toothbrush (*Table 5*).

The mean DMFT index was 19.9 ± 8.0 with a mean number of decayed teeth of 1.0 ± 1.7 . The mean number of natural teeth was 18.9 ± 9.7 . The mean number of teeth without prosthetic reconstruction was 14.7 ± 9.6 with a mean coefficient of masticatory effectiveness of 75.2 ± 22.2 and mean FTU of 9.2 ± 3.6 . The number of teeth replaced by fixed prostheses was 4.8 ± 4.8 and the number replaced by removable prostheses was 7.1 ± 10.5 . The mean number of missing or non-functional teeth was 5.4 ± 4.2 (*Table 6*). Details of prosthetic needs, for maxilla and mandible, are presented in *Table 6*. A combination of unit and/or plural prostheses was needed in 9.1% and 15.2% of patients in the maxilla and mandible, respectively. A complete removable prosthesis was needed in 15.2% and 7.6% patients, in the maxilla and mandible respectively. When maxilla and mandible needs were added, 60.9% of patients had a dental prosthetic need.

Discussion

In this descriptive study, the frequency of moderate to severe periodontitis was 96% in subjects with rheumatoid arthritis. We identified a serious need for periodontal and prosthetic treatment.

This sample revealed particular characteristics for RA variables, more severe than in general RA population since this department is a reference service for RA surveillance for the South West of France with the ability to establish biotherapeutics. We took advantage of the rheumatological treatment infusion time to perform the complete dental and periodontal examinations and questionnaires. Subjects presented long mean disease duration and had high mean age (> 60 years). The high unemployment rate of subjects may have been due to their age but perhaps also to a deteriorated joint status with considerable restriction of their ability to work, productivity losses and work limitations [25]. In France, a study carried out on 1109 patients managed by hospital-based rheumatologists in 2000 showed that only 28.3% patients were working, 36.7% were retired, 26.4% were unemployed and 8.6% were housewives [26].

The full-mouth periodontal probing was performed with

Table 1. Socio-demographic characteristics of the study population.

	Number of patients (n=74)	Mean \pm SD or %	Min	Max
Age				
Total	74	60.3 ± 11.9	26.1	85.9
Women	56	59.7 ± 11.6	26.1	76.8
Men	18	62.1 ± 11.9	41.1	85.9
Gender	74			
Women	56	75.7%		
Men	18	24.3%		
Educational level	71			
Primary	9	12.7%		
Secondary	41	57.7%		
High school	21	29.6%		
Professional activity	73			
Inactive	59	80.8%		
Active	14	19.2%		
Smoking habits	73			
Smokers	11	15.1%		
Number of cigarettes per day in smokers	11	8.9 ± 5.3	2	20

Table 2. Medical characteristics of the study population.

	Number of patients (n=74)	Mean ± SD or %	Min	Max
Body Mass Index	74	25.4 ± 5.0	15.6	42.7
RA activity				
Sedimentation rate	72	18.5 ± 15.2	1	58
DAS28	72	3.8 ± 1.3	0.2	6.9
Weak disease activity	21	29.2%		
Moderate disease activity	35	48.6%		
High disease activity	16	22.2%		
RA severity				
RA duration (years)	70	15.2 ± 9.5	1	47
HAQ	73	1.4 ± 0.7	0	2.9
Severity (HAQ>0.5)	63	86.3%		
Smokers	11	15.1%		
Antibiotic treatment during the previous 3 months	23	31.1%		

RA: Rheumatoid arthritis; DAS 28: Disease Activity Score 28; HAQ: Health Assessment Questionnaire

Table 3a. Periodontal characteristics of the study population.

	Number of patients (n=52)	Mean ± SD	Min	Max
Number of sites with bleeding on probing	51	34.0 ± 28.8	2	130
Percentage of bleeding on probing sites	52	31.9% ± 28.8	1	100
PISA/PESA ratio	52	33.2% ± 24.2	1	100
PISA (mm ²)	52	291.9 ± 348.7	8.5	2161
PESA (mm ²)	52	800.4 ± 385.1	85.6	2570
Mean recession (mm)	52	0.7 ± 0.8	0	3.9
Mean pocket depth (mm)	52	2.2 ± 0.6	1.3	3.9

PISA: Periodontal Inflamed Surface Area; PESA: Periodontal Epithelial Surface Area

Table 3b. Hardship during periodontal probing.

	Number of patients (n=57)	Mean ± SD or %	Min	Max
Mean global pain/discomfort	32	2.2 ± 0.4	0	7.5
Severe pain (VAS > 4 or probing stopped because of pain)	22	38.6%		

VAS: Visual Analogue Score

Table 4a. Periodontitis according two different definitions.

	Number of patients (n=52)	Frequency
Page and Eke definition	50	100%
Severe periodontitis	23	46%
Moderate periodontitis	24	48%
Mild or no periodontitis	3	6%
5th European Workshop in Periodontology definition	49	
Sensible periodontitis	28	57.1%
Specific periodontitis	21	42.9%

Table 4b. Number and percentage of sites affected by periodontitis.

	Number of patients (n=52)	Mean ± SD	Min	Max
Affected sites by periodontitis				
Number of affected sites	47	20.5 ± 15.0	0	59
Percentage of affected sites	51	21.0% ± 18.2	0	73

a Florida Probe® constant pressure probe to standardize the procedure. Nevertheless, a risk of underestimation was also possible because periodontal probing had to be stopped on 5 patients (for pain reasons), and their data were not usable.

We decided to employ a cross-sectional design for this study since our aim was to draw up an oral inventory of outpatients. So we did not calculate a needed number of subjects. Nevertheless, the high refusal rate, the duration of dental examinations and the time taken for the analysis of medical records may explain the relatively modest number of subjects included. One limitation of this study was that it did not consider the effect of the types of biotherapies on oral clinical

parameters. This could be the subject of a new study with a broader population. To finish, we did not take salivary dysfunction into account in outpatients since some biotherapy could, itself, stimulate salivation [27]. Thus, new work should develop the study of salivary dysfunctions in patients receiving biotherapy.

There is no consensus on a strict definition of periodontitis; diagnosis may be based on clinical, microbiological or radiological arguments [21]. Clinical arguments are very often used in epidemiological studies. We chose to define periodontitis according to clinical parameters and two qualitative definitions, integrating firstly the severity and secondly the extent of periodontitis.

Table 5. Dental hygiene characteristics.

	Number of patients (n=68)	Frequency 100.0%
Date of the last scaling	68	
< 6 months	18	26.5%
≥ 6 months and < 1 year	7	10.3%
≥ 1 year and < 2 years	19	27.9%
≥ 2 years	22	32.4%
Never	2	2.9%
Tooth brushing frequency	68	
At least twice a day	50	73.5%
Once a day	15	22.1%
Every week	3	4.4%
Electric toothbrush use	60	
Yes	13	21.7%
No	47	78.3%

Table 6. Prosthetic and masticatory characteristics.

	Number of patients (n=66)	Mean ± SD	Min	Max
Number of natural teeth	66	18.9 ± 9.7	0	32
DMFT index	66	19.9 ± 8.0	3	32
Number of teeth without prosthetic replacement	66	14.7 ± 9.6	0	31
Number of teeth replaced by fixed prosthesis	66	4.8 ± 4.8	0	20
Number of teeth replaced by removable prosthesis	66	7.1 ± 10.5	0	32
Number of missing/non-functional teeth	66	5.4 ± 4.2	0	21
Coefficient of masticatory effectiveness	66	75.2 ± 23.2	0	100
Number of FTUs	66	9.2 ± 3.6	0	12
		Maxilla	Mandible	
	N	Frequency	n	Frequency
	66	100%	66	100%
No need for prosthesis	39	59.1%	32	48.5%
Need for a single-tooth fixed prosthesis	6	9.1%	4	6.1%
Need for a plural prosthesis	5	7.6%	15	22.7%
Need for combination of unit and/or plural prosthesis	6	9.1%	10	15.1%
Need for a complete prosthesis	10	15.1%	5	7.6%

DMFT: Decayed, Missing, Filled Teeth; FTU: Functional Tooth Unit

Periodontitis was moderate to severe in 96% of patients. This frequency was higher than the 69.2% prevalence for moderate to severe periodontitis identified by Mercado et al. [3] on 65 RA patients attending either a Rheumatology Clinic or a single private practice in Australia, and the 51% identified by Dissick et al. [28] on 69 RA patients recruited from Veteran Affairs rheumatology outpatient clinics in the USA. For the latter, differences could be partly attributed to RA severity since the mean HAQ in our study sample was higher: 1.4 ± 0.7 in our study and 0.87 ± 0.80 for Dissick et al. [28]. Moreover, these two studies defined periodontitis differently from ours, respectively with the extent of alveolar bone loss (panoramic radiograph assessment), and with a combination of total bone loss (panoramic radiograph assessment) and bleeding on probing. As there is no consensus on the definition of periodontitis, it is difficult to make comparisons across studies [21]. If we consider quantitative criteria, our results of mean PPD, CAL and percentage of BOP are lower than those encountered in the literature on RA patients. Variations in mean RA duration between studies could explain the differences observed, but there was no evidence of a link between RA duration and periodontal status in our sample (data not shown). We could attribute part of these differences to RA disease activity, which was higher in the populations studied by Ortiz et al. [29] or Mayer et al. [30]. However on 57 subjects recruited in a Rheumatology Department and examined by Pischon et al. [12], RA disease activity and severity was lower than in our sample. 62% of

these 57 patients had been prescribed anti-TNF α ; none were using any other biotherapy. In our study, nearly all the patients were treated by biotherapy, which was anti-TNF α therapy for a third of them. The lower means of periodontal parameters in our results may be due to biotherapy treatment. Rheumatoid arthritis per se predisposes to infections [31], and anti-TNF α use increases the bacterial and opportunist infection risk [32]. However the consequences of such therapy on dental and periodontal parameters are not clearly known. Mayer et al. [30], in 2009, divided 30 RA patients into 3 groups and their findings suggested lower BOP scores and CAL with RA patients taking anti-TNF α versus RA patients without anti-TNF α or versus patients without RA [30]. But results seem to be contradictory, as Pers et al. [33] studied 40 subjects with RA (20 with anti-TNF α and 20 without) in 2008 and reported that anti-TNF α tended to aggravate gingival inflammation [33].

Our study did not show any evidence of a link between the periodontal inflamed surface area (PISA index) and RA parameters such as DAS 28 (data not shown). However, the elevated PISA/PESA ratio and the proportion of sites bleeding on probing suggested active periodontitis among RA patients. Unlike BOP, PISA takes the anatomy of the periodontal lesions into account. To compute it, we measured periodontal pocket depth all around the teeth (6 measurements per tooth). PISA had been used to study a dose-response relationship between periodontitis and HbA1c in type 2 diabetics [34]. To our knowledge, this is the first time such an index

has been used for clinical examination of patients with RA and, given the hypotheses of pathophysiological inflammation between the two diseases, the use of PISA could be relevant. This continuous index takes both periodontal pocket depth and inflammation into account to compute the amount of gingival inflammation.

After periodontal probing at constant pressure, values of VAS were 1.5 to 2 times higher than those found in the literature on patients without systemic diseases and under periodontal treatment [35]. Only 15% of non RA patients experienced VAS > 4/10 compared to 33.2% of RA patients from our study [35]. This difference might be explained by the threshold of pain, heat, cold and pressure being decreased compared to patients without RA, with feelings that lasted longer after cessation of the stimulus. The presence of hyperalgesia suggested a central nervous system [36] mechanism underlying pain on stimulation.

About 60% of the area of the teeth was covered by dental plaque and contributed to a large bacterial pool. These results could be partly explained by patients suffering from reduced temporo-mandibular joint, global motor [37], and finger mobility [12]. Patients could have difficulties in opening a toothpaste tube or a mouth rinse bottle, or simply holding a toothbrush [13].

The elevated global DMFT score might be related to the large number of missing teeth rather than to decayed teeth. Nonetheless, the marked prevalence of hyposalivation and siccative syndrome in patients with RA may increase the caries risk [38-40]. The loss of a tooth is the result of a multifactorial process involving biological diseases such as periodontitis and caries [4]. We suggest that, in addition to periodontitis and caries, the patient's motivation and ability to follow constraining treatment in a context of pain and impaired mobility are unfavourable factors for the preservation of teeth. Moreover, the socio-economic status (work interruptions, job loss) could also be unfavourable. We have identified that there are strong needs for plural prostheses, combinations of unit and plural prostheses, and complete removable prostheses: new prostheses had

to be made or existing prostheses had to be done again. Thus, it is primordial to rebuild a stable occlusion to correct the consequences of temporal-mandibular disorders. These disorders could affect the functional capacities of patients to eat. Bessa-Nogueira et al. [37] found that, among 61 subjects with RA, 50% had difficulties in eating solid food and 39.3% in chewing [37]. Needs for a prosthetic rehabilitation were not significantly associated with the oral quality of life. For Trulsson [14], the reason most often given for undergoing prosthetic treatment was to restore dental status and also to retrieve self-esteem and attractiveness [14].

Conclusion and Perspectives

This study highlights the need for prevention and for adequate dental care to improve global and oral quality of life of patients with rheumatoid arthritis. We have identified important needs for dental care: need for periodontal and caries treatments, and need for prosthetic treatments. A dental check-up for patients suffering from rheumatoid arthritis should be part of the personal health assessment. It is important to develop global strategies, for example through public health policies suggesting better healthcare and social care provision for patients with rheumatoid arthritis, and/or through better communication between hospital rheumatology units and dentistry departments or dentists. In research, given the frequency of periodontitis and some physiopathological hypotheses, clinical trials are necessary to assess if periodontal treatment could improve RA biological and clinical parameters.

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